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Joyce Lake Direct Shipping Iron Ore Project:

Chapter 15:

Fish and Fish Habitat

File No. 121416571

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15.0 FISH AND FISH HABITAT

Within this section, the Project environmental effects including accidents, malfunctions and cumulative environmental effects are assessed for Fish and Fish Habitat. Proposed mitigation measures, and evaluation of residual and cumulative environmental effects, significance and suggestions for follow-up are also presented.

As detailed in chapter 1, Joyce Direct Iron Inc. succeeded Labec Century Iron Ore Inc. ("Labec Century") as the Project Proponent on February 18, 2021 following an internal reorganization. All references to Labec Century as the Project proponent may be interpreted as now referring to Joyce Direct Iron Inc.

15.1 VC Definition and Rationale for Selection

The Fish and Fish Habitat VC includes the populations and habitats for all freshwater fish species within areas that may or will be affected by the Project. Fish include all species that reside within or use habitat during any life stage within the Local and Regional Study Areas, as defined in Section 15.2.3. In accordance with Section 2(1) of the revised *Fisheries Act*, fish habitat is defined as:

> *"water frequented by fish and any other areas on which fish depend directly or indirectly to carry out their life processes, including spawning grounds and nursery, rearing, food supply and migration areas."*

For this EIS, fish habitat consists of all productive and migratory fish habitat areas that may be affected by the Project.

This VC was selected for environmental assessment to satisfy requirements under Section 4.4.3 and 4.18.4 of the NLDOECC EIS Guidelines and Section 9.1.2 of IAAC EIS Guidelines for the Joyce Lake Direct Shipping Iron Ore Project (the Project). Additionally, Fish and Fish Habitat was chosen as a VC because of: importance as an ecosystem component; regulatory protection; and public concern. Fish and Fish Habitat is intrinsically linked to the following other VCs in this EIS: Chapter 11: Water Resources, Chapter 14: Wetlands , and Chapter 17: Species at Risk and Species of Conservation Concern.

The Fish and Fish Habitat VC includes potential environmental effects on both riverine and lacustrine fish habitats. The effects of a change in water quality from the Project on the lacustrine environment are assessed in Chapter 11: Water Resources.

15.2 Scope of the Assessment

15.2.1 Regulatory Setting

Key federal and provincial acts and associated regulations that potentially apply to fish and fish habitat resources in the Project area include:

- *Fisheries Act*;
- SARA;
- CEAA 2012;
- NLESA; and
- Newfoundland and Labrador *Environmental Protection Act* (NLEPA) and associated *Environmental Assessment Regulations*.

In addition to regulatory requirements, the Project will also be subject to the applicable federal, provincial, and non-governmental policies, guidelines and ratings, including:

- CCME CWQG-PAL;
- Guidelines for the Use of Explosives in or near Canadian Fisheries Waters (Wright and Hopky 1998);
- MDMER Technical Guidance for Aquatic Environmental Effects Monitoring (Environment Canada 2012);
- MDMER – Discharge criteria; and
- Environmental Code of Practice for Metal Mines (Environment Canada 2009).

Fisheries Act

Bill C-68 came into force on August 28, 2019 introducing new Fish and Fish Habitat Protection Provisions to the *Fisheries Act*, most notably Section 35 prohibiting “harmful alteration, disruption or destruction" (HADD) of fish habitat. An updated Fish and Fish Habitat Protection Policy Statement was also released, replacing the previous Fisheries Protection Policy.

The updated Fish and Fish Habitat Protection Policy Statement interprets “harmful alteration, disruption or destruction” as any temporary or permanent change to fish habitat that directly or indirectly impairs the habitat’s capacity to support one or more life processes of fish.

With the new amendments, all fish and fish habitat is protected where previously only those related to a commercial, recreational or Indigenous fishery were protected. The new amendments also added the ability to enter into agreements with Indigenous governing bodies and any body established under a land claims agreement, as well as provinces and territories.

Table 15.1 outlines the relevant requirements for the Project under the federal *Fisheries Act* and regulations.

Table 15.1 Relevant Directives Under the *Fisheries Act*

Regulations	Nature of Directive	Relevance to Project	Federal Authority
Section 20(1)	Implement designs that ensure the free passage of fish without harm and maintain a flow of water sufficient to allow the free passage of fish.	Crossing designs, surface water withdrawals, Joyce Lake drawdown.	DFO
Section 20(2)	Implement mitigations as per guidelines for screening and flows for water intakes.	Water intakes	DFO
Section 35(1)	Ensure protection of fish and fish habitat.	Construction of causeway, Joyce Lake drawdown, construction of watercourse crossings.	DFO
Section 35(2)	Permit authorizations for the alteration of fish habitat.	Permit HADD authorizations	DFO
Section 36	Implement mitigations as per guidelines for Introduction of deleterious substances into fish bearing waters.	All work in or around waterbodies	Environment and Climate Change Canada
Section 28 and Guidance	Implement mitigations for use of explosives in or near fish bearing waters.	Mining operations	DFO
MDMER	Implement mitigation and monitoring programs for mine effluent	Mining operations	DFO and Environment and Climate Change Canada

Species at Risk Act and Endangered Species Act

Three species are currently listed under the SARA registry and NLESA with ranges in Newfoundland and Labrador: the American eel; banded killifish (Mainland and Newfoundland populations); and fourhorn sculpin (freshwater form) (Table 15.2).

As of 2014, none of the fish species listed in Table 15.2 have been reported to occur in the Regional Study Area (refer to Section 15.2.3 for a definition of this area). The Newfoundland population of banded killifish is known from a limited number of sites within insular Newfoundland on the west and northeast coasts and the Burin Peninsula. American eel are 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; Newfoundland and Labrador is the only province where it has been found (a single specimen in 1964, at Sipukat Lake on the coast of northern Labrador) (COSEWIC 2003).

The Project is not anticipated to interact with freshwater fish species at risk, as none are reported to inhabit or are likely to inhabit the RSA. Therefore, no detailed identification and description of species at risk habitat within the LSA or RSA is required for this assessment.

Table 15.2 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*	COSEWIC Threatened – No SARA Schedule (May 2012)	Vulnerable (October 2006)
Banded Killifish (Mainland Population)	*Fundulus diaphanous*	Not at Risk – No Schedule (May 1989)	-
(Newfoundland Population)		Special Concern (January 2005)	Vulnerable (May 2003)
Fourhorn Sculpin (freshwater form)	*Myoxocephalus quadricornis*	Special Concern – Schedule 3 (November 2003) (COSEWIC data deficient)	-
Notes: 1. Government of Canada. November 2014. Species at Risk Public Registry according to SARA. 2. NLDOECC 2014 - NLESA.			

15.2.2 Influence of Consultation and Engagement on the Assessment

The consultation program in support of this EIS focused primarily on the area(s) most likely to be affected by the Project, including the Town of Schefferville in the province of Québec and local Indigenous groups. Issues or concerns regarding Fish and Fish Habitat identified during consultation and engagement (Table 15.3) informed baseline data collection and are addressed through the effects analysis.

Table 15.3 Issues Raised by Indigenous Groups and Stakeholders

Question / Issue	Community/ Organization	Summary of Comments	Response
Effects on water and aquatic environment	Naskapi of Kawawachikamach	What are the impacts on water and on the environment?	Overburden, waste rock and low grade ore piles will be graded (sloped and stable) to avoid issues with erosion and gullying. The overburden, waste rock and low grade ore stockpiles will also have perimeter ditches to collect runoff and groundwater seepage and direct it to sedimentation ponds before release to the environment. The primary potential effects of the quarried rock for causeway construction on Iron Arm water will arise from some explosives residue on the surface of the blasted rock. The explosives residue may cause elevated ammonia or nitrogen concentration for a short and temporary period, however the concentrations are not expected to exceed the long term exposure limits of the CWQG-PAL.

Table 15.3 Issues Raised by Indigenous Groups and Stakeholders

Question / Issue	Community/ Organization	Summary of Comments	Response
Rock Causeway on Iron Arm	Naskapi of Kawawachikamach	How will the year-round bridge and rock causeway affect the fish and the lake? (we fish in that area near those islands).	Stantec has assessed fish passage through the causeway bridges and their recommendations to reduce water velocities for resident species such as northern pike and lake trout to pass has been adopted and incorporated into the bridges and causeway designs by increasing the width of both bridges from 4 to 8 m. The causeway bridge designs also allow for easy passage of fishermen and others in small boats under both of the bridges..
Water Quality/ Fish and Fish Habitat	DFO	Would like to know plans for crossing structures. Project design should try to stay out of water to avoid issues with fish and fish habitat. Consider bottomless culverts or bridge with no in-water footprint. Flow data required for stream crossings as they are important for determining impacts on existing fish habitats at potential impact areas and any areas downstream that may rely on them. Potential impacts of pit drainage on Joyce Lake.	There are four bridge structures proposed at this point. Two along the access road and two in the causeway. All bridges and culverts area designed for fish passage which for culverts means culvert embedment as per DFO recommendations. Regional flow data will be gathered to size all culverts and bridge openings The Joyce Lake and open pit water management plan provides details regarding the recommended Joyce Lake dewatering strategy and the approach to draining non-contact water from the Joyce Lake watershed to the downstream receiving water system during operations.
Water quality/Fish and Fish Habitat	Kawawachikamach Band Council (Paul Mameanskum, George Guanish, Ken Lam, Léonard McKenzie)	Concern about potential Project effects of Iron Arm on water quality and fish populations	Mine contact water will be treated to regulatory effluent criteria in sediment ponds to meet CWQG-PAL
Fish and Fish Habitat	DFO	Important to consider Indigenous and recreational fisheries.	These fisheries have been considered in the assessment.

15.2.3 Temporal and Spatial Boundaries

The temporal boundaries for the assessment of the potential environmental effects of the Project on Fish and Fish Habitat are the following periods:

- Construction – anticipated to be approximately one year (pre-operation);
- Operation and Maintenance – anticipated to be approximately seven years; and
- Closure and Decommissioning – anticipated to be one year.

Most potential Project environmental effects on Fish and Fish Habitat will begin and peak during Construction, and diminish during Operation and Maintenance of the Project. The Closure and Decommissioning phase includes any monitoring or active site management required to ensure that an appropriate end land use has been established. Project-related effects that conclude during Construction or Operation and Maintenance are considered to be temporary, while effects that persist after Closure and Decommissioning are considered to be permanent.

The spatial boundaries for the environmental effects assessment of Fish and Fish Habitat are defined below, and take into account the scale and spatial extent of potential environmental affects, existing scientific and traditional knowledge, current land and resource use, and biological and ecological considerations.

15.2.3.1 Project Development Area (PDA)

The Project Development Area (PDA) is the immediate area encompassing the Project. The PDA is limited to the anticipated area of physical disturbance associated with the construction or operation of the Project. This Project is within six map-staked licenses (682 claims) covering 17,050 hectares (ha). The PDA includes the mining area including the section within Joyce Lake, the waste stockpiles, the processing plant, the accommodation facility, the haul road, the causeway across Iron Arm, access roads and the Astray rail loop near the existing railroad. The PDA is illustrated in Figure 15.1 as it applies to the Fish and Fish Habitat VC.

15.2.3.2 Local Study Area (LSA)

The Local Study Area (LSA) for Fish and Fish Habitat is the PDA and associated surrounding areas where potential direct Project-related environmental effects may reasonably be expected to occur and are measurable to a high degree of confidence. The LSA includes all areas where discharges may occur, areas anticipated to have indirect loss of fish habitat, and all areas where environmental effects are anticipated across all phases of the Project. For example, the LSA includes sufficient upstream and downstream within-channel habitat at all crossings to incorporate anticipated measurable environmental effects from crossing installations. In general, the LSA includes: a portion of Attikamagen Lake, Iron Arm, Joyce Lake, Astray Lake, the lower Gilling River, and various stream reaches associated with the crossings. The LSA is depicted in Figure 15.2.

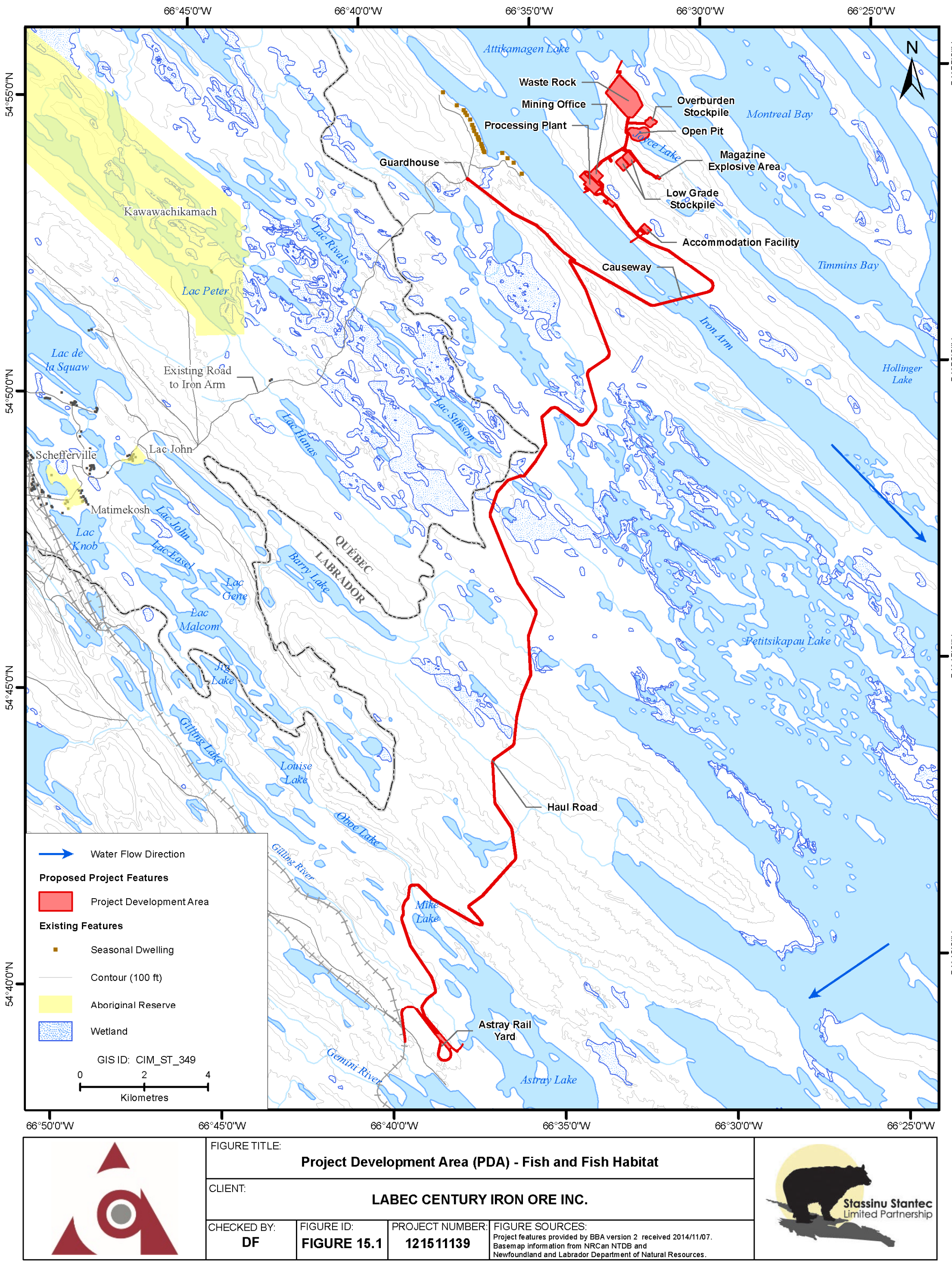

Figure 15.1 Project Development Area (PDA) - Fish and Fish Habitat

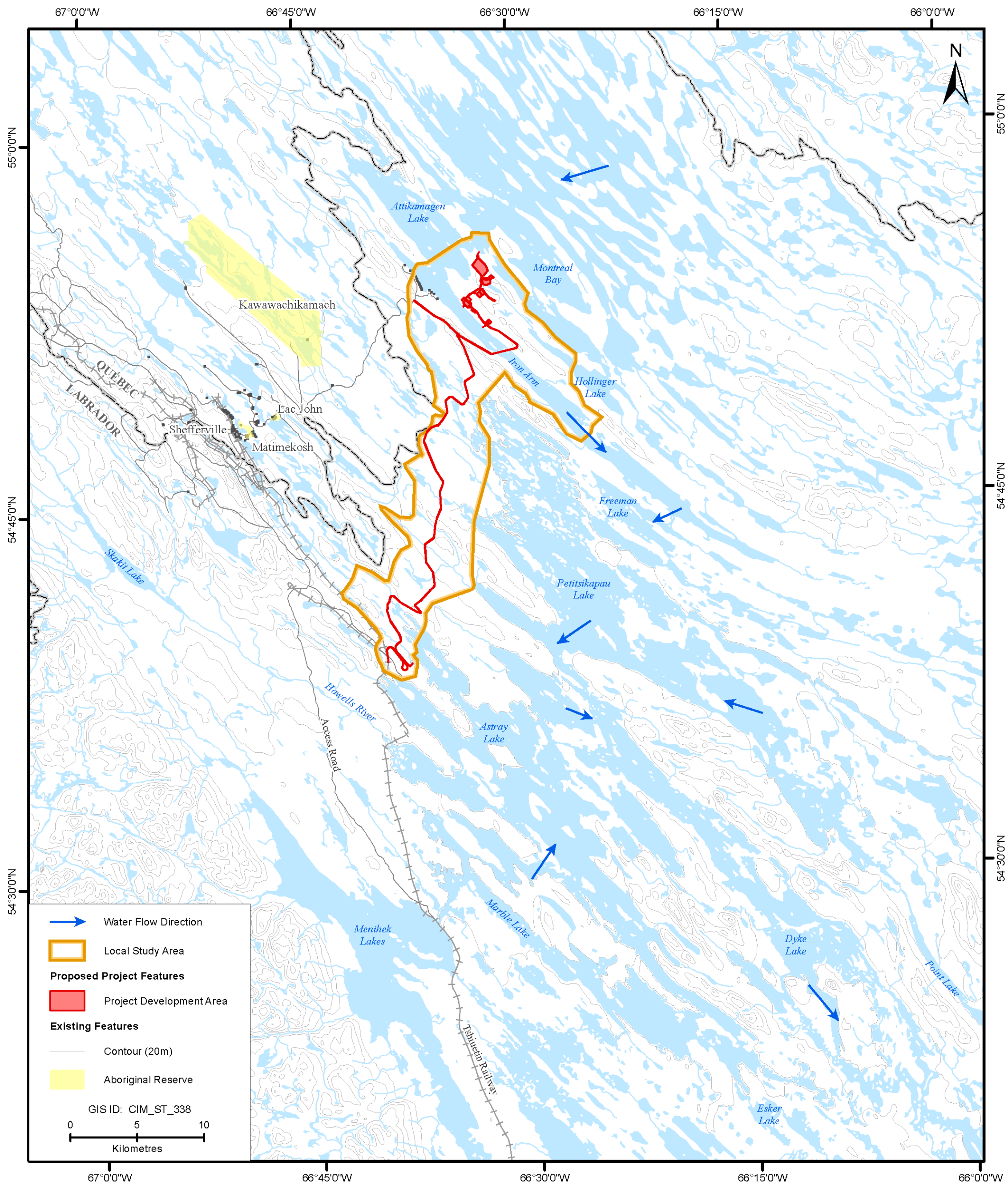

FIGURE TITLE: Local Study Area (LSA) - Fish and Fish Habitat			
CLIENT: LABEC CENTURY IRON ORE INC.			
CHECKED BY: DF	FIGURE ID: FIGURE 15.2	PROJECT NUMBER: 121511139	FIGURE SOURCES: Project features provided by BBA version 2 received 2014/11/07. Basemap information from NRCan NTDB and Newfoundland and Labrador Department of Natural Resources.

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Figure 15.2 Local Study Area (LSA) - Fish and Fish Habitat

15.2.3.3 Regional Study Area

The Regional Study Area (RSA) was delineated to capture the farthest extent of potential environmental effects of the Project on Fish and Fish Habitat, but which are not directly measurable to a high degree of confidence. The RSA is the estimated limit of potential fish movement within Attikamagen and associated lakes upstream and downstream. The RSA is also the area within which cumulative environmental effects are assessed. In general, the RSA includes: Attikamagen Lake, Hollinger Lake, Iron Arm, Freeman Lake, Petitsikapau Lake, Astray Lake, Dyke Lake, Marble Lake, the Gilling River system, Howells River up to and including Elross Lake and Skakit Lake, and various drainage areas associated with the crossings (Figure 15.3).

15.2.4 Selection of Environmental Effects and Measurable Parameters

Throughout the life of the Project, there will be interactions with Fish and Fish Habitat that will have varying degrees of environmental effects. To assess these interactions, potential environmental effects were identified along with associated measurable parameters. The two potential environmental effects are change in fish habitat and productivity, and change in fish health and mortality. Measurable parameters for the assessment of these effects and rationale for their selection are provided in Table 15.4.

Table 15.4 Environmental Effects and Measurable Parameters for Fish and Fish Habitat

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Fish Habitat and Production	Permanent area of fish habitat altered (m^2) or production losses.	Permanent habitat alteration or loss 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 habitat to be permanently altered or lost is necessary to request authorization and provide habitat offset 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 such as MDMER and CCME guidelines.
	Barriers to fish passage. (Physical barriers or changes in maintenance flow)	Obstructions to fish passage can reduce availability to or eliminate habitat that may be critical for certain life stages. Can be measured as vertical barriers or with respect to water velocities that may act as barriers to fish passage.
Change in Fish Health or Mortality	Mortality attributable to the Project	Works within fish bearing waters may result in isolation or fish kills or relocation. The draining of lakes will require relocation of resident fish populations. Loss of individuals can be measured through counting or estimated based on applicable removal procedures.
	Change in fish condition (length/ weight ratio).	A general metric of relative fish health is fish condition (length/weight ratio).

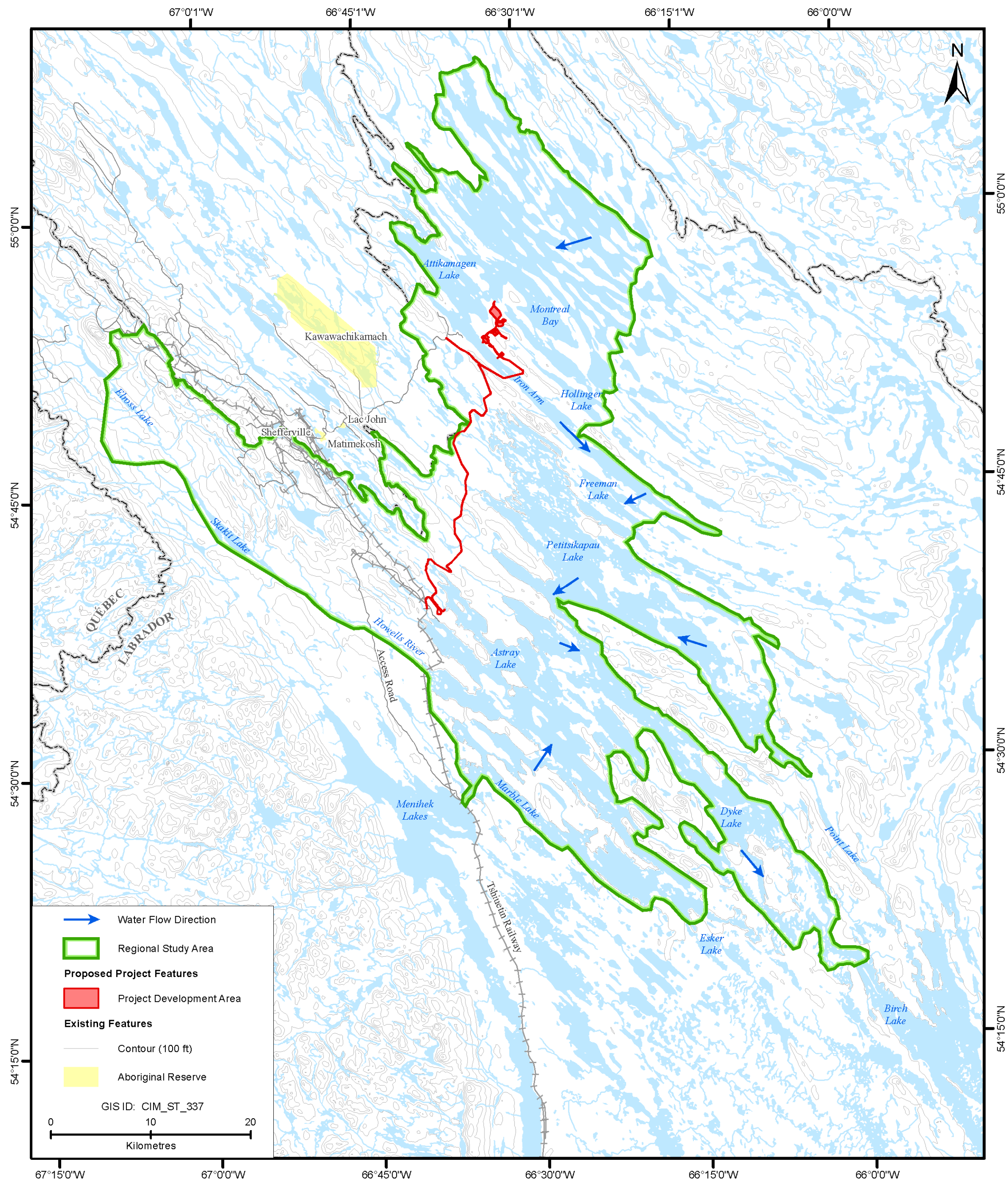

FIGURE TITLE:			
Regional Study Area (RSA) - Fish and Fish Habitat			
CLIENT: **LABEC CENTURY IRON ORE INC.**			
CHECKED BY: **DF**	FIGURE ID: **FIGURE 15.3**	PROJECT NUMBER: **121511139**	FIGURE SOURCES: Project features provided by BBA version 2 received 2014/11/07. Basemap information from NRCan NTDB and Newfoundland and Labrador Department of Natural Resources.

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Figure 15.3 Regional Study Area (RSA) - Fish and Fish Habitat

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

The following terms are used to characterize residual environmental effects.

Direction

- Positive: an increase in or improvement as compared to baseline conditions.
- Neutral: no net change in comparison to baseline conditions.
- Adverse: a decrease in or negative change as compared to baseline conditions.

Magnitude:

- Negligible: no measurable adverse environmental effects anticipated.
- Low: measurable environmental effects anticipated in low-sensitivity habitats and no measurable mortality risk to non-listed species.
- Moderate: measurable environmental effects anticipated in moderately sensitive habitat or anticipated mortality risk to non-listed species.
- High: measurable environmental 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: environmental effects are restricted to the PDA.
- Local: environmental effects extend beyond the PDA but remain within the LSA.
- Regional: environmental effects extend into the RSA.

Frequency:

- Once: environmental effect occurs only one time during the life of the Project.
- Sporadic: effect occurs effect occurs more than once at irregular intervals.
- Regular: effect occurs on a regular basis and at regular intervals.
- Continuous: effect occurs constantly.

Duration:

- Short Term: residual environmental effect occurs during the Construction phase of the Project (i.e., one year).

- Medium Term: residual environmental effect extends throughout the Construction and Operation and Maintenance phases of the Project (i.e., up to seven years).
- Long Term: residual environmental effect extends beyond Closure and Decommissioning (i.e., >10 years).
- Permanent: measurable parameter unlikely to recover to baseline (i.e., residual environmental effect persists).

Reversibility

- Reversible: effects will cease during or after the Project is complete.
- Irreversible: effects will persist after the life of the Project, even after habitat restoration and habitat offset works.

Environmental/Socio-economic Context:

- Undisturbed: environmental effect takes place in an area that has not been adversely affected by human development.
- Disturbed: environmental effect takes place in an area that has been previously affected by human development or in an area where human development is still present.

Prediction Confidence:

- Low: biological processes not well understood, limited baseline data, quantitative metrics limited, and mitigation measure effectiveness unknown.
- Moderate: general biological processes understood, adequate baseline, quantitative metrics available, and proven mitigation measures.
- High: biological process well understood and predictable, adequate baseline and regional data, mitigation measures proven successful.

Significant adverse residual environmental effects on Fish and Fish Habitat are defined as follows:

- A permanent and irreversible reduction in the productive capacity of fish habitat that remains after mitigation and offsetting measures are implemented and which will likely result in HADD as defined under the *Fisheries Act*.
- 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 measurable decrease in fish condition, below baseline conditions and directly attributable to Project activities, which threatens the sustainability of the regional fisheries.

15.4 Potential Project-VC Interactions

The Project will interact with Fish and Fish Habitat. The degree of interaction is dependent on the Project activity and phase. For assessment purposes, potential interactions were identified in respect to Project phases (i.e., Construction, Operations and Maintenance, and Closure and Decommissioning) and rated with respect to the anticipated level of interaction.

Interaction level ratings are:

- Project activities with no interaction with Fish and Fish Habitat were assigned a rate of 0.
- Project activities that interact with Fish and Fish Habitat, but where resulting environmental effects can be managed with the application of standard operating procedures and/or codified practices were assigned a rate of 1.
- Project activities that interact with Fish and Fish Habitat, and where resulting environmental effects may not be acceptable and cannot be managed or compensated for with the application of standard operating procedures and/or codified practices, were assigned a rate of 2.

The interaction ratings for Project activities are shown in Table 15.5. Following Table 15.5 is a brief environmental assessment and discussion of significance for interactions rated as 0 or 1. Interactions rated as 2 are assessed in detail in Section 15.6.

Table 15.5 Potential Project Environmental Effects to Fish and Fish Habitat

Project Activities and Physical Works	Potential Environmental Effects	
	Change in Fish Habitat and Production	Change in Fish Health or Mortality
Construction		
Site Preparation (including clearing, grubbing, excavation, material haulage, grading, removal of overburden, ditching, and stockpiling)	1	1
Construction of Roads	1	1
Construction of Causeway	2	2
Construction of Site Buildings and Associated Infrastructure	1	1
Construction of Rail Loop and Associated Infrastructure	1	1
Construction of Stream Crossings	2	2
Installation of Water Supply Infrastructure (wells, pumps, pipes)	1	1
Onsite Vehicle/Equipment Operation	1	0
Waste Management	1	1
Transportation of Personnel and Goods to Site	0	0
Expenditures	0	0
Employment	0	0
Operation and Maintenance		
Maintenance of Causeway	1	1

Table 15.5 Potential Project Environmental Effects to Fish and Fish Habitat

Project Activities and Physical Works	Potential Environmental Effects	
	Change in Fish Habitat and Production	**Change in Fish Health or Mortality**
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	1	1
Dewatering Joyce Lake	2	2
Ore Processing (including crushing, conveying, storage, grinding, screening)	0	0
Waste Rock Disposal on Surface	1	0
Water Treatment (including mine water and surface runoff) and Discharge	1	1
Rail Load-Out and Transport	0	0
Onsite Vehicle/Equipment Operation and Maintenance	1	0
Waste Management	1	1
Transportation of Personnel and Goods to Site	0	0
Fuel Transport	0	0
Fuel Storage and Dispensing	0	0
Progressive Rehabilitation	1	0
Expenditures	0	0
Employment	0	0
Closure and Decommissioning		
Site Decommissioning	1	1
Site Reclamation (building demolition, grading, scarifying)	1	0
Accidents and Malfunctions		
Hydrocarbon Spill	2	2
Train Derailment	2	2
Forest Fire	1	1
Settling/Sedimentation Pond Overflow	2	2
Premature or Permanent Shutdown	1	1

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 and/or through the application of best management or codified practices. No further assessment is warranted.
2 Interaction occurs, and resulting environmental effect may exceed acceptable levels without implementation of specific mitigation. Further assessment is warranted.

15.4.1 Changes in Fish Habitat and Production

Potential changes to fish habitat and production from Project activities were assessed based on direct or indirect changes to fish habitat, water and sediment quality and creation of barriers to fish movement. SARA listed or fish species of management concern have not been reported in the RSA; therefore, no further assessment was completed for aquatic SAR.

The following sub-sections describe potential environmental effects to fish habitat and production for each phase of the Project for interactions rated as 0 and 1. The construction of the Iron Arm causeway and watercourse crossings may result in a barrier to fish passage and potential changes in fish habitat, as these project activities will require specific mitigation in addition to application of best management practices; they are rated as a 2 and assessed in in Section 15.6. The dewatering of Joyce Lake during the Construction phase of the Project is likely to produce a change in fish habitat, this project activity will require specific mitigation and assessment under the *Fisheries Act* and is rated as a 2 and assessed in in Section 15.6.

15.4.1.1 Construction

Interactions Rated as 0

There will be no direct interaction between the Project and fish and fish habitat resulting from construction of site buildings and associated infrastructure, onsite vehicle and equipment operation, transportation of personnel and goods to site and, expenditures and employment. Environmental effects from potential spills are discussed under accidents and malfunctions in Section 15.8. Therefore, there will be no change in fish habitat and production for these project activities or physical works.

Interactions Rated as 1

Project interactions with fish habitat and production during Construction that were rated as 1 are related to potential introductions of sediment-laden water or substances to waterbodies and the alteration of riparian vegetation. Other activities that may produce such environmental effects on fish and fish habitat include: site preparation, construction of roads, construction of site buildings, construction of rail loop, installation of water supply infrastructure, onsite vehicle and equipment operation, waste management, and infrastructure associated with these project activities.

Potential alterations to riparian areas will occur during the construction phase. These environmental effects will be mitigated through the establishment of riparian set back limits within the PDA, adherence to BMPs, such as clearing only the required right-of-way, limiting the use of machinery within 3 m of the watercourse and progressive rehabilitation of riparian areas. The progressive rehabilitation program will be implemented to rehabilitate disturbed riparian areas with native grasses and shrubs.

Potential alterations of water and sediment quality will be mitigated through design and application of surface water management systems with settling lakes, erosion and sediment control measures, spill prevention and cleanup procedures, a dust suppression program, adherence to riparian set back limits, progressive reclamation of disturbed surfaces, a site waste management plan, ongoing monitoring of settling lake performance and erosion control measures, implementation of wet weather shutdown, adherence to operational statements, and the development of a water management, and an EMP.

The facilities requiring run-off management, such as the waste rock, low grade ore, and overburden stockpiles will include surface water drainage systems with a settling lake, with any treated waters being discharged through an engineered channel, into an adjacent bay of Attikamagen Lake. The water quality of all discharged water will be within regulated limits and standards. All of these facilities are isolated from and located away from existing waterbodies. Likewise, the run-of-mill stockpile and the Astray Lake rail yard will also have surface water collection and treatment systems, in addition to being located away from any waterbodies. The assessment of project related effects on surface water quality is described in detail in Chapter 11: Water Resources.

Given the implementation of these measures, it is likely that all potential effects rated as 1 on fish habitat and production will be mitigated. Therefore, there are no likely significant environmental effects on fish habitat and production anticipated from these activities.

15.4.1.2 Operation and Maintenance

Interactions Rated as 0

There will be no physical fish habitat alteration or serious harm to fish habitat and production resulting from ore processing, rail load-out and transport, transport of personnel and goods, expenditures, employment, and fuel transport and storage. Environmental effects from potential spills are discussed under accidents and malfunctions in Section 15.8. Therefore, there will be no interaction or environmental effect to fish habitat.

Interactions Rated as 1

During Operation and Maintenance, interactions rated 1 include potential introductions of sediment laden water or substances to waterbodies and dust borne particulates to waterbodies. Activities that may produce such environmental effects include maintenance of causeway, open pit mining, water treatment, onsite vehicle operation, waste rock disposal, waste management, and progressive rehabilitation.

Dust borne particulates are likely to be introduced through maintenance of the causeway, open pit mining activities and onsite vehicle use. These will be mitigated through dust management measures, as detailed in Chapter 10: Atmospheric Environment and Climate.

Deleterious substances may be introduced into waterbodies as a result of the discharge of waste water or from the discharges associated with various surface water collection systems deployed across the site, the rail loop, the mine and stockpile areas, and the ore processing areas. These substances have the potential to change the fish habitat in the receiving environment. All water-based discharges (waste, collected surface run-off, and process) will be treated and released within applicable regulatory guidelines and standards. Specifics regarding the designs and environmental effects associated with surface and waste water collection and treatment are discussed in detail in Chapter 11: Water Resources.

Potential alterations of water and sediment quality from mining operations will be mitigated through design and application of surface water management systems with settling lakes, erosion and sediment control measures, spill prevention and cleanup procedures, a dust suppression program, progressive reclamation of disturbed surfaces, a site waste management plan, ongoing monitoring of settling lake performance and erosion control measures, adherence to operational statements, effluent discharge adherence to MDMER requirements, and the development of a water management and an EMP.

Given the implementation of these measures, it is likely that all potential effects rated as 1 on fish habitat and production will be mitigated. Therefore, there are no likely significant environmental effects on fish habitat and production anticipated from these activities.

15.4.1.3 Closure and Decommissioning

The environmental effects resulting from Closure and Decommissioning are rated 1 where resulting environmental effects can be managed with the application of standard operating procedures. There are no interactions rated 2 for this phase of the Project.

Closure and Decommissioning will include waste disposal, the dismantling and removal of Project equipment, facilities and infrastructure, and site grading and rehabilitation. These activities could affect fish habitat and productivity as a result of the potential introduction of deleterious substances into waterbodies. There may also be temporary indirect and direct environmental effects on fish habitat and fish passage as a result of the removal of stream crossings.

Potential environmental effects of these activities will be mitigated through adherence the water management plan, and dust management plan. Potential environmental effects related to the removal of the stream crossing structures will be mitigated by the use of instream isolation techniques, implementation of erosion and sediment control measures, and establishment of continuous flow around each crossing during removal and the inclusion of erosion protection material once the crossing has been removed.

Given application of these measures, effects on fish habitat and production can be mitigated within the Closure and Decommissioning phase. Therefore, there are no likely significant environmental effects to fish habitat and production resulting from these activities.

15.4.2 Change in Fish Health or Mortality

Potential changes to fish health or mortality resulting from Project activities were assessed based on potential losses of fish due to incidental takings and potential reduction in fish health. Potential reductions in fish health are related to changes in fish habitat, most prominent being changes in water and sediment quality. Therefore many of the Project activities rated 1 for fish habitat and production are likewise rated 1 for fish health or mortality. Many of these also share similar mitigation strategies. The following section describes potential environmental effects across all phases of the Project for interactions rated 0 and 1. SARA listed or fish species of management concern have not been reported in the RSA; therefore, no further assessment is required for aquatic SAR. The construction of the Iron Arm causeway and dewatering of Joyce Lake may result in a change to fish health and mortality, as these project activities will require assessment under the *Fisheries Act* and specific mitigation outside of DFO operational statements, and BMPs, they are rated as a 2 and assessed in in Section 15.6.

15.4.2.1 Construction

Interactions Rated as 0

There will be no direct interaction between fish health or mortality and the Project resulting from onsite vehicle operation, transportation of personnel and goods to site, expenditure and employment. Therefore, there will be no potential environmental effect on fish health or mortality.

Interactions Rated as 1

Interactions with fish health or mortality during construction that were rated 1 include site preparation, construction of roads, construction of stream crossings, installation of water supply infrastructure and waste management. These interactions are predominately indirect and related to potential alterations to water and sediment quality. Two exceptions include the potential taking of fish species associated with stream crossings and the installation and operations of the water supply system.

During Construction, the application of environmental protection measures, guidelines, BMPs for the installation and maintenance of erosion control structures, or operational standards will mitigate potential alterations to water and sediment quality, thereby diminishing interactions between fish health or mortality and Project activities.

For construction activities that require in-water works (road crossings and water intake infrastructure) environmental effects on fish health or mortality will be reduced through adherence to standard practices. Fish salvage plans will be prepared with proper fish removal / relocation protocols and techniques and with the identification of appropriate relocation sites. Work areas will be isolated and environmental protection measures (such as erosion and sedimentation control) will be implemented for all in-water works. Measures will be taken where possible to avoid instream works during sensitive seasonal periods (i.e., spawning or migration) for the various fish species. Instream work protocols that include maintaining water flow around works, controlling erosion, and the use of fish screening approved under DFO Freshwater End-of-Pipe Intakes Fish Screen Guidelines (DFO 1995) will all reduce the risk to fish.

Application of these mitigation measures, in conjunction with those described in Chapter 11: Water Resources, will greatly reduce the potential for incidental fish takings and reduce possible environmental effects on fish health and condition. Therefore, there are no likely significant environmental effects to fish health or mortality resulting from these activities.

15.4.2.2 Operation and Maintenance

Interactions Rated as 0

There will be no direct interaction between fish health or mortality and the Project resulting from ore processing, surface waste rock disposal (water treatment is discussed separately as water treatment and discharge, and rated as 1), rail load-out and transport, transportation of personnel and goods to site, fuel transport and storage, expenditure and employment. Environmental effects from potential spills are discussed under accidents and malfunctions in Section 15.8. Therefore, there will be no interaction or environmental effect to fish health or mortality.

Interactions Rated as 1

During the Operation and Maintenance phase, interactions with fish health or mortality that were rated as 1 are predominately indirect and related to potential alterations to water and sediment quality. Activities that are rated 1 include maintenance of the causeway, open pit mining, water treatment and discharge, waste management, and onsite vehicle and equipment operations. None of these activities are anticipated to have any environmental effect on fish health or mortality with respect to direct fish takings. The potential environmental effects relate to changes in water or sediment quality that may result in changes in overall fish condition. The dewatering of Joyce Lake is rated 2 and is discussed separately in Section 15.6.

The main vectors for potential environmental effects from these Project activities are water or airborne contaminants. The potential environmental effects will be mitigated through surface water control and treatment systems, waste management, discharges in compliance with MDMER standards, operational guidance documents, dust management, an EMP, erosion and sediment control plans, adoption and adherence to BMPs for the installation and maintenance of erosion control structures, spill prevention and cleanup procedures, and a progressive rehabilitation plan.

Monitoring will also be conducted for compliance with the MDMER. Compliance with MDMER standards requires biological studies to determine fish health based on condition factor, gonad development, liver development, and egg size and numbers. This will enable direct assessment of fish condition during Operation of the Project.

The use of explosives during mining operations has the potential to interact with fish inhabiting the LSA. IAAC EIS guidelines for use of explosives in or near fish bearing waters will be adhered to ensure no detrimental harm to fish (Wright and Hopky 1998) as a result of blasting activity.

The grading of the rock causeway has the potential to introduce particulate matter into the Iron Arm area of Attikamagen Lake. Given the depths and water velocities at the proposed sites, along with the temporary nature of the works, potential environmental effects on water quality and fish are likely limited or negligible.

Application of these mitigation measures, in conjunction with those described for water treatment and discharge in Chapter 11: Water Resources, will greatly reduce the potential for alterations to existing water and sediment quality, thereby mitigating potential environmental effects on fish health and condition. Therefore, there are no likely significant environmental effects to fish health or mortality resulting from these activities.

15.4.2.3 Closure and Decommissioning

The environmental effects resulting from Closure and Decommissioning are rated as 1 for fish health and mortality. There are no interactions rated 2 for this phase of the Project.

Closure and Decommissioning will include waste disposal, the dismantling and removal of Project equipment, facilities and infrastructure, and site grading and rehabilitation. These activities could have environmental effects on fish health and mortality as a result of the removal of watercourse crossing structures and sedimentation during the removal process. Potential environmental effects of these activities will be mitigated through timing of decommissioning to avoid sensitive seasonal periods for species found in the PDA, a site water management plan, dust management, and Federal and/or Provincial permits which will outline guidelines or operational statements to reduce effects to fish health.

Potential environmental effects related to the removal of the stream crossing structures will be mitigated by the use of instream isolation techniques, implementation of erosion and sediment control measures, establishment of continuous flow around each crossing during removal, the inclusion of erosion protection material once the crossing has been removed and timing of removal to avoid sensitive seasonal periods for species found in the PDA.

Following application of these measures, it is anticipated that all potential environmental effects on fish health or mortality can be mitigated during Closure and Decommissioning. Therefore, there are no likely significant environmental effects to fish health or mortality resulting from these activities.

15.5 Existing Environment

15.5.1 Information Sources

Information used in support of the assessment of fish and fish habitat has been derived from a variety of baseline data sources, including 2012 and 2013 field surveys (Appendix V), reviews of existing literature, and local and Indigenous traditional knowledge.

Local and Indigenous Traditional Knowledge pertaining to Fish and Fish Habitat is presented in Table 15.6.

Table 15.6 Local and Indigenous Traditional Knowledge - Fish and Fish Habitat

Stakeholder	Community	Comment
Naskapi of Kawawachikamach	Naskapi of Kawawachikamach	• Fishing during the early phase of settlement at Schefferville was focused on the Attikamagen Lake system. • Montreal Bay - Very large lake trout in the area. • Goose River (Southeast of Iron Arm) Spawning area for trout; good fishing. • Fishing takes place on most lakes in the area, including the ones near the communities. Specifically the Lakes between Schefferville and Astray Lake (Lac John, Lac Gene, Barry Lake) • Attikamagen Lake (throughout) Lake trout, speckled trout and pike are the main species caught. Most lakes in the system are used for fishing. Everyone consumes fish. Year-round activity. • Pike are found at Iron Arm associated lakes • Freeman Lake was identified as a key Innu fishing area. Travel to Freeman Lake is via Astray Lake.

15.5.2 Methods for Characterization of Baseline Conditions

Fish and fish habitat field surveys were conducted between July 22 to August 10, 2012 and from August 21 to September 2, 2013. Overviews of the methods used in these baseline surveys are provided below, with complete documentation provided in the 2012 Fish and Fish Habitat Baseline Study and 2013 Update. (Appendix V).

15.5.2.1 Bathymetry and *In Situ* Water Chemistry

Bathymetric surveys were carried out in selected lakes to determine morphometric characteristics, such as maximal and mean depths, and water volume. The bathymetry was required for the classification of fish habitat based on Bradbury et al. (2001).

At the deepest location within waterbodies, *in situ* water temperature, dissolved oxygen, conductivity, pH, and turbidity were measured approximately 0.5 m below the water surface using a YSI 556 multi-parameter water quality meter. Temperature and dissolved oxygen were measured each metre down to 14 m and then each 2 m until the bottom was reached using the same multi-parameter instrument. The Secchi depth was measured using a Secchi disc to determine the approximate depth of the photic zone.

15.5.2.2 Substrate and Aquatic Vegetation Mapping

Substrate and vegetation mapping was performed visually in shallow water and when the water was very clear. Substrate data were collected by looking over the shaded side of a boat. Below the photic zone, sediment was sampled using a Petite Ponar grab to collect data on substrate type. The substrate was classified based on the nine categories proposed in Bradbury et al. (2001); (see 2012 Fish and Fish Habitat Baseline Study and 2013 Update in Appendix V.) This method was applied in waterbodies where the presence of fish was confirmed. Plant species were identified within the vegetation zones delineated.

15.5.2.3 Connecting Streams

Connecting streams (tributaries flowing in or flowing out of the lakes) were identified and characterized. The following information was also collected for at least the lowermost 100 m of each tributary: average depth, average width, surface velocity, habitat type, substrate composition, cover, riparian vegetation, stream bank stability, and any obstructions to fish passage.

15.5.2.4 Fish Sampling

In 2012, fish sampling was conducted in Joyce Lake, as well as in six unnamed lakes located on the peninsula (Figure 15.6). These were identified as Lakes A, B, C, D and Lakes E and F. Fish sampling was also conducted in two areas in Attikamagen Lake: Iron Arm and in a bay located to the west of the open pit mine (Bay 2). Additional fish sampling was conducted in 2013 in Joyce Lake, Gilling River and two unnamed water bodies (identified Lake H and Lake I) (Figure 15.6). Fishing was carried out using gillnets, fyke nets, minnow traps, and seine nets.

Gillnets were set perpendicular to the shore and small mesh sizes were set nearshore and offshore in alteration. Fyke nets were also set perpendicular to the shore. Minnow traps were distributed in shallow water in habitat favourable to small species (e.g., aquatic vegetation, covered by overhead vegetation, near shelter such as boulders or fallen trees). Seine nets were used in shallow water where the bottom was relatively even and free of large debris.

Fish caught alive were identified, measured and released. Dead fish were identified, measured and weighed. Sex and gonad development stage were also determined for brook trout, lake trout, round whitefish, longnose sucker, and white sucker. Abnormalities and parasites were noted when observed.

15.5.2.5 Stream Crossings

Fish Habitat

Stream crossings were characterized over approximately 250 m upstream and downstream from the intercept point. Where access was not possible near an intercept point, another part of the stream was characterized to estimate the type of habitat found in the stream. In 2012, stream crossings were divided into homogenous segments based on habitat types, while in 2013 streams were characterized based on 50 m long segments. In each segment, the following information was collected: length, mean width, water depth, flow velocity, type of habitat, number of pools and dimensions, substrate composition, bank description, presence of aquatic vegetation and cover, fish barrier, shelter and suitable spawning habitats. Temperature, conductivity, pH and dissolved oxygen were measured using YSI 63 and Oakton 300 water quality meters in each stream. Assessment of potential spawning and overwintering habitat, and existence of fish passage barriers was also conducted within a 2 km buffer area upstream and downstream of the crossing areas.

Fish Sampling

In 2012 and 2013, index electrofishing surveys were conducted to determine the fish species at identified crossing locations. Qualitative electrofishing stations covered 6 to 120 m^2 depending on the stream width, water depth and flow velocity. No blocknets were installed upstream or downstream, and only one sweep was conducted in each station. Each station described water temperature, station length and width, mean water depth, flow pattern, flow speed, vegetation cover and substrate composition. Station coordinates and fishing time were recorded. Fish captured were identified, measured (total length) and released.

15.5.2.6 Water and Sediment Quality

Water and sediment samples were collected in 2012 and 2013 and field methods, sample conservation and shipping were conducted according to the Metal Mining Technical Guidance for EEM (Environment Canada 2012). The stations were located in Joyce Lake, Iron Arm, Attikamagen Lake, Timmins Bay, Lake H, Lake I, Petitsikapau Lake and Gilling River. A summary of findings and results are provided within the Water and Sediment Quality component of the existing environment section.

Additional information can be found in the 2012 Fish and Fish Habitat Baseline Study and 2013 Update (Appendix V).

15.5.2.7 Benthic Invertebrate Communities

In 2013, benthos samples were collected at the same stations as the sediment samples using an Ekman grab. In addition, six samples were collected in coarse substrate habitat using a D-net. Twenty-three benthic invertebrate samples were collected and analyzed. A summary of findings and results are provided within the benthic invertebrate community section of the existing environment section.

Soft Substrate Habitat

Each sample was made of three grab subsamples collected approximately 1 m apart from each other. When the grab could not penetrate deeply into the sediment, additional subsamples were also collected. Sediment was sieved using a 500 microns mesh size and the remaining content was placed into a jar filled with ethanol 85%. Samples were sent to Laboratoires SAB in Longueuil, Québec for identification to the family level.

Additional information can be found in the 2012 Fish and Fish Habitat Baseline Study and 2013 Update (Appendix V).

15.5.2.8 Coarse Substrate Habitat

Where the substrate was too coarse for the Ekman grab, a D-net (500 µm mesh size) was used to collect benthic invertebrates. This method was used in streams, but also in Iron Arm along the shoreline where coarse substrate is found. Each station was 100 m long and made of 20 sampling plots scattered in various types of habitats. Each sampling plot was 30 cm wide and 50 cm long.

Additional information can be found in the 2012 Fish and Fish Habitat Baseline Study and 2013 Update (Appendix V).

15.5.3 Baseline Conditions

The Regional Study Area covers 2,140 km² of which 922 km² are lakes and rivers (Figure 15.3). The lakes and streams in this area of western Labrador form part of the Churchill River watershed. The Project lies on a peninsula of land in Attikamagen Lake, which drains south via Iron Arm into Freeman Lake, Petitsikapau Lake, Dyke Lake, and then into the Ashuanipi River, and finally into the Smallwood Reservoir. The Smallwood Reservoir is the main headwater to the Churchill River. In the southern part of the RSA, Howell River and Gilling River watersheds drain into Astray Lake which then drains to Dyke Lake.

A total of 25 fish species, are reported to occur throughout the fresh waters of Labrador (Bradbury et al. 1999); many of these are found in the region nearest Schefferville. According to New Millennium Iron Corporation (NML 2009) and field surveys conducted by WSP (Genivar 2013; WSP 2014), 16 fish species are known to occur within the RSA, including:

- brook trout (*Salvelinus fontinalis*);
- lake trout (*Salvelinus namaycush*);
- burbot (*Lota lota*);
- lake chub (*Couesius plumbeus*);
- lake whitefish (*Coregonus clupeaformis*);
- round whitefish (*Prospium cylindraceum*);
- longnose dace (*Rhinichthys cataractae*)
- longnose sucker (*Catostomus catostomus*);
- white sucker (*Catostomus commersoni*);
- mottled sculpin (*Cottus bairdi*);
- northern pike (*Esox lucius*);
- pearl dace (*Margariscus margarita*);
- slimy sculpin (*Cottus cognatus*);
- spottail shiner (*Notropis hudsonius*);
- threespine stickleback (*Gasterosteus aculeatus*);
- ouananiche (Landlocked Atlantic salmon; *Salmo salar*)

The distribution of species in the LSA and RSA is listed in Table 15.7. None of these species are listed under the NLESA or SARA. Fish presence surveys were conducted on many watercourses and waterbodies that potentially could be affected by the Project; these crossing locations might change with alterations to the Project footprint.

Table 15.7 Fish Species Present in the Local and Regional Study Area

Location [a]	Species Present																Sources
	Brook Trout	Lake Trout	Burbot	Lake Chub	Pearl Dace	Longnose Dace	Spottail Shiner	Threespine Stickleback	Lake Whitefish	Round Whitefish	Longnose Sucker	White Sucker	Northern Pike	Slimy Sculpin	Mottled Sculpin	Ouananiche	
Attikamagen Lake		x			x			x		x	x	x			x		1
Iron Arm		x			x			x		x	x	x					1
Petitsikapau Lake		x		x							x		x				1
Joyce Lake			x	x							x						1
Lake E	x	x	x		x						x	x			x		1
Lake F	x										x	x					1
Lake H			x									x	x		x		1
Gilling River	x		x	x				x			x	x	x		x		1, 4
AR07	x											x			x		1
AR08	x																1
AR09	x										x				x		1
AR11	x																1
AR12	x			x		x					x						1
AR13	x	x		x													1
HO-T02[b]	x											x					1
Slimy Lake	x	x			x				x		x	x					3
Bean Lake	x		x		x		x		x		x	x		c			3
Howell River	x	x											x			x	2

Notes:
Lakes include tributaries and outlets. Different level of effort and different gear were used for sampling: some species present may not have been captured.
a. Locations surveyed by Genivar and WSP are not necessarily the same as current stream crossing locations
b. Tributary of Hollinger Lake
c. Species not identified but could occur.
Sources: 1 – Genivar (2013) and WSP (2014) (Appendix V); 2 - NML (2009); 3 – LIM (2009); 4 - LIM (2013).

15.5.3.1 Fish Habitat in Lakes and Connecting Streams within the LSA

A total of 12 fish species were found in the LSA: longnose sucker, longnose dace, white sucker, lake chub, threespine stickleback, mottled sculpin, burbot, pearl dace, round whitefish, northern pike, brook trout and lake trout. The following sections present the general description of the lakes that potentially could be affected by the Project. Additional information is available in the 2012 Fish and Fish Habitat Baseline Study and 2013 Update in Appendix V.

Attikamagen Lake and Iron Arm

Attikamagen Lake is a large waterbody with a surface area of 27,053 ha characterized by the presence of numerous bays. The perimeter of this lake is 780 km and the shoreline development index was 13.4, which reflects the potential for greater development of littoral communities in proportion to the volume of the lake (Wetzel 2001).

Iron Arm is the connection between Attikamagen Lake and Petitsikapau Lake and is considered to be part of Attikamagen Lake. Iron Arm covers a surface area of 4,032 ha. The bathymetric survey was conducted in the central part of Iron Arm within the PDA. The maximum depth reaches 34.8 m in a pool located at the head of the channel. Shallow waters are found mainly on the eastern shore of Iron Arm and in its southern part.

The 2012 fish sampling campaign confirmed the presence of seven fish species, with the round whitefish and lake trout being the two most abundant, with relative catch abundances of 70.6% and 10.8%, respectively. Other fish species found were longnose sucker, white sucker, pearl dace, mottled sculpin and threespine stickleback, accounting for less than 5% each (GENIVAR 2013).

The substrate along Iron Arm shoreline was mostly composed of cobble and rubble. However, in small bays near the cabins on the west shore, the substrate was predominantly muck, with some cobble and sand. Small patches of aquatic vegetation occur in shallow areas, mostly composed of bur-reed (*Sparganium sp.*) and rush (*Juncus sp.*). The eastern shoreline was characterized by the presence of small bays where muck was the predominant substrate constituent. Patches of aquatic vegetation are also found along this shore.

Several small streams discharge into Iron Arm. However, most of these are probably seasonally intermittent watercourses due to their small catchment areas and only one is crossed by the proposed haul road.

A rockfill causeway and bridge spans are proposed to cross Iron Arm in order to provide access to the mine site. Habitat within this area of Iron Arm consists of littoral habitat with substrate composed predominantly of rubble, cobble and gravel. The water depths within the causeway footprint vary from 1 to 3 m. Small patches of aquatic vegetation are located to the north of the large island, this is illustrated in Figure 15.4.

Joyce Lake

Joyce Lake is a small 37.8 ha waterbody that lies on a peninsula of land in Attikamagen Lake (Figure 15.5). The bathymetric survey indicates that the maximum depth (23.0 m) occurs in the northern part of the lake. The mean water depth was 7.7 m. There are no connecting streams to or from Joyce Lake. The outlet appears to be ephemeral on the surface, but may flow as underground seepage. Pockets of water were found approximately 500 m south (down gradient) of the lake during the 2012 field surveys.

The temperature-oxygen profile in Joyce Lake during the 2012 field survey was typical of a heterograde dimictic lake. A thermocline was present between 6 and 10 m and an increase of oxygen was observed in the metalimnion. The dissolved oxygen concentration in the deepest two metres was below the minimum requirement for fish. Lake water showed no particular colour and the Secchi depth was 7.5 m. This value was quite high and is generally representative of a low productivity lake.

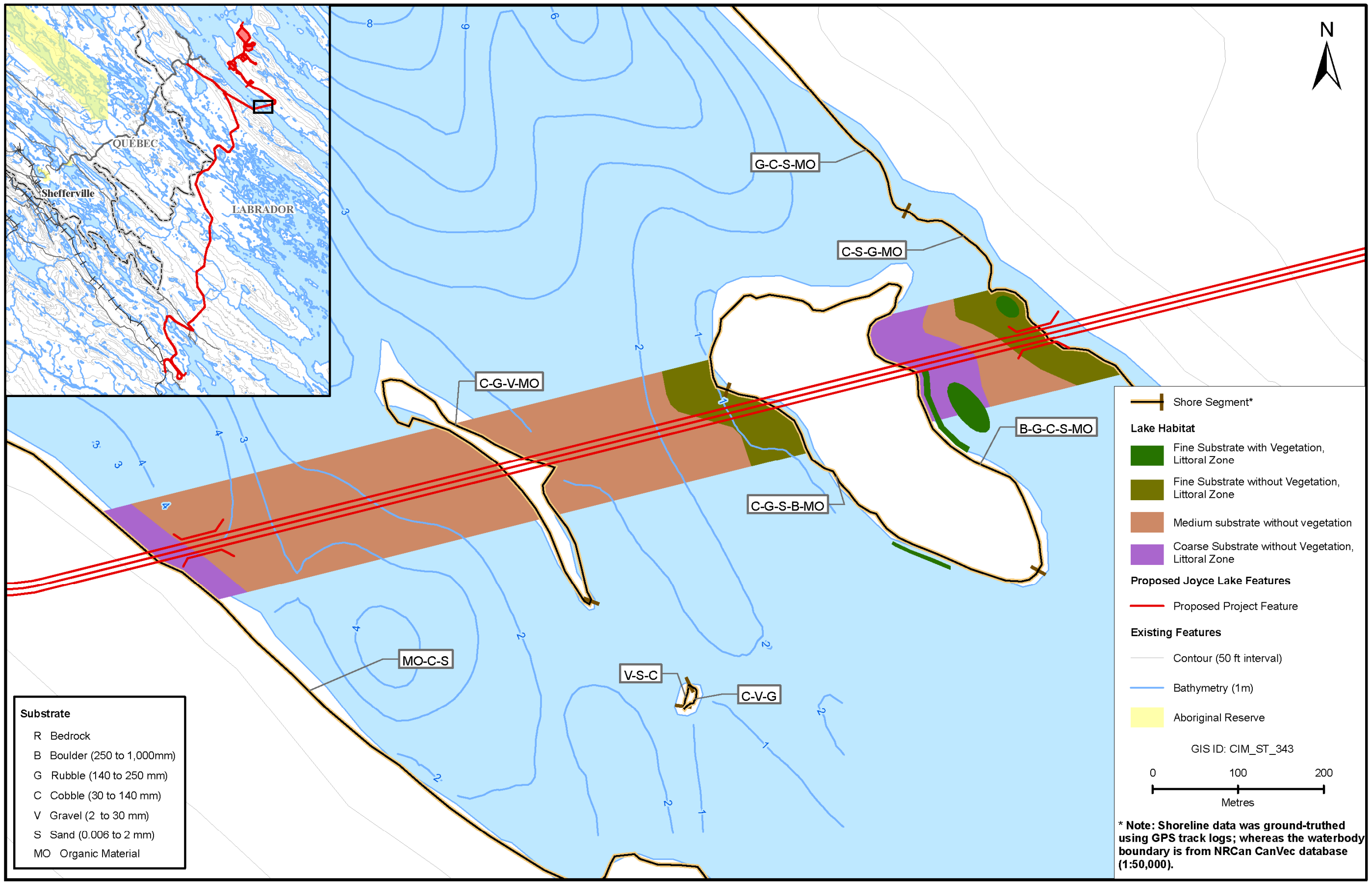

FIGURE TITLE: Iron Arm Causeway - Substrate Mapping				
CLIENT: LABEC CENTURY IRON ORE INC.				
CHECKED BY: DF	FIGURE ID: FIGURE 15.4	PROJECT NUMBER 121511139	FIGURE SOURCES: Project features provided by BBA version 2 received 2014/11/07. Fish Habitat data provided by WSP received 2014/12/09. Basemap information from NRCan CanVec database and Newfoundland and Labrador Department of Natural Resources.	Stassinu Stantec Limited Partnership

Figure 15.4 Iron Arm Causeway - Substrate Mapping

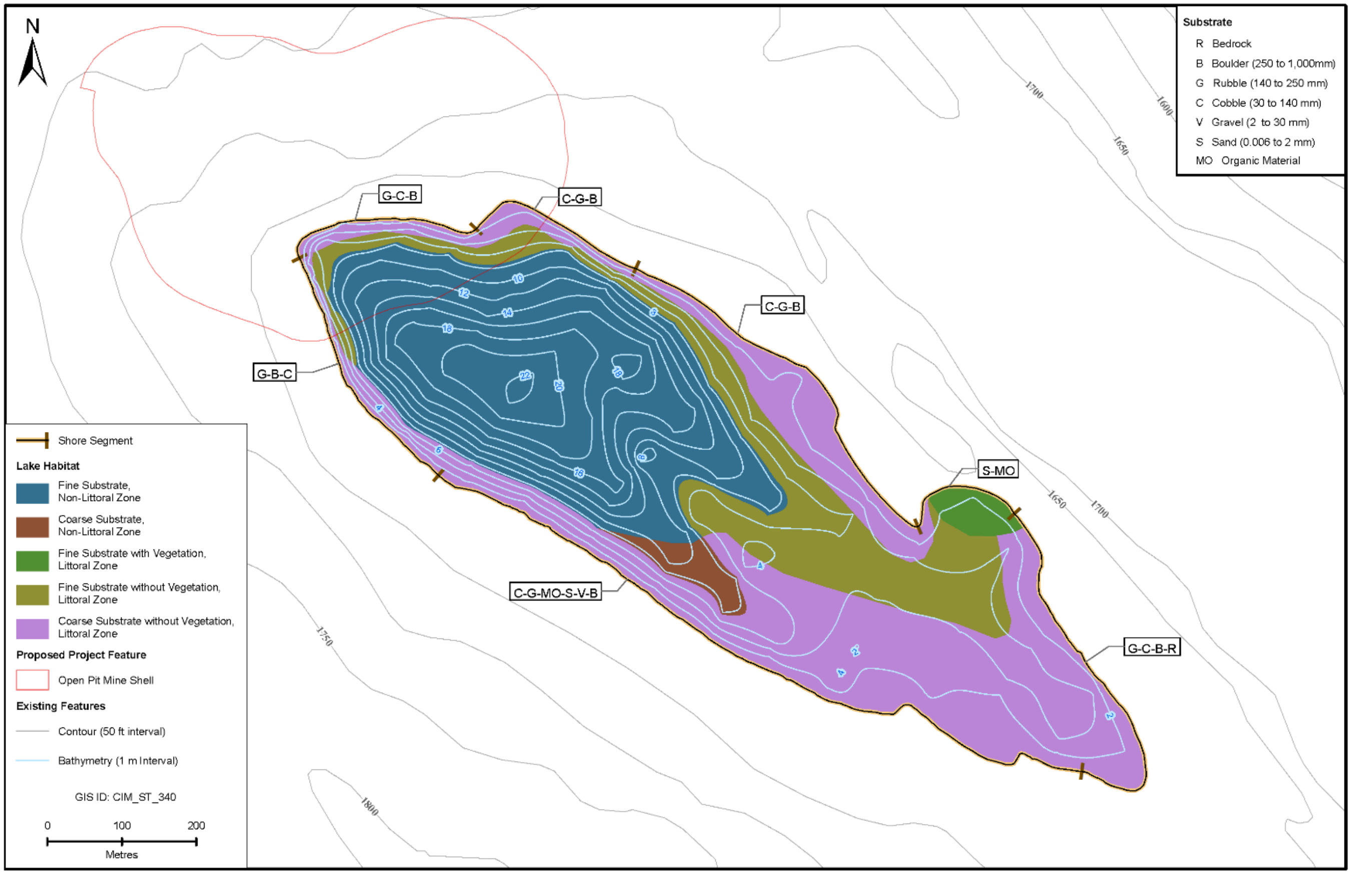

	FIGURE TITLE: Joyce Lake - Substrate Mapping				
	CLIENT: LABEC CENTURY IRON ORE INC.				Stassinu Stantec Limited Partnership
	CHECKED BY: DF	FIGURE ID: FIGURE 15.5	PROJECT NUMBER 121511139	FIGURE SOURCES: Project features provided by BBA version 2 received 2014/11/07. Fish Habitat data provided by WSP received 2014/12/09. Basemap information from NRCan CanVec database and Newfoundland and Labrador Department of Natural Resources.	

Figure 15.5 Habitat Mapping of Joyce Lake

The surface water pH was alkaline with a value of 7.77; however, the pH value decreases with depth to reach an acidic value of 5.24 near the bottom of the lake. Low pH value in depth may be due to higher CO_2 (lower oxygen content) concentrations near the bottom (Wetzel 2001). The conductivity was very low (11.0 µS/cm) and also representative of a low productivity lake.

On August 1 2012, fish sampling was conducted in Joyce Lake using gillnets and minnow traps with a total of 119 lake chub captured in the traps. In August 2013, three fish species were captured using gill nets, fyke nets, and minnow traps: lake chub (1,239), longnose sucker (149) and burbot (10).

The shoreline substrate was mainly composed of cobble and rubble and the riparian vegetation was mainly composed of shrubs. In the littoral zone, coarse substrate without vegetation was predominant, followed by fine substrate without vegetation (Figure 15.5). In the non-littoral zone, fine substrate (mostly reddish silt and clay) was dominant but coarse substrate was also found.

Despite the fact that sucker and burbot may be fished by Naskapi from Kawawachikamach and Innu from Matimekush–Lac John in the Schefferville region there is no known Indigenous fishery occurring in Joyce Lake (WSP 2014). During the surveys conducted in 2012 and 2014 on Joyce Lake no outlet was identified, the natural relief to the south of the lake may provide drainage during high flows but Joyce Lake most likely drains underground. During the 2014 surveys isolated pockets of water were observed approximately 500 m south of the lake in the wetland. The fish community within Joyce Lake is isolated from other populations with no direct connection to other fish communities.

Lakes A, B, C and D

Lakes A, B, C and D are small waterbodies adjacent to Joyce Lake with area covering 0.75, 2.51, 0.30 and 2.10 ha, respectively (Figure 15.6). These lakes have no interconnecting streams and there was no sign of any tributaries or outlets based on the high-resolution aerial photographs.

Fish sampling was conducted in these lakes in August 2012 using a seine net, gillnet and minnow traps and no fish were found. Considering morphometric characteristics and the absence of fish, these lakes were not considered as fish habitat.

Lake E

Lake E is located halfway between Joyce Lake (north) and Hollinger Lake (south) (Figure 15.6). This waterbody has a surface area of 26.9 ha and the bathymetric survey indicates that there are three basins in the lake and the deepest (19.0 m) was located in its eastern part. The mean water depth was 5.3 m. This lake has a very long shoreline as compare to its surface area (D_L: 2.20) which, in general, indicates a relatively high potential of productivity.

In August 2012, fish sampling was conducted in Lake E using gillnets, a fyke net and minnow traps and a total of seven fish species were caught, longnose sucker (87), white sucker (45) and pearl dace (35) lake trout (8), brook trout (4), burbot (3), and mottled sculpin (1).

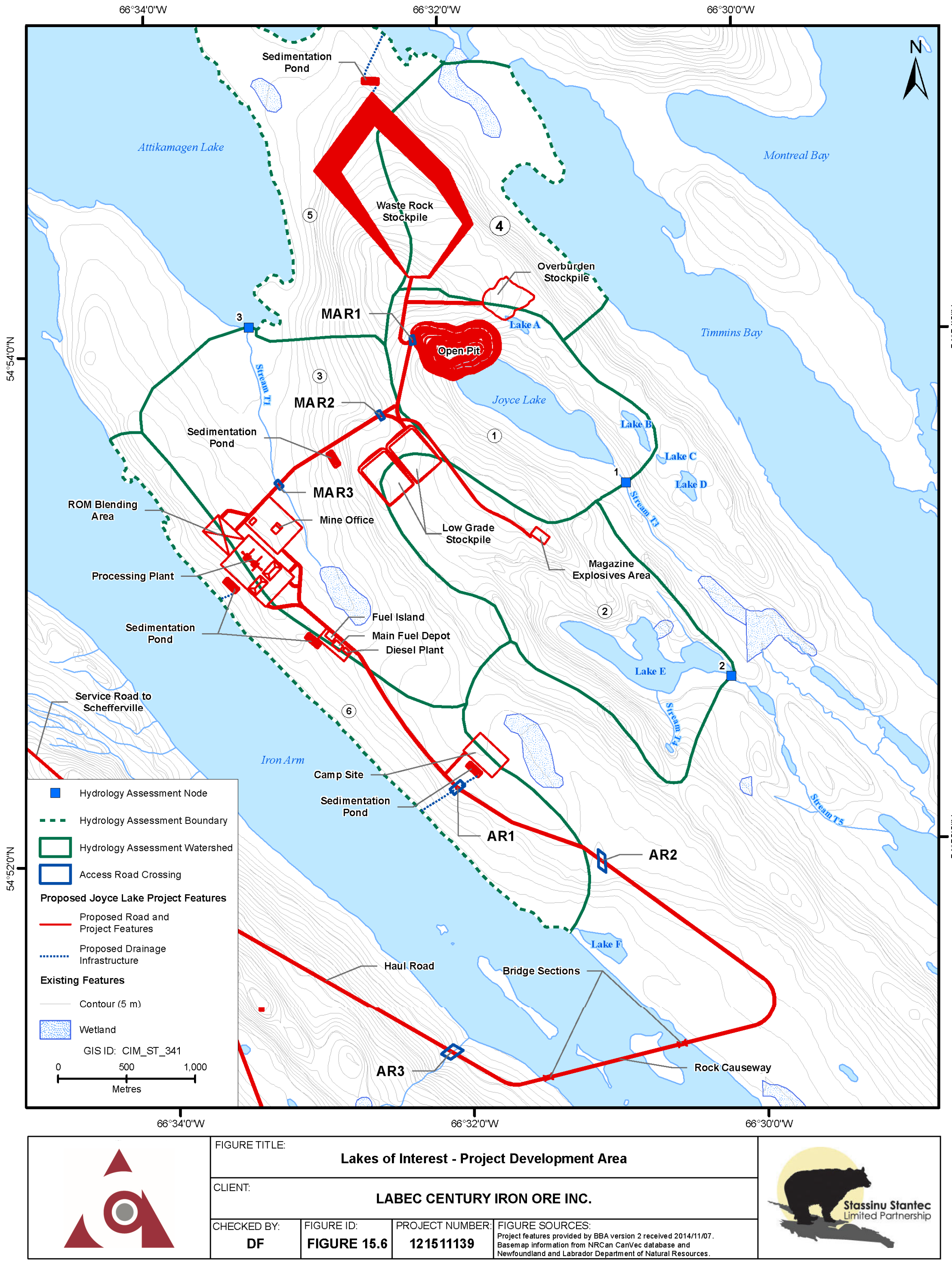

Figure 15.6 Lakes of Interest – Project Development Area

In the littoral zone, fine substrate without vegetation was predominant. Medium substrate and coarse substrate without vegetation were mostly found along the shoreline. Two small areas with vegetation were found, a small one with fine substrate and one thin area along the south-west shore composed of medium substrate. In the non-littoral zone, fine substrate was predominant but coarse substrate was also found. The total habitat equivalent units varies from 12,276 m^2 (longnose sucker) to 175,634 m^2 (lake trout). However, the non-littoral zone may be unsuitable at times for fish or some fish life stages, when dissolved oxygen concentrations below 10 m are very low. This condition may occur during the summer, when the thermocline is established, or during the winter under ice cover.

There are three tributaries and the outlet streams that connect to Lake E. The most important watercourse is LE-E01, which is the lake outlet that discharges into a small lake that connects to HO-T02 (Hollinger Lake tributary). Electrofishing was conducted in LE-E01 in August 2012. Three fish species were caught: brook trout, longnose sucker and mottled sculpin. Electrofishing in Tributary HO-T02 found white sucker. A dead brook trout was also found.

Lake F

Lake F is a small waterbody (3.8 ha) located on the east shore of Iron Arm. The bathymetric survey indicates that the water was very shallow, with a maximum and a mean water depth of 1.1 and 0.48 m, respectively.

Fish sampling was conducted in Lake F using gillnets and minnow traps and a total of three fish species were caught; these being white sucker (22), longnose sucker (17) and brook trout (2).

Petitsikapau Lake

Petitsikapau Lake is a vast (17,087 ha) waterbody located in the southern part of the RSA (Figure 15.3). No bathymetric survey was conducted in this lake. The shoreline was characterized in a small area and electrofishing was conducted in one tributary. Many streams likely to be affected by crossings discharge into this lake.

In the bay surveyed, the shoreline presents, in general, a coarse substrate composed of cobble, rubble, and boulders. The riparian vegetation was almost non-existent as the banks are mostly composed of boulders.

Northern pike and lake trout remains (bones) were found along the shoreline of Petitsikapau Lake, which indicates that these two species are present in this waterbody. A lake trout was also captured using a fishing rod. Longnose sucker and lake chub were also caught using electrofishing.

15.5.3.2 Fish Habitat at Stream Crossings within the LSA

A total of 17 stream crossings were identified with respect to the mine site and proposed haul road. These crossings are illustrated in Figure 15.7 and listed in Table 15.8, with additional information on stream characteristics in the 2012 Fish and Fish Habitat Baseline Study and 2013 Update (Appendix V).

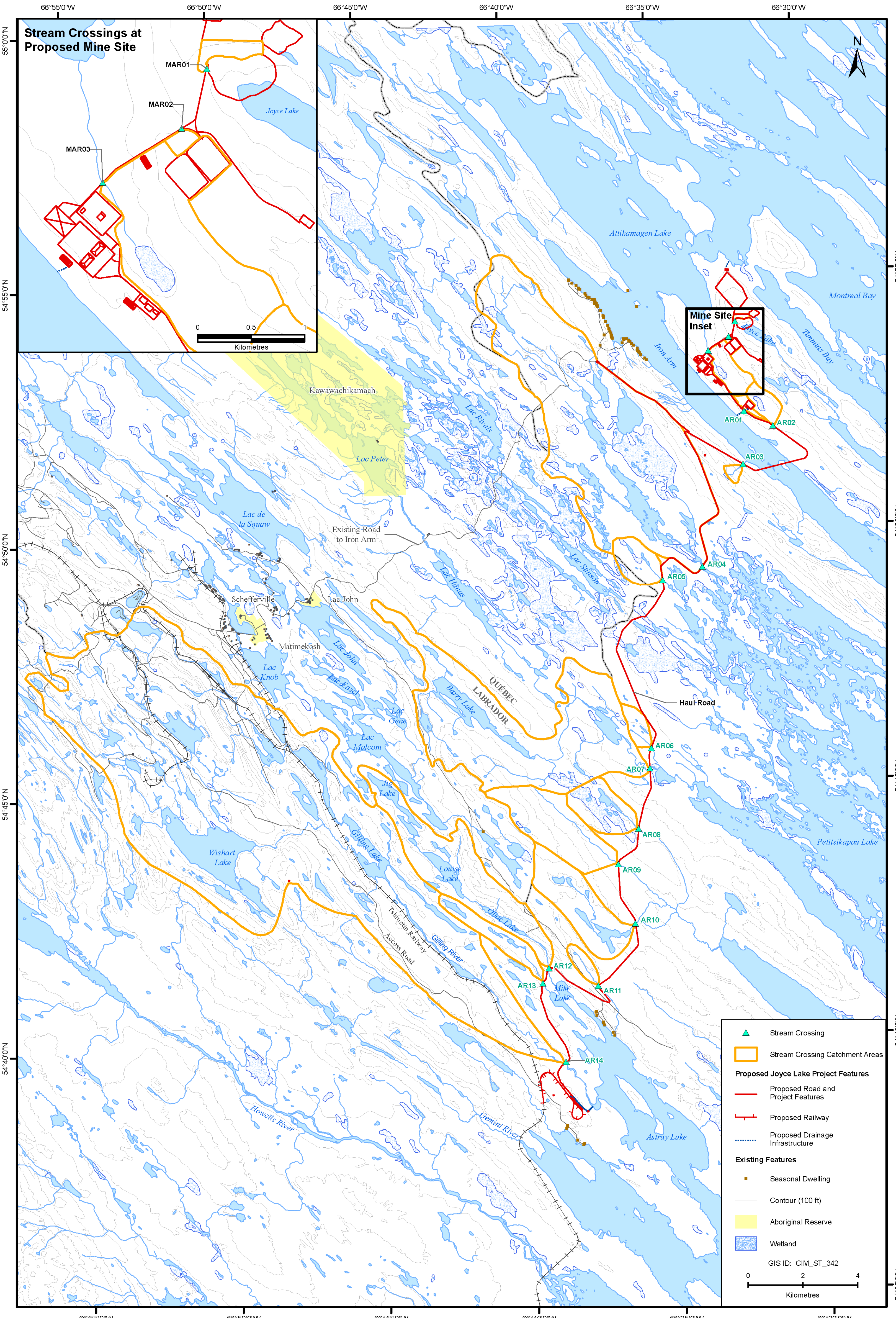

FIGURE TITLE: Watercourse Crossings Along Access and Site Roads			
CLIENT: LABEC CENTURY IRON ORE INC.			
CHECKED BY: DF	FIGURE ID: FIGURE 15.7	PROJECT NUMBER: 121511139	FIGURE SOURCES: Project features provided by BBA version 2 recieved 2014/11/07. Basemap information from NRCan CanVec database and Newfoundland and Labrador Department of Natural Resources.

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Figure 15.7 Watercourse Crossings along Access and Site Roads

Table 15.8 Potential Stream Crossings within the LSA

Stantec - FFH VC Chapter1	WSP Fish and Fish Habitat Baseline Study²			Stantec - Water Resources VC Chapter3		
Crossing ID	**Crossing ID**	**Fish Habitat**	**Fish Presence**	**Fish Passage Required**	**Culvert Type**	**Culvert Design**
MAR01	Not Assessed in 2012 or 2013 surveys			-	-	-
MAR02	Not Assessed in 2012 or 2013 surveys			-	-	-
MAR03	AT-T01	No	-	-	-	-
AR01	Not Assessed in 2012 or 2013 surveys			-	-	-
AR02	Not Assessed in 2012 or 2013 surveys			No	CSP	Circular
AR03	Not Assessed in 2012 or 2013 surveys			No	CSP	Circular
AR04	CR-20[1]	Yes	Yes	Yes	CSP	Arch
AR05	CR-21	No	No	No	CSP	Circular
AR06	CR-09	No	No	No	CSP	Circular
AR07	CR-10	Yes	Yes	Yes	CSP	Arch
AR08	CR-11	Yes	Yes	Yes	CSP	Circular
AR09	CR-12	Yes	Yes	Yes	CSP	Circular
AR10	Not Assessed in 2012 or 2013 surveys			Yes	CSP	Circular
AR11	CR-14[1]	Yes	Yes	Yes	CSP	Circular
AR12	CR-15	Yes	Yes	Yes	CSP	Circular
AR13	CR-16	Yes	Yes	Yes	CSP	Circular
AR14	CR-17	Yes	Yes	Yes	Bridge	Span

Notes:
1 Stream Habitat Assessment was conducted greater than 1 km from the proposed crossing
² WSP 2014

A summary of the habitat characteristics associated with the stream crossings is provided in Table 15.9, with more detailed descriptions for fish-bearing streams included below. All but one stream to be crossed by the access roads are unnamed watercourses; therefore, all were given project IDs for the purpose of the assessment.

Table 15.9 Fish Habitat Summary of Stream Sections at Proposed Crossing Areas

Crossing ID	Segment	General Characteristics					Stream Bed								
		Length (m)	Mean width (m)	Mean Depth (m)	Type of habitat (%)	Flow velocity (m/s)	Substrate (%)[1]								Aquatic vegetation[2]
							L	S	V	C	G	B	R	MO	
MAR01	Not Assessed in 2012 or 2013 surveys														
MAR02	Not Assessed in 2012 or 2013 surveys														
MAR03	*Intermittent; crossing located in a wetland were pockets of water were visible a short distance downstream the crossing location. No fish habitat.*														
AR01	Not Assessed in 2012 or 2013 surveys														
AR02	Not Assessed in 2012 or 2013 surveys														
AR03	Not Assessed in 2012 or 2013 surveys														
AR04	AV-S2	68	10.0	0.16	70Rapid; 30Run	0.2 - 0.6 - 0.5; 0.2 - 0.7 - 0.5; 0.2 - 0.4 - 0.4	-	-	-	45	45	10	-	-	S – 5 %
AR05	*Intermittent; dry during field campaigns. No fish habitat.*														
AR06	*Intermittent; dry during field campaigns. No fish habitat.*														
AR07	US-SEG1	50	9	1.2	100Flat	0.1 - 0.1 - 0.1	-	5	-	-	-	5	-	90	S – 40%
	DS-SEG1	50	9	1.1	100Flat	0.1 - 0.1 - 0.1	-	-	-	-	-	10	-	90	S – 45%
AR08	US-SEG1	50	2.0	0.50	100Flat	0.3 - 0.3 - 0.3	-	5	5	30	20	10	-	30	S – 10%
	DS-SEG1	50	2.0	0.45	90Flat; 5Run; 5Riffle	0.4 - 0.4 - 0.4	-	10	5	30	30	5	-	20	S – 10%
AR09	US-SEG1	50	2.8	0.6	70Run; 20Flat; 10Rapid	0.3 - 0.6 - 0.4	-	-	-	10	20	70	-	-	No
	DS-SEG1	50	2.5	0.5	80Run; 20Riffle	0.3 - 0.8 - 0.4	-	-	-	5	15	80	-	-	No
AR10	Not Assessed in 2012 or 2013 surveys, based on aerial imagery presents probable fish and fish habitat														
AR11	US-SEG4	50	0.8	0.2	20Run; 80 Flat	0.1 - 0.2 - 0.1		5	5	10	15	5		60	No

Table 15.9 Fish Habitat Summary of Stream Sections at Proposed Crossing Areas

Crossing ID	Segment	General Characteristics					Stream Bed								
		Length (m)	Mean width (m)	Mean Depth (m)	Type of habitat (%)	Flow velocity (m/s)	Substrate (%)[1]								Aquatic vegetation[2]
							L	S	V	C	G	B	R	MO	
AR12	US-SEG1	50	3.0	0.4	90Rapid; 10Cascade	0.8 - 0.9 - 0.8	-	-	-	10	50	40	-	-	No
	DS-SEG1	50	2.5	0.5	80Rapid; 20Run	0.8 - 0.7 - 0.8	-	-	5	15	70	10	-	-	No
AR13	US-SEG1	50	0.5	0.8	50Run; 40Riffle; 10Flat	0.4 - 0.5 - 0.4	-	10	20	60	5	5	-	-	No
	DS-SEG1	50	0.5	0.4	60Run; 40Riffle	0.4 - 0.4 - 0.4	-	5	15	35	40	5	-	-	E – 5%
AR14 Gilling R.	AM-S1	268	21.0	0.45	100Flat	0.3 - 0.4 - 0.3	-	90	-	-	-	-	-	10	E – 60 %

Notes:
[1] Substrate: L: Silt and clay; S: Sand; V; Gravel; C; Cobble; G: Rubble; B : Boulder; R: Bedrock
[2] E: Emergent vegetation; S: Submergent vegetation

The following fish habitat descriptions are a summary of the data collected as part of the fish and fish habitat assessments conducted by WSP, the full data set for each watercourse is included in Section 5 of the Baseline Report (Appendix V).

MAR03

MAR03 is a stream identified in the 1:50,000 topographic map that discharges into Attikamagen Lake. In 2012, only small lakes in wetlands and pockets of water were found. The stream was determined to be an intermittent stream receiving water on rare occasions. During the 2013 field campaign, a stream was visible from Attikamagen Lake and up to approximately 350 m upstream. Beyond that point, the water was running through multiple small channels and, in some areas, the water seemed to flow underground.

The proposed crossing location was not accessible by foot; small channels and small pockets of water were visible by helicopter. It is assumed that in minimum flow condition, part of this watercourse stream could be dry and inaccessible to fish. In the area of the crossing, the small channels also run underground over short distances in many areas. Therefore, it is unlikely that there are fish in the upper part of the stream, where the projected crossing is located. The upper part of MAR03 corresponds to a wetland and is not considered to be a fish habitat (Table 15.9). No electrofishing was conducted in the lower part of the stream where a channel was present.

AR01

There is no information available on the stream crossing AR01.

AR02

There is no information available on the stream crossing AR02.

AR03

There is no information available on the stream crossing AR03.

AR04

The habitat assessment for AR04 conducted in 2013 was approximately 1.25 km upstream from the current proposed crossing location. AR4 is an outlet of a large unnamed lake and the stream crossing intercept is characterized by rapid and run types of habitats (Table 15.9). Mean width was 10.0 m and mean water depth ranged from 0.05 to 0.22 m during the 2012 field work. Flow velocities ranged from 0.2 to 0.7 m/s. The substrate was coarse with cobble and rubble as the dominant classes found. The stream discharges into a small lake that connects to Petitsikapau Lake. Additional information was collected in 2013 in the lake located downstream from the proposed crossing location. The water was too shallow to navigate and therefore the information was collected from the helicopter at low altitude. The substrate is predominantly organic material and large patches of aquatic vegetation were found in the lake (lake lilies and bur-reed). The lake provides suitable habitat for juveniles of many fish species.

Fish were observed upstream from the crossing site during the 2012 field work. In the uppermost part of the stream, a large beaver dam was determined to act as a fish barrier. In 2012, some northern pike were observed downstream from this dam, but no fish was caught using electrofishing, probably due to the high water level caused by the rain (Table 15.9). In 2013, four species were captured: two burbot, five mottled sculpin, two lake chub and a single white sucker (Table 15.7).

AR05

As observed in 2012, no streams were found at AR05 in 2013, but a few pockets of water were observed. These seemed to be part of some wetlands but not connected to each other. In 2013, water could be heard underground running through boulder covered by peat. AR5 is considered to be a hydric link between a wetland (north) and a waterbody (south); but considering it runs underground over a long distance, it is not considered to be a fish habitat.

AR06

As observed in 2012, there was no stream found at proposed crossing AR06 in 2013 (Table 15.9). A wetland was found as well as some small pockets of water. At this location the flow is intermittent and partially underground and does not connect upstream to any other watercourse or waterbody. There is no fish habitat at this crossing.

AR07

In 2013, AR07 was characterized over a distance of 200 m upstream and 250 m downstream from the proposed crossing. In general, this stream section is quite homogenous with a flat type of habitat (Table 15.9), a width ranging from 9 to 12 m, a water depth ranging from 0.9 to 2.2 m, and a flow velocity of 0.1 m/s. The substrate is mostly composed of organic material. In CR10B, three fish species were caught using electrofishing: six mottled sculpin, one brook trout and one white sucker (Table 15.7).

AR08

AR08 was characterized over a distance of 200 m upstream and 250 m downstream from the proposed crossing. This stream section is predominantly a flat type of habitat, with short segment with run and riffle types of habitat (Table 15.9). The stream width ranges from 1.2 to 2.4 m, the water depth ranged from 0.4 to 0.8 m, and a flow velocity was 0.3 to 0.4 m/s. The substrate is mostly composed of cobble and rubble with organic material.

Electrofishing was conducted on August 29, 2013. The station was located upstream from the crossing due to the dense vegetation found in the area of the proposed crossing. There are no fish barriers between the two areas so the fish species are assumed to be the same. Four brook trout were caught and two other fish were observed (Table 15.7).

AR09

AR09 was characterized over a distance of 200 m upstream and 250 m downstream from the proposed crossing. This stream section is predominantly a run type of habitat, with short segments with rapid and riffle types of habitat (Table 15.9). The stream width ranges from 2.8 to 3.5 m, the water depth ranged from 0.4 to 0.6 m, and a flow velocity was 0.3 to 0.9 m/s. The substrate is mostly composed of boulder, with cobble and rubble. There was no aquatic vegetation.

Electrofishing was conducted on August 29, 2013. Three fish species were captured: one mottled sculpin, one longnose sucker and five brook trout (Table 15.7).

AR10

There is no information available on the stream crossing AR10.

AR11

This stream is approximately 3.7 km long and discharges into Astray Lake. It does not connect to any other waterbody. This stream was characterized over a distance of 500 m only in the upper part of the stream approximately 2.0 km upstream from the proposed crossing (Table 15.9). In this area, electrofishing was conducted on August 30, 2013, four brook trout were captured, and two other individuals were observed (Table 15.7).

AR12

In 2012, AR12 was characterized from the ground in its downstream part is located in a black spruce stand. The rest of the stream, up to Oboe Lake was characterized from the helicopter and only barriers to fish passage and suitable spawning habitat were searched in this section.

In 2013, the proposed stream crossing was characterized from the ground. This stream section is predominantly a rapid type of habitat (Table 15.9), with a stream width ranging from 2.5 to 3.7 m, a water depth ranging from 0.2 to 0.7 m, and a flow velocity of 0.5 to 1.2 m/s. The characterized upper segment (US-SEG4) differs from the rest of the section by the presence of a pool type of habitat where the flow velocity was 0.4 m/s and the mean depth was 1.0 m. The substrate is mostly composed of rubble, cobble and boulder and no aquatic vegetation was found.

In 2012, one suitable brook trout spawning habitat was identified during the characterization from the helicopter and it is located 875 m upstream from the proposed stream crossing. Six other suitable brook trout spawning habitats were identified and several juveniles were observed during the fieldwork. Brook trout, longnose sucker and lake chub were caught in this stream using electrofishing. In 2013, the electrofishing station was located approximately 200 m upstream the proposed crossing and three species were captured: two brook trout, five longnose dace and two lake chub (Table 15.7). A brook trout (approximately 20 cm long) was observed in a pool during the fieldwork.

AR13

AR13 also discharges into Mike Lake and its lowermost part was characterized in 2012 from the ground up to the first fish barrier. Upstream, the water runs underground which prevent fish passage. The crossing is located in an area where the stream is partially underground.

In 2013, the proposed stream crossing was visited again to validate the information available. It was characterized 150 m downstream from the proposed crossing (until it became underground) and 200 m upstream (Table 15.9). This stream section is predominantly a run/riffle type of habitat, with a stream width ranging from 0.25 to 0.90 m, a water depth ranging from 0.4 to 0.8 m, and a flow velocity of 0.3 to 0.5 m/s. The substrate is mostly composed of gravel and rubble with some sand and cobbles. The underground section of the stream may prevent fish passage during minimum flow periods.

Electrofishing was conducted on August 30, 2013 and the station was located 430 m upstream from the proposed crossing. Three species were captured: one brook trout, one lake trout and one lake chub (Table 15.7).

AR14 (Gilling River)

AR14 corresponds to a section of the Gilling River and the stream crossing is located in segment AM-S1 (Table 15.9). AM-S1 is a linear channel of approximately 21.0 m wide and with water depths of 0.41 to 0.51 m and flow velocities of 0.3 to 0.4 m/s during the fieldwork. The substrate is predominantly sand with some organic material. Aquatic vegetation covered approximately half of the substrate.

On August 26 and 27, 2013, fish sampling was conducted in the Gilling River using gillnets, fyke nets and minnow traps. Fishing gear was set overnight. 59 fish were captured, with lake chub brook trout and white sucker being the predominant species. The other fish species that occur in this river are longnose sucker, northern pike, burbot, threespine stickleback and mottled sculpin.

15.5.3.3 Water Quality

Water Quality was collected from five stations within the PDA, these locations are illustrated in Figure 15.8. Results obtained from these stations are presented in Table 15.10. Where numerical guidelines exist results have been compared to the CWQG-PAL published by the CCME (2012a). Four parameters exceeded CCME Guidelines: aluminum, chlorine, copper and zinc, these four parameters are discussed further below. Additional information can be found in the 2012 Fish and Fish Habitat Baseline Study and 2013 Update in Appendix V.

Aluminum concentrations slightly above the guidelines was found in Joyce Lake, Attikamagen Lake and Petitsikapau Lake water samples. Total chlorine was measured in the Gilling River with a concentration of 0.2 mg/L, which is above the CWQG-PAL, while it was not detected in the other samples. Copper was above the CWQG-PAL in Bay 3 (0.005 mg/L) while zinc was above the Guidelines in Bay 2 (0.16 mg/L) and Joyce Lake (0.004 mg/L).

The results suggest that aluminum, copper and zinc concentrations in excess of the CWQC-PAL guideline are naturally occurring and represent baseline conditions at the Project site.

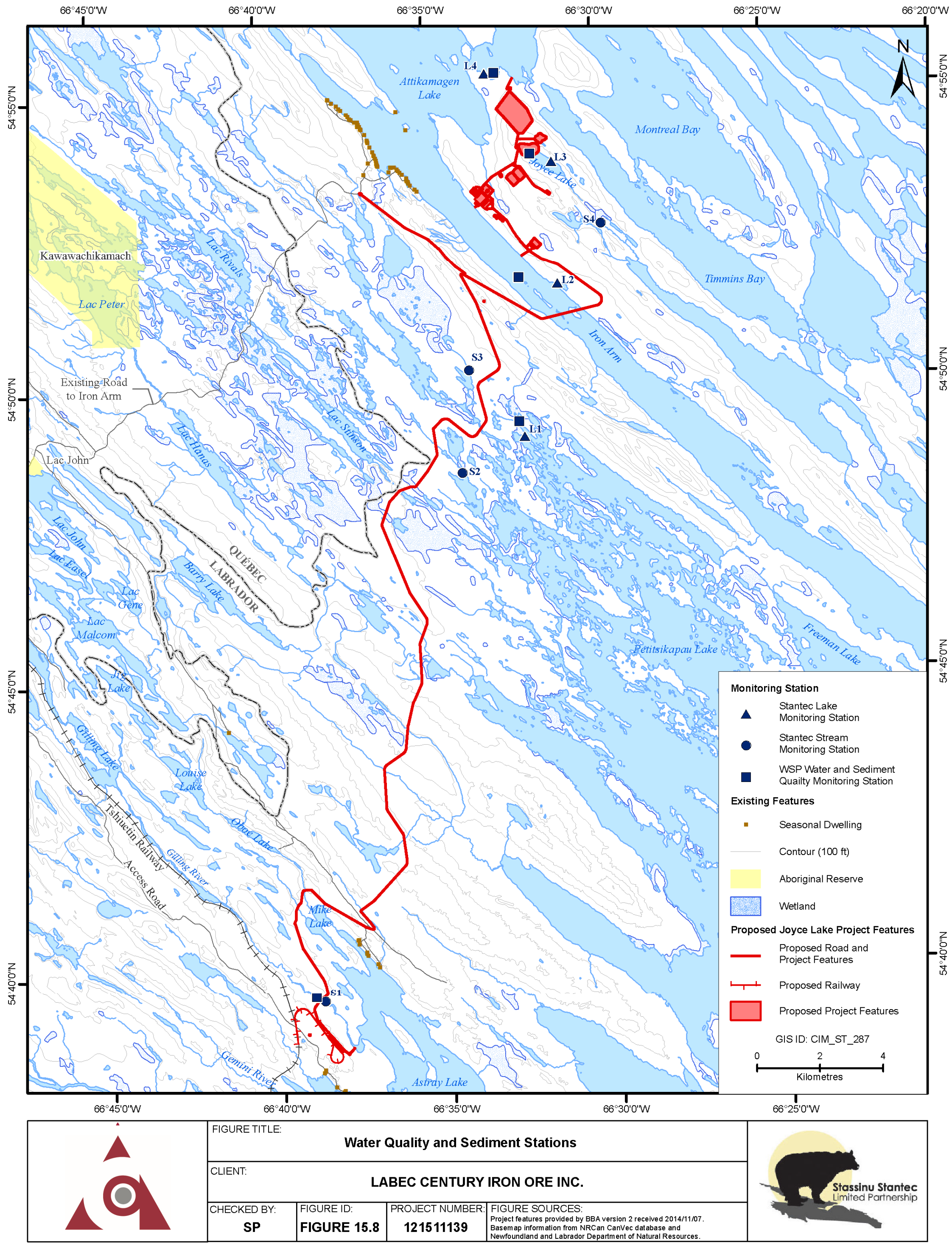

Figure 15.8 Water Quality and Sediment Stations

Table 15.10 2012 *In-situ* Water Quality and Analytical Results

Parameters	Units	Sample ID					CWQC-PAL[e]		NL ECWSR[f]
		Attikamagen Lake (Bay 2)	Joyce Lake	Iron Arm	Petisikapau Lake (Bay 3)	Gilling River	Short-term	Long-term	
General chemistry									
Temperature (*in situ*)	°C	15.5	16.4	15.7	16.7	15.4			
Dissolved oxygen (*in situ*)	mg/L	9.64	8.45	7.83	8.65	9.38			
Conductivity	µS/cm	25	5	27	24	99			
pH	mg/L	7.2	6.5	7.3	6.9	7.9		6.5 to 9.0	
Turbidity	NTU	0.4	0.4	0.3	1.1	1.7			
Total dissolved solids	mg/L	40	24	36	56	97			1000[c]
Total suspended solids	mg/L	<4	<4	<4	<4	8		---[b]	30[c]
Dissolved inorganic carbon	mg/L C	1.1	<0.5	1.3	1.4	5.8			
Dissolved organic carbon	mg/L C	2.1	0.5	2.0	11.3	<0.5			
Total organic carbon	mg/L C	4.4	1.1	2.3	12.4	<0.5			
Total carbon	mg/L C	4.9	1.4	4.7	15.6	12.3			
Anions									
Cyanides (available)	mg/L CN	<0.01	<0.01	<0.01	<0.01	<0.01		0.005	0.025
Ammoniacal nitrogen (N)	mg/L	0.03	<0.02	<0.02	0.02	0.03			2.0
Nitrates	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2	550	13	10
Nitrites	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2		0.060	
Nitrites-Nitrates	mg/L	<0.2	<0.2	<0.2	<0.2	<0.2			
Ortho-phosphate	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01			
Chloride	mg/L	<0.5	<0.5	<0.5	<0.5	<0.5	640	120	
Metals									
Aluminum	mg/L	0.12	0.06	0.08	0.17	0.06		0.005 if pH <6.5 and 0.1 if pH ≥6.6	
Silver	mg/L	<0.0006	<0.0006	<0.0006	<0.0006	<0.0006		0.00025	0.05
Arsenic	mg/L	<0.001	<0.001	<0.001	0.004	0.002		0.005	0.5
Barium	mg/L	<0.01	<0.01	<0.01	<0.01	<0.01			5.0
Boron	mg/L	<0.02	<0.02	<0.02	<0.02	<0.02	29	1.5	5.0
Cadmium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001		0.000006 [d]	0.05
Total chlorine	mg/L	<0.1	<0.1	<0.1	<0.1	0.2		0.0005	1.0
Chromium	mg/L	0.001	<0.001	0.001	0.003	0.002		---[a]	

Table 15.10 2012 *In-situ* Water Quality and Analytical Results

Parameters	Units	Sample ID					CWQC-PAL[e]		NL ECWSR[f]
		Attikamagen Lake (Bay 2)	Joyce Lake	Iron Arm	Petisikapau Lake (Bay 3)	Gilling River	Short-term	Long-term	
Copper	mg/L	0.001	0.001	0.001	0.005	0.002		0.002 [d]	
Iron	mg/L	<0.10	<0.10	<0.10	0.30	0.23		0.3	10
Mercury	mg/L	<0.00013	<0.00013	<0.00013	<0.00013	<0.00013		0.000026	0.005
Molybdenum	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001		0.073	
Nickel	mg/L	<0.001	<0.001	<0.001	0.006	0.003		0.025 [d]	0.5
Lead	mg/L	0.001	0.001	0.001	0.001	0.001		0.001 [d]	0.2
Selenium	mg/L	<0.001	<0.001	<0.001	0.001	<0.001		0.001	0.01
Total phosphorus	mg/L	<0.03	<0.03	<0.03	<0.03	<0.03		0.01	
Thallium	mg/L	<0.001	<0.001	<0.001	<0.001	<0.001		0.0008	
Zinc	mg/L	0.16	0.04	0.02	0.02	0.01			0.5
Others									
Phenols (4AAP)	mg/L	0.002	<0.002	<0.002	0.002	<0.002		0.004	
Total oil and grease	mg/L	---	---	<5	---	---			15
BOD_5	mg/L O_2	---	---	<6	---	---			20
Fecal coliforms	CFU/100ml	---	---	<10	---	---			1000
Total coliforms	CFU/100ml	---	---	<100	---	---			5000

Notes:

[a] The criteria are 0.001 mg/L for hexavalent chromium and 0.0089 mg/L for trivalent chromium.

[b] 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). High flow: Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. Should not increase more than 10 % of background levels when background is > 250 mg/L.

[c] If water is being abstracted from a water course, used, treated and subsequently returned to the same water course, these solids data mean that the effluent should not contain more than 1000 or 30 mg/L more than was in the water quality original abstracted.

[d] These metals have hardness adjusted threshold, which were determined using a hardness value of 12.6 mg/L (the lowest value measured in the samples).

[e] CWQG-PAL (CCME 2012a).

[f] Government of Newfoundland and Labrador *Environmental Control Water and Sewage Regulation*.

Blue shading indicates samples which exceed the CWQG-PAL

15.5.3.4 Sediment Quality

Sediment quality samples were collected from the Water Quality stations illustrated in Figure 15.8. Results for 2012 and 2013 are presented in Tables 15.11 and 15.12, respectively. The results have been compared to the applicable CSQG-PAL published by the CCME (2012b), these guidelines list both the ISQG and the PELs. The CSQG ISQG is defined as the possible effect range within which adverse effects occasionally occur, the CCME PEL is the level at which adverse biological effects frequently occur. Additional information can be found in the 2012 Fish and Fish Habitat Baseline Study and 2013 Update (Appendix V).

The 2012 sampling campaign indicated that:

- Arsenic is naturally present in concentrations above the ISQG in Bay 2, Joyce Lake, Iron Arm and Bay 3 (Table 15.11). In the Gilling River, the concentration measured was slightly below the ISQG.
- Cadmium was found equal to the PEL in Bay 3 and above the ISQG in Bay 2, Joyce Lake and Iron Arm.
- Chromium and copper were found in concentrations above the ISQG in Bay 2, Iron Arm and Bay 3.
- Lead was below the CSQG in all samples.
- Zinc concentration in Bay 3 (Petitsikapau Lake) was above the PEL and above the ISQG in Bay 2, Joyce Lake and Iron Arm.

In general, the other metals analyzed were also found in lower concentrations in the Gilling River as compared to the other sampling stations in 2012. The Gilling River was characterized by high concentrations of manganese and iron, but no metal exceeded the CSQG.

In 2013, additional waterbodies were characterized where effluent discharge may occur. The analytical results indicated that:

- Arsenic is naturally present in concentrations above the ISQG in almost all stations sampled, except in Lake H where it was below the guideline (Table 15.12). Arsenic was also above the PEL in three samples: Timmins Bay (106 mg/kg), Iron Arm No. 6 (18.8 mg/kg) and Lake I (19.0 mg/kg). Considering the high concentration found in Timmins Bay No. 1, verifications were made with the laboratory to ensure there was no error. The analysis was conducted a second time and the result was 134 mg/kg. Since there is no industrial activity in this area, the arsenic concentration found is considered to be natural and probably associated with silt and clay that were found in high proportions at this station.
- Cadmium was found to be above the ISQG in all samples collected in Iron Arm, in Timmins Bay, in the waste rock effluent area in Attikamagen Lake, in Lake H and in one sample collected in Joyce Lake. Lake I showed a concentration of cadmium above the PEL (5.0 mg/kg).

- Chromium also exceeded the ISQG in five samples collected in Iron Arm while all other results were below this guideline.
- Copper was found in concentrations above the ISQG in all samples collected in Iron Arm, in Timmins Bay, in the waste rock effluent area in Attikamagen Lake and in Lake H.
- Lead was below the CSQG in all samples.
- Zinc was found to be above the ISQG in five samples collected in Iron Arm and in Timmins Bay.

These results indicate that heavy metals naturally occur in high concentrations in the sediment within the Study Area. As observed in 2012, the Gilling River was characterized by high concentrations of manganese and iron. High concentrations of iron were also found in Timmins Bay and in Iron Arm sediment. Timmins Bay showed also the highest concentrations of barium, manganese, nickel and lead.

Table 15.11 2012 Analytical Sediment Chemistry Results

Parameters	Units	Sample Location					CSQG[a]	
		Attikamagen Lake (Bay 2)	Joyce Lake	Iron Arm	Petisikapau Lake (Bay 3)	Gilling River	ISQG	PEL
General chemistry								
Moisture	%	86.4	71.8	71.8	27.3	23.7		
Total organic carbon	%	8.43	2.87	3.55	0.64	0.55		
pH	-	5.7	5.6	5.7	7.2	6.9		
Anions								
Arsenic	mg/kg	8.9	6.3	12.5	15.1	5.7	5.9	17.0
Cadmium	mg/kg	1.1	1.0	1.4	3.5	<0.9	0.6	3.5
Chromium	mg/kg	38	32	43	49	13	37.3	90.0
Copper	mg/kg	52	35	53	56	9	37.7	197.0
Iron	mg/kg	30,900	40,500	29,300	46,900	40,900		
Lead	mg/kg	10	11	11	18	<10	35.0	91.3
Zinc	mg/kg	193	132	202	326	42	123.0	315.0

Notes:
[1] CSQG-PAL (CCME 2012a).
Grey = Samples exceeding ISQG
Orange = Samples exceeding PEL

Table 15.12 2013 Analytical Sediment Chemistry Results

Parameters	Units	Sample ID															CSQG[a]	
		Iron Arm No. 2	Iron Arm No. 3	Iron Arm No. 5	Iron Arm No. 6	Iron Arm No. 7	Iron Arm No. 8	Timmins Bay	Waste Rock Effluent	Lake I	Lake H	Joyce Lake No. 1	Joyce Lake No. 2	Joyce Lake No. 3	Gilling River No. 1	Gilling River No. 2 (duplicate of No. 1)	ISQG	PEL
General chemistry																		
Moisture	%	42.4	29.6	80.7	85.4	83.5	80.6	89.5	50.5	88.1	88.2	47.5	25.0	24.3	28.0	25.9		
Total organic carbon	%	1.16	0.37	5.36	4.47	4.97	4.95	6.66	1.47	16.4	23.8	1.90	0.30	0.43	0.20	0.09		
Metals																		
Arsenic	mg/kg	16.5	12.0	7.3	18.8	16.6	6.8	106	12.3	19.0	5.1	9.9	14.4	12.7	9.5	8.6	5.9	17.0
Cadmium	mg/kg	1.9	2.0	2.4	1.8	2.0	3.3	1.8	1.1	5.0	0.9	0.4	0.9	0.6	0.4	0.5	0.6	3.5
Chromium	mg/kg	51	32	43	38	46	47	22	32	7	13	23	26	29	9	8	37.3	90.0
Copper	mg/kg	59	43	67	89	105	104	42	38	69	15	23	30	29	13	13	37.7	197.0
Iron	mg/kg	75,700	67,900	18,000	91,400	88,600	46,000	136,000	64,100	13,800	13,700	62,400	76,200	69,900	90,900	92,900		
Lead	mg/kg	14	13	13	26	18	15	21	13	8	12	8	11	8	4	4	35.0	91.3
Zinc	mg/kg	126	106	262	192	242	277	171	101	317	97	62	71	60	27	26	123.0	315.0

Notes:
[1] CSQG-PAL (CCME 2012a).
Grey = Samples exceeding ISQG
Orange = Samples exceeding PEL

15.6 Assessment of Project Related Effects

This section describes the interactions that require Project-specific mitigation measures (those potential interactions rated 2 in Section 15.4). Each environmental effect (change in fish habitat and production and change in fish health or mortality) was assessed for each Project phase using the identified measurable parameters. Accidents and malfunctions are discussed separately in Section 15.8.

15.6.1 Assessment of Changes in Fish Habitat and Production

Assessment of change in fish habitat/production included the physical alteration or destruction of fish habitat, change in water quality or sediment quality and potential barriers to fish passage. Environmental effects discussed in this section focus on the alteration or removal of existing fish habitat and potential barriers to fish passage, the latter of which fall under provisions of the *Fisheries Act*. The Project is likely to require a *Fisheries Act* Authorization and subsequent habitat offsetting for the loss of habitat associated with the construction of the Iron Arm causeway.

Project activities that will require Project-specific mitigation measures include construction of the Iron Arm causeway, the crossing of streams during the construction of the access road, and the dewatering of Joyce Lake. These are assessed below along with mitigation measures and characterization of any likely residual environmental effects following application of the specified mitigation measures.

15.6.1.1 Environmental Effects to Fish Habitat / Production

An Indigenous fishery exists within Attikamagen Lake and the in-filling of a portion of Iron Arm for the creation of the rock causeway will result in direct effects to fish habitat and production protected under the *Fisheries Act*. A change in fish habitat will result from the loss of fish habitat within the footprint of the causeway and a partial offset of habitat along adjacent to the bridge spans and along the 2:1 slope of the infill. The species targeted for habitat offsetting would include lake trout and northern pike, both fished by first nations and recreational anglers.

Lake trout have been known to spawn within water depths of 0.5 to 5 m in small lakes (Bradbury 1999). It could be contended that Iron Arm acts as a shallow lake due to its minimal depth and spawning areas could be located within Iron Arm. Lake trout spawning areas are generally located in areas with prevailing winds to reduce the deposition of sand, silt and detritus (Bradbury 1999). The concentration of flow through the bridge spans will result in increased water velocities, which may result in the reduction of fine sediments within the path of the currents; this may be used by spawning lake trout.

The submerged portion of the rock causeway will provide heterogeneity to the habitat along the length of the causeway. The causeway slope will be entirely within the photic zone and has the potential to provide suitable substrate and light levels for growth of aquatic vegetation. This vegetation has the potential to be used by broadcast spawners such as northern pike.

The watercourses crossed by the site and access roads feed into Attikamagen Lake and thus the fish species located within the watercourses indirectly support an Indigenous fishery. Therefore, the habitat within the watercourses crossed by the access road is protected under the *Fisheries Act*. Along the access road and site roads, there are 17 watercourse crossings, of these, eight crossings have been identified as fish habitat, with six crossings remaining unassessed after the final access road alignment. These crossings with indeterminate fish habitat will be assessed in follow-up surveys.

Of the eight fish bearing streams one will be spanned using a bridge, two will be crossed using arch culverts and five will be crossed using circular culverts. All provincial permits and federal authorizations will be obtained prior to their installation. The bridge span across Gilling River (AR14) is anticipated to be installed outside the high water mark of the watercourse; therefore, no direct effect on fish habitat is expected to occur. The open bottom culverts installed at crossings AR7 and AR4 will be constructed on the stream banks outside the channel and are not expected to directly affect the watercourse substrate.

The five stream crossings scheduled for circular culverts are expected to produce a direct loss in fish habitat within the footprint of the culvert. This loss is based on the permanent alteration of the streambed within the culvert footprint. Circular culverts are not expected to directly affect fish migration if installed correctly, at a slope suitable for the fish species that are found within the watercourse. A basic culvert design is included in the mitigation section.

Table 15.13 outlines the expected loss of fish habitat within the causeway and the circular culvert footprints. Loss of fish habitat will require a *Fisheries Act* HADD authorization and habitat offsetting. The gain of fish habitat units from the slope of the causeway infill is indicated as a partial offset. This table does not include potential losses arising from habitat at crossing locations MAR02, MAR03, AR1, AR2, AR3 or AR10; these watercourses have yet to be assessed in the field using the current access road alignment.

Table 15.13 Summary of Potential Alteration to Fish Habitat during Construction

Project Task or Feature	Habitat Area Altered (m^2)		
	Loss of Habitat	Gain of Habitat	Resulting Habitat Loss
Iron Arm Causeway	42,900	14,750	28,150
Access Road Crossing AR08	48	0	48
Access Road Crossing AR09	76	0	76
Access Road Crossing AR11	19	0	19
Access Road Crossing AR12	84	0	84
Access Road Crossing AR13	12	0	12
Habitat Loss during Construction[1]	**43,139**	**14,750**	**28,389**

Note:
[1] Does not include potential habitat losses from MAR02, MAR03, AR01, AR02, AR03 or AR10

Joyce Lake will be drained during Operation and Maintenance phase, requiring a *Fisheries Act* HADD authorization and habitat offsetting. The dewatering of Joyce Lake will include a coordinated fish salvage and relocation plan for burbot, lake chub and longnose sucker within the Lake. Although all fish habitat in Joyce Lake will be lost during the Project as a result of the dewatering, it is expected that, upon closure, restoration and enhancement of productive fish habitat in Joyce Lake may be part of the offsetting plan.

Table 15.14 outlines the loss of fish habitat associated with the dewatering of Joyce Lake. The initial estimate of potential habitat loss is approximately 378,000 m^2, which is the approximate surface area of Joyce Lake. Habitat equivalent units for each of the fish species in Joyce Lake was estimated using the DFO guide for lacustrine habitat (Bradbury et al. 2001) and reported in WSP (2014). These are shown in Table 15.14.

Table 15.14 Summary of Potential Alteration to Fish Habitat

Project Task or Feature	Habitat Area Altered (m^2) Loss of Habitat Equivalent Units By Fish Species
Joyce Lake Dewatering	90,535 m^2 for lake chub 27,727 m^2 for longnose sucker 140,896 m^2 for burbot
Note: Habitat equivalent units for each of the fish species in Joyce Lake was estimated using the DFO guide for lacustrine habitat (Bradbury et al. 2001) and reported in WSP (2014).	

15.6.1.2 Mitigation for Changes to Fish Habitat Production

The following sections outline the best management practices and Project-specific mitigation proposed for Project Construction.

The following general mitigation measures will be used generally during Construction and are applicable for both the Iron Arm causeway and watercourse crossing construction.

- The construction of the Iron Arm causeway and access road stream crossings will follow applicable laws, regulations, and standards, and will be constructed in accordance with recommendations made under approval from DFO.
- An EMP will be created prior to causeway and watercourse crossing construction. The EMP will include the Erosion and Sediment Control Plan, complete with drawings indicating the type, location and inspection requirements for erosion and sediment controls.
- The Project will obtain a DFO Authorization for HADD at the causeway location prior to conducting infilling operations, dewatering of Joyce Lake, and at the water crossings prior to culvert installation. To offset for the direct loss of fish habitat, the Project will be required to create new habitat (or improve existing habitat) to meet DFO's policy under the *Fisheries Act*.

To reduce direct environmental effects on fish habitat associated with the construction of the Iron Arm causeway, the following measures are proposed:

- Geotechnical/engineering investigations into causeway construction methods to reduce the quantity of materials placed in the freshwater environment (i.e., reduction of the causeway footprint).
- The causeway will comply with the NLDOECC Water Resources Management Division Conditions of Approval (i.e., permit to alter a body of water), which will stipulate specific monitoring or mitigation requirements.
- The causeway will be constructed of quarried material and not waste rock from mining operations. This quarried material will be free of fines.
- Two 8 m wide bridge spans will be incorporated to allow fish, watercraft and snowmobile passage through the causeway.
- Additional culverts may be included where required for additional fish passage.

To reduce direct environmental effects on fish habitat associated with the dewatering of Joyce Lake, a Joyce Lake Water Management Plan (Appendix W) has been developed. Highlights of this plan include:

- The steps for dewatering Joyce Lake via the natural slope to the southeast of the lake through a linear bog system into Attikamagen Lake.
- The procedures in place to intercept and convey surface run-off away from the lake and put during mining operations.
- The collection and pumping of incidental precipitation and run-off from within the open pit and Joyce Lake footprint.

To reduce direct environmental effects on fish habitat associated with the installation of the circular culverts following measures are proposed:

- The use of open-bottomed culverts at crossings AR4 and AR7 and a clear span bridge across the Gilling River (AR14).
- The watercourse crossings will comply with the NLDOECC Water Resources Management Division Conditions of Approval (i.e., permit to alter a body of water), which will stipulate specific mitigation requirements.
- Any watercourse crossings will be properly sized and designed to facilitate watercourse flow and, in fish-bearing streams, to allow fish passage as per the criteria detailed in the DFO's Design Criteria for Fish Passage. A conceptual design is illustrated in Figure 15.9.

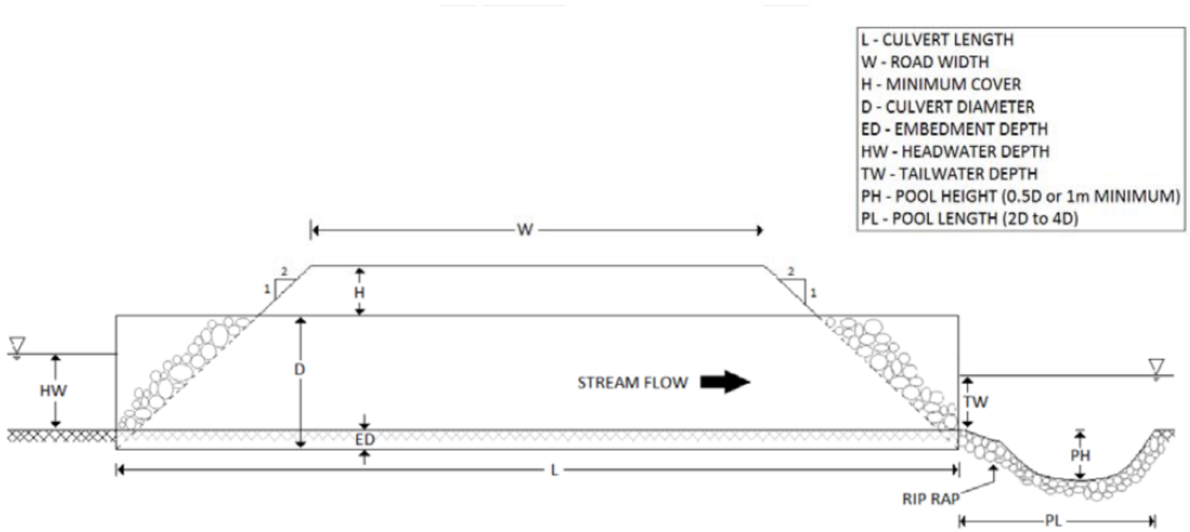

Figure 15.9 Conceptual Design for Crossing Fish Bearing Streams

- Any closed bottom structures will be embedded to allow substrate to enter the culvert, the culverts will be sized to allow for the appropriate amount of embeddedness.
- The watercourse crossing structures will be inspected, cleaned and repaired on a regular basis, as required, to maintain normal water flows.

15.6.1.3 Characterization of Residual Environmental Effects on Fish Habitat and Production

The watercourses crossed by the access road feed into Attikamagen Lake and indirectly support an indigenous fishery. The Iron Arm causeway is located in a region of Attikamagen Lake, which local indigenous groups use to fish for Northern Pike and Lake Trout. As a result, the habitat within the watercourses crossed by the access road and the habitat in Iron Arm is protected under the *Fisheries Act*.

The construction of the causeway and the culvert installation for the watercourse crossings will require Project-specific mitigation as described in Section 15.6.1.2. This mitigation is anticipated to protect fish habitat outside the footprint of these structures. Fish passage will be maintained through the use of culverts under the access road and bridges within the causeway. The causeway bridges and the culverts will be installed as per NLDOECC guidelines and DFO's Design Criteria for Fish Passage.

For the causeway, the primary barrier was identified as the mean water velocity as Iron Arm acts as the staging area. The DFO Fish Swimming Performance User Guide (2014) presents fatigue curves, which were used in interpreting the water velocity passing through the causeway bridges. The DFO guide groups species of fish based on similar characteristics and presents fatigue curves for each group. The Northern Pike are represented by the Pike group and Lake Trout are represented by the Salmon and Walleye group. Based on the completed hydraulics assessment, the mean flow velocity in the bridge openings is approximately 1.6 m/s. Assuming a downstream to upstream passage length of 20 m, the DFO guide curves indicate that Northern Pike greater than 500 mm long and Lake Trout greater than 200 mm long could pass through the bridges.

The culverts installed as part of the stream crossings under the access, haul and mine site roads have the potential to increase water velocity, this can create a barrier to fish. During the design of the crossings the slope of the existing streambed and the proposed slope of the culvert will be identified, from this the mean water velocities will be calculated. This mean water velocity will be compared to the most recent DFO Fish Swimming Performance Guide to determine what mitigative measures if any are required. Where velocities may be exceeded the culvert designs will be in accordance with DFO's Design Criteria for Fish Passage. This will include the creation of energy dissipation pools as staging habitat for all culverts and the installation of baffled culverts if velocities are deemed to exceed fish performance.

The mitigative measures in place and contingency proposed limit the extent of fish habitat alteration from the project during construction of the footprint of the causeway and the culverts. DFO will assess permanent loss of fish habitat of a fish species and will determine whether an authorization under the *Fisheries Act* and the development and application of a habitat offset measures are required. If applicable, this will provide direct mitigation for any losses in fish habitat and production.

Based on the mitigation measures and any required offsetting measures proposed for the construction of the Iron Arm causeway and the culvert installations, residual environmental effects to fish habitat and production will be neutral in direction, low in magnitude, site-specific in geographic extent, occur once, be medium in duration, and be reversible.

The ecological/socio-economic context is deemed to be both undisturbed and disturbed. Shoreline areas around several of the area lakes have cabin and camp associated structures with ongoing human activity. Areas to the west and southwest of the Project have established settlements and historic and ongoing mining operations. There are also areas at the headwaters of many of the streams and along more remote shorelines north of the Project that have likely seen little or no human activity.

Prediction confidence is high as the general biological processes are understood, quantitative metrics are available, and there are several proven mitigation measures available. Current limitations related to adequate baseline and predictive analysis are compensated for through using a precautionary assessment of significance of potential environmental effects.

Residual environmental effects on fish habitat and production for the construction of the Iron Arm causeway and the culvert installations are not likely to be significant as there are no anticipated permanent and irreversible reductions of fish habitat that will be uncompensated for.

Specific mitigation is required for effects to fish habitat and production for the dewatering of Joyce Lake. This mitigation is included in the Joyce Lake Water Management Plan (Appendix W). The dewatering of Joyce Lake will result in the loss of fish habitat throughout the life of the Project (see Table 15.14). It is expected that, upon closure, restoration, and enhancement of productive fish habitat in Joyce Lake may be part of the offsetting plan.

Despite the fact that sucker and burbot may be fished by Naskapi from Kawawachikamach and Innu from Matimekush–Lac John in the Schefferville region, there is no known Indigenous fishery occurring in Joyce Lake (WSP 2014).

The extent of fish habitat loss from the project during operation will be limited to the fish habitat within Joyce Lake, residual environmental effects to fish habitat and production will be negative, low in magnitude, site-specific in geographical extent, occur once with a permanent duration for Joyce Lake.

The ecological and socio-economic context is deemed to be undisturbed. There is currently no human development adjacent to or along the shoreline areas of Joyce Lake.

Predictive confidence is moderate as the general biological processes are understood, quantitative metrics are available, and there are mitigation measures available.

Residual environmental effects on fish habitat and production during Project Operation are not likely to be significant as there are no anticipated permanent and irreversible reductions of fish habitat production.

15.6.2 Assessment of Changes in Fish Health and Mortality

Assessment of the environmental effects on fish health or mortality included the direct loss of fish attributable to the Project, loss of fish species of management concern, and changes to fish condition. Potential environmental effects that will require Project-specific mitigation include the construction of the rock causeway and the dewatering of Joyce Lake during the Operation and Maintenance phase. There are no fish species of management concern identified within the RSA; therefore, the assessment is based on the health and mortality of fish species observed to inhabit the PDA.

15.6.2.1 Environmental Effects to Fish Health and Mortality

Construction

The in-filling of a portion of Iron Arm for the creation of the rock causeway will result in direct effects on the mortality risk of fish inhabiting Iron Arm within the area planned for alteration. The increase in mortality risk occurs through the potential for smothering of fish eggs, larvae, fry, juveniles or adults during in-filling. Sessile or slow moving demersal fish or invertebrates will likely be unable to avoid construction activities within the footprint and will suffer mortality as a result of smothering or crushing. Adult fish are expected to have a lower mortality risk from the impact injuries.

Operation and Maintenance

The dewatering of Joyce Lake will have direct effects on the mortality risk of fish species that have been found in Joyce Lake: lake chub, longnose sucker and burbot. During the dewatering of Joyce Lake, a coordinated fish salvage and relocation plan will be undertaken. It is likely that a *Fisheries Act* HADD authorization will be required, including the requirement for habitat offsetting.

A Dewatering Plan for Joyce Lake will reduce the effects of sediment and changes in hydrology on the receiving environment.

15.6.2.2 Mitigation for Changes to Fish Health and Mortality

Potential effects during the construction of the rock causeway will be mitigated through established measures including:

- Where feasible, construction will be limited to the provincial timing windows established by DFO to mitigate effects from in-water construction (June 15 to September 15). As required, additional mitigation measures to manage construction outside of these windows will be agreed upon in consultation with DFO and with local Indigenous groups.
- Geotechnical/engineering investigations into causeway construction methods to reduce the quantity of materials placed in the marine environment.
- The creation of an Environmental Management Plan for construction activities which includes construction sequencing, an erosion and sedimentation control plan and other procedures for the construction of the rock causeway.
- The construction of the causeway will comply with the NLDOECC Water Resources Management Division Conditions of Approval (i.e., Permit to alter a body of water), which will stipulate specific mitigation requirements.
- Compliance with stipulations in in the *Fisheries Act* authorizations approvals.
- The contractor will be required to use fill material for the causeway to be free of fines, debris and any substances that would be deleterious to the freshwater environment.

Potential effects during the dewatering of Joyce Lake will be mitigated through established measures including:

- Water pump intakes on the pumps will be screened in compliance with the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995).
- Preparation of a formal Dewatering Plan for Joyce Lake that includes measures that support an effective Fish Removal Plan that reduces risk to fish health and mortality.
- The preparation of a Fish Removal Plan for Joyce Lake will include but is not limited to:
  - Methods and procedures for sequestering, capturing, removal, handling, transport, and relocation of fish.
  - Identification and assessment of potential waterbodies to relocate the fish.
  - Phased approach to address the logistical demands of this large scale fish relocation effort.

15.6.2.3 Characterization of Residual Project Environmental Effects on Fish Health or Mortality

Construction

The construction of the rock causeway has potential to result in residual environmental effects on fish health and mortality. The adoption and adherence to the proposed mitigation measures will likely diminish these environmental effects though will not eliminate them. The adverse effects on fish mortality from the infilling operations during the Iron Arm causeway construction are expected to be limited to individual fish. The loss of individual fish within the community that is expected to inhabit Iron Arm and Attikamagen Lake is not substantive. This loss of fish during the construction of the causeway will not affect the sustainability of the populations or the local fisheries.

Therefore, residual environmental effects are adverse, likely low in magnitude and local in extent. As infilling for the construction of the causeway is predicted to occur once, the effects are considered reversible as a sustainable population of fish will remain.

The ecological/socio-economic context is considered disturbed as fishing takes place within Iron Arm. The predictive confidence is considered high as the general biological processes are understood and there are proven mitigation measures available to reduce potential mortality associated with in-water works.

The construction of the rock causeway across Iron Arm is likely to be not significant as it is unlikely that levels of fish mortalities, following application of mitigation measures, will be of sufficient magnitude to depress recovery of the fish stocks.

Operation and Maintenance

Residual environmental effects on fish health or mortality that will require Project-specific mitigation include potential mortality and alterations to fish health associated with the dewatering of Joyce Lake. Environmental effects will be reduced by the development and implementation of a Joyce Lake dewatering plan and a fish salvage and relocation plan. The scale of the operation and logistical challenges in the area, create a potential for loss of individual fish or adverse environmental effects to fish health. The fish community within Joyce Lake will be salvaged and relocated during dewatering. Following closure, restoration and enhancement of productive fish habitat in Joyce Lake may be part of the offsetting plan.

The adoption and adherence to the proposed mitigation measures detailed in these plans will likely reduce the residual environmental effects. Residual environmental effects for fish health or mortality in the LSA will be adverse, low in magnitude, site-specific in geographic extent, occur once with a short-term duration, and be reversible. The ecological/socio-economic context is considered undisturbed. The predictive confidence is considered moderate with the application of the proposed mitigation measures.

The dewatering of Joyce Lake is likely to be not significant as it is highly unlikely that levels of fish mortalities, following application of mitigation measures, will be of sufficient magnitude to affect the populations of lake chub, longnose sucker or burbot in the LSA.

15.6.3 Summary of Residual Effects

Although environmental effects on the local fisheries are anticipated with respect to changes in fish habitat and mortality, these can be reduced through adherence to regulatory requirements and guidelines, application of management plans and offsetting where required to compensate for HADD. Significant residual environmental effects from the Project on existing fish habitat area, fish habitat productive capacity, or fish health are therefore not likely. A summary of residual environmental effects is provided in Table 15.15.

15.7 Assessment of Cumulative Environmental Effects

Potential cumulative environmental effects on fish and fish habitat could occur from a Project-related loss of fish habitat and a decline in fish health and/or increase in fish mortality in combination with those of other past, present or future physical activities that will take place. The assessment of cumulative environmental effects includes the review of nine projects located both within and outside the current RSA (Table 15.16).

Table 15.15 Summary of Residual Environmental Effects

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental/ Socio-economic			
Change in Fish Habitat and Production											
Construction	• The construction of the Iron Arm causeway and access road stream crossings will follow applicable laws, regulations, and standards • Fish Habitat offsetting Plan as required under *Fisheries Act* Authorization. • Crossing design for adequate water depth and flows to enable seasonal fish passage. • An EMP will be created prior to causeway and watercourse crossing construction. • Geotechnical/engineering investigations into causeway construction methods to reduce the quantity of materials placed in the freshwater environment. • The causeway will be constructed of quarried material and not waste rock from mining operations. This quarried material will be free of fines. • Two 8 m bridge spans will be incorporated to allow fish passage through the causeway. • The use of open-bottomed culverts at crossings AR4 and AR7 and a clear span bridge across the Gilling River (AR14). • The watercourse crossing structures will be inspected, cleaned and repaired on a regular basis, as required, to maintain normal water flows.	N	L	S	MT	O	R	U/D	N	H	• Fish habitat offsetting monitoring under the *Fisheries Act*. • Construction Monitoring

Table 15.15 Summary of Residual Environmental Effects

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental/ Socio-economic			
Operation and Maintenance	• Dewatering Plan for Joyce Lake complete with erosion and sedimentation controls. • Procedures for dewatering Joyce Lake via the natural slope to the southeast of the lake through a linear bog system into Attikamagen Lake. • Procedures to intercept and convey surface run-off away from the lake and pit during mining operations. • Collection and pumping of incident precipitation and run-off from within the open pit and Joyce Lake footprint	A	L	S	ST/ P	O	I	U	N	M	• Inspection and monitoring of the erosion and sedimentation controls, pumps and ditches.
Change in Fish Health or Mortality											
Construction	• Scheduling of construction below the high water mark to avoid spawning periods for sensitive freshwater fish groups (i.e., salmonids). • Geotechnical/engineering investigations into causeway construction methods to reduce the quantity of materials placed in the marine environment. • The creation of an EMP for construction activities which includes construction sequencing, an erosion and sedimentation control plan and BMPs for the construction of the rock causeway. • The construction of the causeway will comply with NLDOECC Water Resources Division Conditions of Approval, which will stipulate specific mitigation requirements. • Compliance with stipulations in in the *Fisheries Act* authorizations approvals.	A	L	L	ST	O	R	D	N	H	• Construction Monitoring during the construction of water crossings as outlined in the EMP..

Table 15.15 Summary of Residual Environmental Effects

Project Phase	Mitigation/Compensation Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental/ Socio-economic			
	• Reducing in-water works associated with the Iron Arm causeway, and if such is required, using available measures to isolate these works which reduce potential fish mortalities. • The contractor will be required to use fill material for the causeway to be free of fines, debris and any substances that would be deleterious to the freshwater environment.										
Operation and Maintenance	• The creation of an EMP for construction activities which includes construction sequencing, an erosion and sedimentation control plan and BMPs for the construction of the rock causeway. • Compliance with stipulations in in the *Fisheries Act* authorizations approvals. • Water pump intakes on the pumps will be screened in compliance with the DFO Freshwater Intake End-of-Pipe Fish Screen Guideline (DFO 1995). • Preparation of a formal Dewatering Plan for Joyce Lake that includes measures that support an effective Fish Removal Plan that reduces risk to fish health and mortality. • The preparation of a Fish Removal Plan for Joyce Lake	A	L	S	ST	O	R	U	N	M	• Compliance monitoring as per MDMER or Newfoundland and Labrador Department of Environment and Labour requirements.

Table 15.15 Summary of Residual Environmental Effects

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

Key:

Direction:
P Positive
A Adverse
N Neutral

Magnitude:
N Negligible: no measure adverse effects anticipated.
L Low: measurable effects anticipated in low-sensitivity habitats and no measurable reduction in the number of fish species anticipated.
M Moderate: measurable effects anticipated in moderately sensitive habitat or anticipated mortality risk to non-listed species.
H High: measurable 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: environmental effect confined to the PDA.
L Local: environmental effect extends into the LSA.
R Regional: environmental effect extends into the RSA, where indirect or cumulative environmental effects may occur.

Duration:
ST Short-term: residual environmental effect occurs during the Construction phase (i.e., one year)
MT Medium-term: residual environmental effect extends through the Operation and Maintenance phase (i.e., up to seven years)
LT Long-term: residual environmental effect extends beyond Closure and Decommissioning (i.e., > 10 years).
P Permanent: measurable parameter unlikely to recover to baseline

Frequency:
Quantitative measure; or
O Once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.
U Unlikely to occur

Reversibility:
R Reversible: effects 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 habitat offsetting works.

Environmental or Socio-economic Context:
U Undisturbed: environmental effect takes place in an area that has not been adversely affected by human development.
D Disturbed: environmental effect takes place in an area that has been previously affected by human development or in an area where 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.

Table 15.16 Potential Cumulative Environmental Effects

Other Projects and Activities with the Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects	
	Change in Fish Habitat and Production	Change in Fish Health or Mortality
Champion Iron Ltd. Kami Iron Ore	0	0
Arcelor-Mittal Mont Wright Mine	0	0
Champion Iron Ltd. Fire Lake North Iron Ore Project	0	0
Tacora Resources Inc. Scully Mine	0	0
Champion Iron Ltd. Bloom Lake Mine and Rail Spur	0	0
IOC Labrador Operation	0	0
Lower Churchill Hydroelectric Generation Project	0	0
Maritime Transmission Link Project	0	0
Labrador Iron Mines Houston 1&2	1	1
Tata Steel Minerals Canada - DSO Iron Ore Project	1	1

Key:
0 Project environmental effects do not act cumulatively with those of other projects and activities.
1 Project environmental effects act cumulatively with those of other projects and activities, but the resulting cumulative environmental effects are unlikely to exceed acceptable levels with the application of best management or codified practices.
2 Project environmental effects act cumulatively with those of other projects and activities and the resulting cumulative environmental effects may exceed acceptable levels without implementation of project-specific or regional mitigation.

Assessment of potential cumulative environmental effects follows a similar approach as that applied to assess environmental effects for the Project. The potential for interaction was evaluated and rated for each potentially contributing Project phase, followed by a description and rationale for the ratings. Only those Project environmental effects rated 2 (cumulative environmental effects that require project-specific or regional mitigation) are carried forward for assessment of cumulative environmental effects, proposed mitigation strategies, and discussion of any resulting residual cumulative environmental effects. Further project descriptions and locations for the other projects and activities noted in Table 15.16 are provided in Chapter 5: Environmental Assessment Methods and Scope of Assessment.

15.7.1 Interactions Rated as 0

The Kami Iron Ore, Mont Wright Mine, Fire Lake Northern Iron Ore, IOC Carol Mine, Wabush Mines, and the Bloom Lake Mine and Rail Spur projects are all located more than 220 km south of the Project, within both Labrador and Quebec near the Wabush Labrador City area. These projects have resulted in environmental effects on fish and fish habitat (changes to habitat quantity and productivity and potential environmental effects on fish health), though given they are located greater than 200 km from the RSA and are sequestered by the Menihek dam. It is likely that any potential cumulative environmental effects are neither measurable nor discernible with respect to the Project. Therefore, there is no likely interaction between these other projects and the Project on Fish and Fish Habitat and subsequently no cumulative environmental effects are anticipated.

The Lower Churchill Hydroelectric Generation project is located a substantial distance downstream (420 km) from the Project site. There is a low potential for environmental effects from the generation project to affect the Petitsikapau Lake area; however, the effects are likely neither measurable nor discernible given the distance. Therefore, no interaction of environmental effects and subsequently no cumulative environmental effects are anticipated.

15.7.2 Interactions Rated as 1

Two projects (Schefferville Iron Ore Mine, now closed (SIO) and Tata's DSO Iron Ore mine in the development stage (DSO)) have the potential to interact cumulatively with the Project. However, these potential interactions are limited given their location within the RSA in relation to the Project. Both the DSO and LIM's SIO operations are located near or adjacent to the town of Schefferville, Quebec, southwest and west of the PDA. Both are iron ore mining operations with open pits, processing facilities, and related infrastructure and transport systems.

The DSO Iron Ore project is located solely within the Howell's River drainage system, which flows south of the PDA and connects to Astray Lake. LIM's closed SIO mine spans two drainage systems and is located within the Howell's River drainage system and at the headwaters of the Gilling River drainage system. The SIO mine operation has a direct hydrologic connection with the Project in that crossing AR-14 is proposed to cross the Gilling River near Astray Lake.

Environmental effect interactions related to fish health or mortality were rated 1 as they can be mitigated through best management and codified practices and are unlikely to exceed acceptable levels. Potential Project environmental effects on fish health and mortality will be localized within the PDA, leading to no or limited interaction with similar environmental effects that may result from either the DSO or SIO Mine operation. Given the mitigation measures proposed, the limited area potentially affected, the limited direct connectivity between the Project and either existing mine, the proposed best management practices, adherence to fish salvage and isolation recommendations, the likelihood that environmental effects would interact cumulatively in a measurable way is low.

Project environmental effects on fish habitat and production were assigned a rate of 1; the magnitude of the effects on habitat in comparison to the available habitat is low. The Project will result in some direct losses of fish habitat and these will be offset with respect to HADD. It is also not anticipated that any fish habitat will be lost within the Gilling River system, which the Project shares with the SIO Mine; it is proposed that a full span bridge be used at this crossing. The likelihood that these effects will interact cumulatively in a measurable way is low.

15.7.3 Interactions Rated as 2

There are no potential cumulative environmental effects rated as 2.

15.7.4 Characterization of Residual Cumulative Environmental Effects

Based on the full mitigation of Project environmental effects and the limited or no direct connection between these effects and environmental effects associated with other projects within the regional study area, the likelihood of cumulative effects is negligible, and residual cumulative effects on Fish and Fish Habitat are predicted to be not significant.

15.8 Accidents and Malfunctions

Reasonable worst-case scenarios for accidents and malfunctions that may result from the Project and may have an environmental effect on Fish and Fish Habitat include:

- Hydrocarbon Spill;
- Train Derailment;
- Forest Fire;
- Settling/Sedimentation Pond Overflow; and
- Premature or Permanent Shutdown.

15.8.1 Hydrocarbon Spill

Fuel storage on the site will include diesel and fuel oil tanks located at the rail unloading area, near the diesel generators at the mine site, and the process plant area. The maximum total storage capacity for diesel fuel will be 250,000 L. The fuel storage tanks will be located in secondary containment to control spills and will comply with requirements of the applicable provincial and federal acts and regulations, as well as the conditions of the permit and authorizations. The control measures will be able to contain the maximum capacity of all tanks in a storage area.

Potential fuel spills could occur at either the storage areas or during transportation from the rail offloading site in Schefferville to the mine site. Spills at the Project storage sites have varying degrees of potential impact to fish and fish habitat. The storage area at the Astray railyard will have secondary containment and is also surrounded by a surface water collection system. A fuel spill would need to first breach the double wall horizontal tank with its own containment, then the secondary containment area, and then would then be collected by the surface water system that includes a settling lake and 300 m of engineered spillway prior to reaching fish habitat at the confluence of the Gilling River and Astray Lake. Fuel storage at other project locations will also be protected by a double-walled steel tank with its own containment as well as secondary containment and surrounded by a surface water collection system that includes a settling pond and engineered spill way. This arrangement will be in place for each storage area including the power generating plant (2 tanks), the mine area (1 tank), at the site adjacent to the haul road (1 tank) and at the Astray rail loop as described above.

Fuel will be transported to various storage sites within the PDA. Transport to each fuel storage area from Schefferville rail yard will be by contractor and by truck along the existing service road.

During transportation of fuel along the service road and site roads there is potential for the complete loss of fuel directly into a watercourse or Iron Arm. This accident was deemed to be of lower consequence than a spill occurring during rail transportation. The mitigation and characterization of residual effects for these two scenarios is similar and applicable to both.

A worst case scenario for fuel storage is release of both storage tanks at the electric generating plant (total 100,000 L) or release of all six rail tank cars (576,000 L) during rail transportation or while offloading in Schefferville. As the Project site capacity is a nominal maximum of 250,000 L delivery by rail of six tank cars at one time would require additional storage in the rail tank cars or in the contractor's fuel storage tanks in Schefferville. Based on the volume, characteristics and location of the storage areas, a maximum of 50,000 L spill at the Astray railyard is likely the worst case as the location is 300 m from known fish habitat within the Gilling River and is also directly upstream of Astray Lake.

15.8.1.1 Emergency Response/Mitigation of Environmental Effects

The main mitigation measures for a hydrocarbon spill relate to prevention and rapid and effective cleanup. As part of the Emergency Response and Spill Response Plan, spill prevention and response protocols will include the inspection of vehicles and hydraulics on a daily basis for leaks or damage that could cause minor spills and rapid spill response. Vehicles and equipment will be stored in controlled areas where secondary containment of spills can be provided. Staff will be trained in the handling of emergency response and spill scenarios. Response equipment stored on site will include containment and absorbent booms, pads, barriers, sand bags, and skimmers, as well as natural and synthetic sorbent materials.

15.8.1.2 Characterization of Residual Environmental Effects

With respect to Fish and Fish Habitat, the worst case scenario would be the discharge of 50,000 L of diesel fuel at the Astray railyard. To reach fish habitat the spill would need to breach built in fuel tank secondary containment for the 50,000 L horizontal steel fuel tank, then the secondary containment and exceed the capacity of the surface water collection system and settling pond, and then flow 300 m down an engineered spillway into the Gilling River. Diesel fuel reaching the Gilling River would have direct environmental effects on the river and Astray Lake. Effects may include localized fish mortalities, and decreased fish health due to reductions in sediment and water quality at a local scale, and direct and indirect destruction and impairment of fish habitat at a local scale.

Environmental effects resulting from a diesel fuel oil spill would vary depending on the season and conditions, but can be classified as adverse in direction, low to moderate in magnitude, site specific to local to regional in extent, with a frequency of once, with medium to long term environmental effects, likely reversible, in an undisturbed context, with a moderate prediction confidence. A large scale spill (not considered likely with the planned 50,000 L fuel storage tank) could result in significant adverse residual environmental effects on Fish and Fish Habitat although this event is considered to be highly unlikely. A spill determined to create significant harm to fish would require habitat offsetting to compensate for the habitat loss.

15.8.2 Train Derailment

Iron ore product will be transported by truck from the Project site to the Astray rail loop which connects directly to the Tshiuetin/QNS&L railway for transport to Sept-Îles. Diesel fuel will be transported by rail to Schefferville and then by contracted trucker to site. On average, iron ore will be transported on approximately four trains each week during summer months between the Astray rail loop and the Sept-Îles port. Each train set will carry approximately 24,000 tonnes of ore in 240 gondola cars. Based on the speed the train will be travelling in the rail loop (5 miles per hour or 8 km/h), the reasonable worst case is the derailment of a maximum of four to five cars. This could result in the iron ore being spilled onto the ground or at stream crossings. Such an event is highly unlikely.

It is estimated that diesel fuel transport frequency will be a maximum of six 96,000 L tank cars per week for all site purposes.

Fuel tank car numbers are based on shipment in standard 96,000 L tank cars similar to those already in fuel haulage service between Sept-Îles and Labrador City. In a reasonable worst case scenario (i.e., where six tanks of diesel fuel are de-railed), approximately 576,000 L (127,000 Imperial gallons) of diesel fuel could be released.

15.8.2.1 Emergency Response/Mitigation of Environmental Effects

The trains will be operated under current Tshiuetin/QNS&L environmental and safety procedures. A detailed Emergency Response and Spill Response Plan will also be developed by Joyce Direct Iron. This plan will include measures such as:

- Immediate response through the use of absorbent booms and pads;
- Liquid clean up using a vacuum truck (both fuel and groundwater); and
- Reclamation of contaminated soils, removal of contaminated soils and replacement with clean soil.

Additional mitigation measures to be implemented to limit the potential for a train derailment include:

- Manual inspection of rolling stock to confirm there are no problems with the wheels, couplers, carbody or brakes;
- Track inspections in accordance with Transport Canada regulations;
- Properly maintained equipment; and
- Fuel transport amounts will be limited to the amounts required by the Project.

To reduce the likelihood of such an event, emphasis will be placed on safety and accident prevention and on effective and rapid response procedures.

15.8.2.2 Characterization of Residual Environmental Effects

With respect to Fish and Fish Habitat, the worst case scenarios would include either 7,500 tonnes of iron ore (100 tonnes per railcar for 75 railcars maximum potential derailment at full speed on main track) or 576,000 L of diesel fuel released directly into a watercourse or waterbody. Given the existing railway, for part of its length, runs adjacent to the Gilling River system, this system could be directly affected. Downstream environmental effects would depend on the spill location, with spills located further upstream having less potential for direct environmental effects on Astray Lake, due to the numerous lakes located above and feeding the Gilling River. Spills located within Gilling River will have direct environmental effects on the river and likely into Astray Lake. An iron ore spill would result in localized direct fish mortalities, decreased fish health due to reductions in sediment and water quality, and the direct destruction of fish habitat. A diesel oil spill would result in localized fish mortalities, and decreased fish health due to reductions in sediment and water quality at both a local and system scale, and direct and indirect destruction and impairment of fish habitat at a local and system scale. Environmental effects would depend on the season and existing conditions, with winter periods likely reducing the potential overall effects.

Environmental effects resulting from an iron ore spill would be classified as adverse in direction, moderate in magnitude, site-specific to local in extent, with a frequency of once, of a short to medium term duration, reversible, within undisturbed areas, with a moderate prediction confidence. A worst case spill could result in significant environmental effects on Fish and Fish Habitat although this event is considered to be highly unlikely. A spill of iron ore determined to create significant harm to fish would require habitat offsetting to compensate for the habitat loss. It is expected that offsetting would reduce the serious harm and result in a residual effect that is not significant. This prediction is made with a moderate confidence level.

Environmental effects resulting from a diesel fuel oil spill would be classified as adverse in direction, moderate in magnitude, site-specific to regional in extent, with a frequency of once, with a potential for long term environmental effects, likely reversible, in an undisturbed context, with a moderate prediction confidence. A large, scale spill could result in significant adverse residual environmental effects on Fish and Fish Habitat although this event is considered to be highly unlikely. A spill determined to create significant harm to fish would require habitat offsetting to compensate for the habitat loss. It is expected that offsetting would reduce the serious harm and result in a residual effect that is not significant. This prediction is made with a moderate confidence level.

15.8.3 Forest Fire

Although unlikely, Project activities involving the use of heat or flame could result in a fire. Fires can alter habitat, consume riparian vegetation, destabilize shore area soils, and lead to erosion and sedimentation events. The extent and duration of a fire would be dependent on response efforts and meteorological conditions.

15.8.3.1 Emergency Response/Mitigation of Environmental Effects

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*).

Fire suppression water systems will be maintained on site. The fire suppression water supply at the mine and processing site will be extracted from wells and stored in a 200,000 L water tank reservoirs prior to use. The fire suppression water at the rail loop will be sourced from Astray Lake. 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 Spill 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 in Labrador is in Wabush, which has staff and equipment to provide initial suppression activities.

15.8.3.2 Characterization of Residual Environmental Effects

The environmental effects of forest fires on existing Fish and Fish Habitat are limited due to the nature of the PDA area. Mine and processing facilities are sequestered on a peninsula of Attikamagen Lake, surrounded by water that can limit the spread of fire and provide abundant water bodies and water supply areas for fire suppression. The main environmental effect would be the potential destruction of riparian areas and subsequent decreased habitat quality and increased potential for erosion and sedimentation.

Potential residual environmental effects would be considered adverse in direction, low in magnitude, site specific to local in extent, with a frequency of once, with a short to long term duration, reversible, likely in disturbed areas, with a high prediction confidence. Significant adverse residual environmental effects on Fish and Fish Habitat are not considered to be likely.

15.8.4 Settling/Sedimentation Pond Overflow

Settling/sedimentation ponds will be established at waste rock, overburden, run-of-mine stockpile areas, at the crushing and screening plant area, at the accommodation camp area, and at the rail loop. Run-off from the stockpiles and site run-off will be directed to the settling/sedimentation ponds prior to discharge to the receiving environment. The likelihood of an overflow is low because the ponds will be designed to contain run-off associated with a 1:100 year precipitation event. In such an event, settling / sedimentation ponds could overflow, releasing untreated water. Untreated water could have elevated levels of total suspended solids. No other contaminants are anticipated.

In the unlikely event of an overflow, contingency plans will be in place as part of the Emergency Response and Spill Response Plan to mitigate environmental effects to the receiving environment. Water sampling of TSS and other MDMER parameters will be conducted in downstream water bodies. Applicable stakeholders, including regulatory agencies, First Nations and communities, will be consulted to discuss such events and mitigation measures to be implemented.

15.8.4.1 Emergency Response/Mitigation of Environmental Effects

In the unlikely event of an overflow, contingency plans will be in place as part of the Emergency Response Plan to mitigate environmental effects to the receiving environment. Erosion and sediment control measures will be in place to increase the time it would take the spill to enter waterways. Water sampling and monitoring of TSS and pH levels will be conducted in downstream waterbodies. An overflow event determined to create significant harm to fish would require habitat offsetting to compensate for the habitat loss.

15.8.4.2 Characterization of Residual Environmental Effects

Environmental effects of settling pond overflows will differ for each Project area, with the highest potential for significant environmental effects occurring in a scenario where overflow occurs in the settling pond associated with the waste rock and low grade stockpile area. The settling pond is located 200 m upslope from a bay of Attikamagen Lake. An overflow event is likely to release waters with elevated levels of TSS, reduced pH and high metals concentrations into the littoral area of Attikamagen Lake. Season and site conditions will affect the degree of environmental effects on this fish and fish habitat. For example, such a release during a period of fish spawning would have a much greater impact on fish habitat and health. An overflow event determined to create significant harm to fish would require habitat offsetting to compensate for the habitat loss.

Environmental effects resulting from a settling pond overflow would be classified as adverse in direction, low to moderate in magnitude, site-specific in extent, with a frequency of once, of a short to long term duration, reversible, within an undisturbed area. Significant adverse residual environmental effects on fish and fish habitat are not likely. This prediction is made with a moderate degree of confidence.

15.8.5 Premature or Permanent Shutdown

As currently planned, the mine will have an operational production period of approximately eight years, (following approximately one year of construction) at which time decommissioning and rehabilitation will commence. However, should factors arise that result in the premature shutdown of the mine, regulatory requirements include provision for financial assurance from Joyce Direct Iron.

15.8.5.1 Emergency Response/Mitigation of Environmental Effects

Rehabilitative measures may be implemented by the NLDIET, in which case costs incurred by the Crown in implementing these measures may be recovered by drawing on the financial assurance provided by the proponent. Any required cost expenditures over and above the financial assurance provided would be considered debt by Joyce Direct Iron to the Crown.

15.8.5.2 Characterization of Residual Environmental Effects

In the event of a premature or permanent shutdown, it is anticipated that adverse environmental effects would be low, under the assumption that rehabilitative measures would be realized following implementation by the Crown. Residual environmental effects would be site specific, and short to long term duration for some fish habitats following site rehabilitation, or permanent for other fish habitats that may not return to pre-Project conditions (e.g., open pit). Significant effects are not predicted.

15.8.6 Summary of Residual Effects Resulting from Accidents and Malfunctions

A summary of residual environmental effects resulting from accidents and malfunctions is summarized in Table 15.17.

15.9 Determination of Significance – Residual Adverse Environmental Effect

15.9.1 Project Residual Environmental Effects

15.9.1.1 Change in Fish Habitat/Production

The magnitude of the residual adverse effect on fish habitat/production is considered low within the RSA because the change in fish habitat is restricted to the PDA, and fish habitat within Joyce Lake, the crossings and causeway will be offset in accordance with the *Fisheries Act*. The effect is reversible within the PDA due to the offsetting proposed for Joyce Lake, the watercourse crossings and causeway. The residual adverse effect is not likely to be significant. The level of confidence is high because the effects of the Project are well understood and HADD will be offset.

15.9.1.2 Change in Fish Health or Mortality

With respect to fish health or mortality, the likely residual adverse environmental effect will be limited to injury and loss of fish during relocation efforts and infilling for the causeway. The residual adverse effect is likely to be not significant because the magnitude is negligible, and effects will be limited to the LSA. The effect is irreversible within the PDA for the dewatering of Joyce Lake based on plans for fish salvage and on restoration and enhancement of fish habitat in Joyce Lake following closure. The effect within the LSA is reversible because the loss of productivity will be limited to Joyce Lake for the duration of the Project and will be offset. The overall predictive confidence is moderate based on past fish relocation programs and monitoring.

Table 15.17 Summary of Residual Environmental Effects - Accidents and Malfunctions

Project Phase	Emergency Response/Contingency Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental/Socio-economic Context			
Hydrocarbon Spill	• Emergency Response and Spill Response Plan Emergency Response Plan • Habitat offsetting	A	L-M	S-L	M-LT	O	R	UD	N	M	Standard habitat monitoring to confirm effectiveness of clean-up. Offsetting monitoring
Train Derailment	• Emergency Response and Spill Response Plan Emergency Response Plan • Habitat offsetting	A	M	S-L	LT	O	R	UD	N	M	Standard habitat monitoring to confirm effectiveness of clean-up. Offsetting monitoring
Forest Fire	• Emergency Response and Spill Response Plan Emergency Response Plan	A	L	S-L	ST-LT	O	R	UD/D	N	H	Standard habitat monitoring
Settling/Sedimentation Pond Overflow	• Emergency Response and Spill Response Plan Emergency Response Plan • Habitat offsetting	A	L-M	S	ST-LT	O	R	UD	N	M	Standard habitat monitoring to confirm effectiveness of clean-up. Offsetting monitoring
Premature or Permanent Shutdown	• Work with NLDIET to implement rehabilitative measures.	N	L	S	O	ST	R	D	N	L	Standard habitat monitoring

Table 15.17 Summary of Residual Environmental Effects - Accidents and Malfunctions

Project Phase	Emergency Response/Contingency Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental/Socio-economic Context			

Key:

Direction:
P Positive
A Adverse
N Neutral

Magnitude:
N Negligible: no measure adverse effects anticipated.
L Low: measurable effects anticipated in low-sensitivity habitats and no measurable reduction in the number of fish species anticipated.
M Moderate: measurable effects anticipated in moderately sensitive habitat or anticipated mortality risk to non-listed species.
H High: measurable 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: environmental effect confined to the PDA.
L Local: environmental effect extends into the LSA.
R Regional: environmental effect extends into the RSA, where indirect or cumulative environmental effects may occur.

Duration:
ST Short-term: residual environmental effect occurs during the Construction phase (i.e., one year)
MT Medium-term: residual environmental effect extends through the Operation and Maintenance phase (i.e., up to seven years)
LT Long-term: residual environmental effect extends beyond Closure and Decommissioning (i.e., > 10 years).
P Permanent: measurable parameter unlikely to recover to baseline

Frequency:
Quantitative measure; or
O Once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.
U Unlikely to occur

Reversibility:
R Reversible: effects 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 habitat offsetting works.

Environmental or Socio-economic Context:
U Undisturbed: environmental effect takes place in an area that has not been adversely affected by human development.
D Disturbed: environmental effect takes place in an area that has been previously affected by human development or in an area where 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.

15.9.2 Cumulative Environmental Effects

With the proposed mitigation and environmental protection measures, the Project contributions to cumulative effects are not significant. Given there is 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 Fish and Fish Habitat is not likely significant.

15.9.3 Accidents and Malfunctions

Emergency Response and Spill Prevention Plans will be in place to prevent and reduce the severity of adverse effects associated with accidents and malfunctions. In the highly unlikely event of a large spill of hydrocarbon or iron ore, significant effects on Fish and Fish Habitat could occur. Any accidents and malfunctions resulting in serious harm to fish would require offsetting to compensate for any loss of productive capacity. Significant adverse effects are therefore considered unlikely.

15.10 Follow-up and Monitoring

Monitoring is a necessary component of mitigation and will inform future mitigation strategies. In the unlikely event it is found that mitigation systems are not effective, adaptive management will be used to address potential issues.

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 including monitoring, testing and reporting as required by the MDMER
- Fish Habitat Offsetting Monitoring, and
- EMP required under the *Fisheries Act* authorization.

15.11 Summary

The Project will interact with Fish and Fish Habitat with the greatest levels of anticipated interaction attributed to construction of the Iron Arm causeway, stream crossings, dewatering Joyce Lake, accidents, and malfunctions. The Project is likely to require habitat offsetting for the loss of habitat associated with these activities.

Iron Arm is an Indigenous fishery. The Iron Arm causeway is designed to have two 8 m bridges to allow for fish and boat passage. Construction of the Iron Arm causeway will result in direct changes to fish habitat from the loss of fish habitat within the footprint of the causeway and a partial offset of habitat largely along the 2:1 slope of the infill. Mitigations include limiting construction to timing windows established by DFO and use of fill material free of fines and debris.

Joyce Lake has fish present but has no known Indigenous fishery. Dewatering Joyce Lake will result in loss of fish habitat and dewatering flows through a linear bog system into Attikamagen

Lake. A Dewatering Plan and Fish Removal Plan will be developed to reduce risks to fish health and mortality.

17 stream crossings were identified with respect to the Project. 11 were assessed for fish and fish habitat and eight were considered fish habitat. Of the eight fish bearing streams, one will be spanned using a bridge, two will be crossed using arch culverts and five will be crossed using circular culverts. The bridge and arch culverts are not expected to directly affect the watercourse substrate.

Lesser levels of interaction are anticipated to occur as a result of construction, water treatment, waste management, operation and other activities. Design and application of surface water management systems, BMPs, timing of construction and decommissioning, and progressive rehabilitation of riparian areas are likely to mitigate potential effects. Following application of these measures, significant environmental effects are not anticipated from these activities.

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Joyce Lake Direct Shipping Iron Ore Project:

Chapter 16:

Birds, Wildlife and Their Habitat

File No. 121416571

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16.0 ENVIRONMENTAL ASSESSMENT – BIRDS, WILDLIFE AND THEIR HABITAT

As detailed in chapter 1, Joyce Direct Iron Inc. succeeded Labec Century Iron Ore Inc. ("Labec Century") as the Project Proponent on February 18, 2021 following an internal reorganization. All references to Labec Century as the Project proponent may be interpreted as now referring to Joyce Direct Iron Inc.

16.1 VC Definition and rationale for Selection

This VC was selected for environmental assessment to satisfy requirements under Section 4.22 of the Newfoundland and Labrador EIS Guidelines for the Joyce Lake Direct Shipping Iron Ore Project (the Project). The EIS Guidelines for the Project specified that Birds, Wildlife and their Habitat be considered in the EIS because of the potential for interactions between Project activities and birds and wildlife species, and their habitats. Of particular concern are areas near the Project where concentrations of animals may occur (e.g., breeding, denning, and/or wintering areas), or breeding areas of species high in the food chain but believed to be low in number. Furthermore, the MBCA and the NLWLA provide protection for species included in this VC. These species are important to government agencies, Indigenous peoples and the general public, and many provide recreational, domestic (food supply) and economic benefits for residents in Labrador and Québec. As such, there are linkages between this VC and Chapter 19: Current Use of Lands and Resources for Traditional Purposes by Indigenous Persons, and Chapter 18: Historic and Cultural Resources.

The Birds, Wildlife and their Habitat VC includes the following species groups and their habitats in the Project Development Area (or Project footprint), and in Local and Regional Study Areas:

- migratory and non-migratory birds, including waterfowl, raptors, shorebirds, marsh birds and other landbirds;
- ungulates (e.g., George River caribou [*Rangifer tarandus caribou*]);
- furbearers and small game (e.g., American marten [*Martes americana*] and North American beaver [beaver, *Castor canadensis*]); and
- small mammals (e.g., southern red-backed vole [*Clethrionomys gapperi*]).

Note that this assessment does <u>not</u> include species at risk (SAR) and species of conservation concern (SOCC), or wetland habitats. SAR/SOCC are addressed separately in Chapter 17; wetlands are addressed in Chapter 14.

16.1.1 Approach to Assessment of Effects

Many birds and wildlife species use habitats in the PDA for feeding and/or breeding, and/or migrate through the area. Information used to determine the known or likely presence of birds and wildlife in or near the PDA was derived from reviews of local historical records and other baseline data sources including:

- Field data collected as a part of the environmental baseline program for the Project in 2012. Directed surveys targeted birds in the vicinity of the Project, and included waterfowl, Common Loon (*Gavia immer*) and other aquatic birds, raptors, terrestrial birds, and shorebirds. However, all observations of wildlife were recorded during these and other (e.g., vegetation) surveys, and used to supplement existing information on wildlife in the area. Surveys were designed with reference to the Canadian Wildlife Service's guidance (e.g., Environment Canada 1997, 2007);

- Published and unpublished literature, including peer-reviewed academic journals, research project reports, government publications; and

- Government and non-government sources, including AC CDC, NLDFFA, Birds Canada's "Nature Counts" web portal (e.g., Breeding Bird Survey (BBS) data, eBird data), the Québec Breeding Bird Atlas 2010-2014 (Les oiseaux nicheurs du Québec: atlas des oiseaux nicheurs du Québec méridional), and local naturalists.

Existing information on year-round use of the area was compiled, particularly as it pertains to migratory birds. Areas of concentration of animals (e.g., breeding, denning and wintering areas), and breeding areas of species low in number and high in the food chain (e.g., wolf, *Canis lupis*) were given particular attention.

16.2 Scope of the Assessment

16.2.1 Regulatory Setting

Provincial and federal regulations and associated policies that apply to the management and mitigation of wildlife resources during the Construction and Operations and Maintenance phases of the Project include the MBCA, SARA, NLWLA, and NLESA. Details of the MBCA and the NLWLA are presented below for information purposes only. Chapter 17 of the EIS provides similar information related to SARA and the NLESA.

Migratory Birds Convention Act

The MBCA is designed to protect and conserve migratory bird populations and individuals, and their nests (Government of Canada 1994a). 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 Crane);

- Shorebirds (e.g., plovers and sandpipers); and
- Songbirds (e.g., robins and warblers).

Birds not falling under federal jurisdiction within Canada include grouse, ptarmigan, hawks, owls, eagles, falcons, crows, jays and kingfishers. Most birds not included in this list are protected under provincial laws (e.g., NLWLA).

As stated in Section 5 of the MBCA, the possession or purchasing, selling, exchanging or giving of a migratory bird or nest is prohibited without authorization. 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 (Government of Canada 1994b). Section 6 of these regulations under general prohibitions states that no person shall “disturb, destroy or take a nest, egg, nest shelter, eider duck shelter or duck box of a migratory bird, or have in his possession a live migratory bird, or a carcass, skin, nest or egg of a migratory bird except under authority of a permit therefor”. 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, BMP must be followed to prevent contravention of the MBCA.

Newfoundland and Labrador *Wild Life Act*

In Newfoundland and Labrador, wildlife protection is governed through the NLWLA and associated regulations, applied in conjunction with the *Labrador Inuit Land Claims Agreement Act*. The NLDFFA is responsible for managing the province’s wildlife resources. Section 7.1(a) of the NLWLA, 1990 prohibits 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 license or permit. Furthermore, Section 7.1(j) prevents the disturbance of wildlife in reserved areas, in wildlife parks or in other specified places.

The Newfoundland and Labrador *Wild Life Regulations*, 1996, states that:

- Section 14
  - 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.
  - 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.

    - 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.

- Section 75
    - 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).
    - A person shall not take or destroy the nests or eggs of any wild birds except when authorized under the provisions of the MBCA (Canada) and the regulations.
- Section 81
    - A person shall not hunt, take or kill or have in his or her possession an eagle, falcon, hawk, osprey or owl of any species.
- Section 89
    - In relation to any wild life species that is not named in the annual hunting or trapping orders, there is no open season.

The NLWLA provides regulations for all hunters, big and small game, trapping, and migratory game birds. The NLWLA and *Wild Life Regulations*, in combination with other provincial acts and their associated regulations, including the *Wilderness and Ecological Reserves Act* and the NLESA, provide protection of the biodiversity and wildlife resources of Newfoundland and Labrador.

16.2.2 Influence of Consultation and Engagement on the Assessment

Labec Century recognizes the importance of communications with federal, provincial, and municipal regulatory agencies, stakeholders, and the public, and has conducted a stakeholder consultation program as part of the issues scoping exercise for the Project. The consultation program focused primarily on the area(s) most likely to be affected by the Project, including the Town of Schefferville in the province of Québec and local Indigenous groups.

The issues or concerns regarding Birds, Wildlife and their Habitat were raised during consultation and engagement activities with regulatory agencies (i.e., Environment and Climate Change Canada, NLDOECC), Indigenous groups, stakeholder groups, and the general public. These specific concerns informed baseline data collection and are addressed through the effects analyses.

Labec Century has engaged and consulted with a variety of stakeholders, Indigenous 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 VC. Details on the issues raised by stakeholders are provided in Table 16.1.

Table 16.1 Issues Raised by Indigenous Groups and Stakeholders

Question / Issue	Community/ Organization	Summary of Comments	Response	Chapter
Wildlife and Wildlife Habitats	Naskapi of Kawawachikamach	What about the environment and the wildlife for our future generations?	With the proposed mitigation and environmental protection measures, the environmental effect of the Project on Birds, Wildlife and their Habitat is anticipated to be not significant, as there are no unique or limiting habitats within the PDA, and the species occurring in the RSA are expected to maintain sustainable populations outside the PDA. Studies, reviews and evaluations as well as other details regarding Birds, Wildlife and their Habitat are contained in several chapters of the EIS.	Chapter 16: Birds, Wildlife and Their Habitat
Wildlife/Land and Resource Use	Naskapi of Kawawachikamach	How will the project affect hunting? We are still hunting heavily in that area, helicopters have already caused disturbance, and animals are already scared off by exploration activities. What will the hunters do once the mine is being constructed and operations begin? Caribou have been seen, but seem to flee the noise of choppers. Will caribou flee the sound of mining? What about other animals like moose? Future generations are going to inherit disturbed land.	Habitat loss for key species is expected to be low (<0.5% of habitat available in the area). Research and consultation has not identified the mine area as a preferred area for hunting and other land use activities. Other areas, such as the lakes and rivers adjacent to the causeway, haulage road, and rail loop, have been identified as key land use areas for Indigenous residents. Mitigation measures to reduce effects on habitat include: • Reduce construction footprint to the extent feasible; and • Restrict activities associated with maintenance (e.g., vegetation management, periodic grading and ditching). It is anticipated that if caribou were to return to the region in large numbers, they would generally avoid the open habitat created from Project construction. The EIS and EMP include measures to reduce the effects on the movement and distribution of species. Mitigation will include:	Chapter 16: Birds, Wildlife and Their Habitat Chapter 19: Indigenous Land and Resource Use for Traditional Purposes

Table 16.1 Issues Raised by Indigenous Groups and Stakeholders

Question / Issue	Community/ Organization	Summary of Comments	Response	Chapter
			• Limit noise through the use of mufflers on equipment, enclosed motors and other equipment to attenuate sound propagation, and regular maintenance on vehicles and other equipment to reduce air and sound emissions; • Limit lighting to that required for safe operation, use motion sensors for security lighting, and/or shield exterior lights from above; and • Grade or engineer slopes along roads at locations of potential crossing points for caribou. A complete description of mitigation and effects on wildlife is provided in the EIS.	

16.2.3 Temporal and Spatial Boundaries

The temporal boundaries for the environmental assessment include the Project phases of Construction, Operations and Maintenance, and Closure and Decommissioning. The temporal boundary for Construction is one year (pre-operation), for Operations and Maintenance is approximately seven years, and for Closure and Decommissioning is approximately one year.

The spatial boundaries for the environmental effects assessment of the Birds, Wildlife and their Habitat VC are defined below, and take into account the appropriate scale and spatial extent of potential environmental affects, existing scientific and traditional knowledge, current land and resource use, and biological and ecological considerations.

Project Development Area (PDA): The PDA includes the area of physical disturbance (i.e., footprint of the Project), including the mine site and associated mine infrastructure (e.g., crushing and screening plant, settling and sedimentation ponds, waste rock and overburden disposal areas, stockpiles, rock causeway and roadways, rail track, yard, loop, and accommodations camp). The PDA covers an area of approximately 413 ha. Details on these components are provided in Chapter 2: 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 plus a 500-m buffer around the Project footprint (Figure 16.1) where Project-related environmental effects may reasonably be expected to occur. Along the approximately 43-km haul road, the 1-km wide right-of-way corridor (buffered approximately 500 m on either side) allows for minor revisions to the right-of-way alignment, if needed, for environmental (e.g., for mitigation purposes) or technical reasons.

Delineating the LSA based on a 500-m buffer of the Project footprint is a method that has been consistently used, and accepted, in previous EAs completed for similar projects in the region. The buffer represents a zone in which all direct and the majority of potential indirect effects of the Project may occur (e.g., sensory disturbance to wildlife).

The spatial boundary of the LSA for the assessment of Birds, Wildlife and their Habitat is approximately 6,174 ha (Figure 16.1).

Regional Study Area (RSA): The RSA includes the LSA and surrounding area (approximately a 25 km radius around a central point in the PDA), and provides a regional context for understanding Birds, Wildlife and their Habitat, that could potentially interact with the Project. The RSA is designed to capture the expected overall spatial extent of the Project's effects, based on factors such as the distribution or movement of birds and wildlife, and is representative of the area within which cumulative environmental effects may occur, depending on physical and biological conditions and the type and location of other past, present, and reasonably foreseeable projects. The RSA is approximately 196,349 ha in size (Figure 16.2).

Watershed boundaries were not selected as the basis of the RSA, as this would represent a larger area and potentially result in the dilution of predicted environmental effects, particularly given the relatively small size of the PDA.

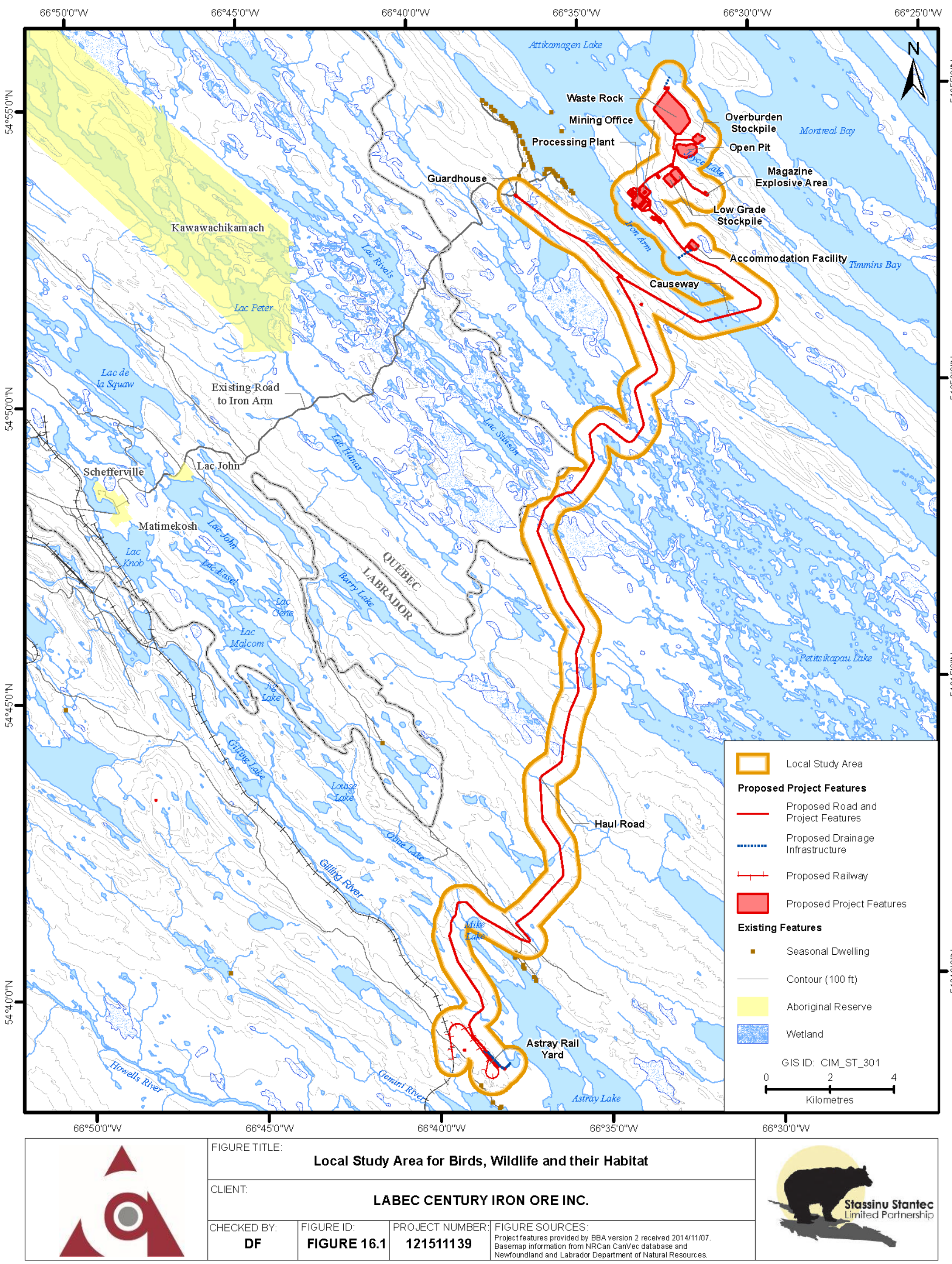

Figure 16.1 Local Study Area for Birds, Wildlife and their Habitat

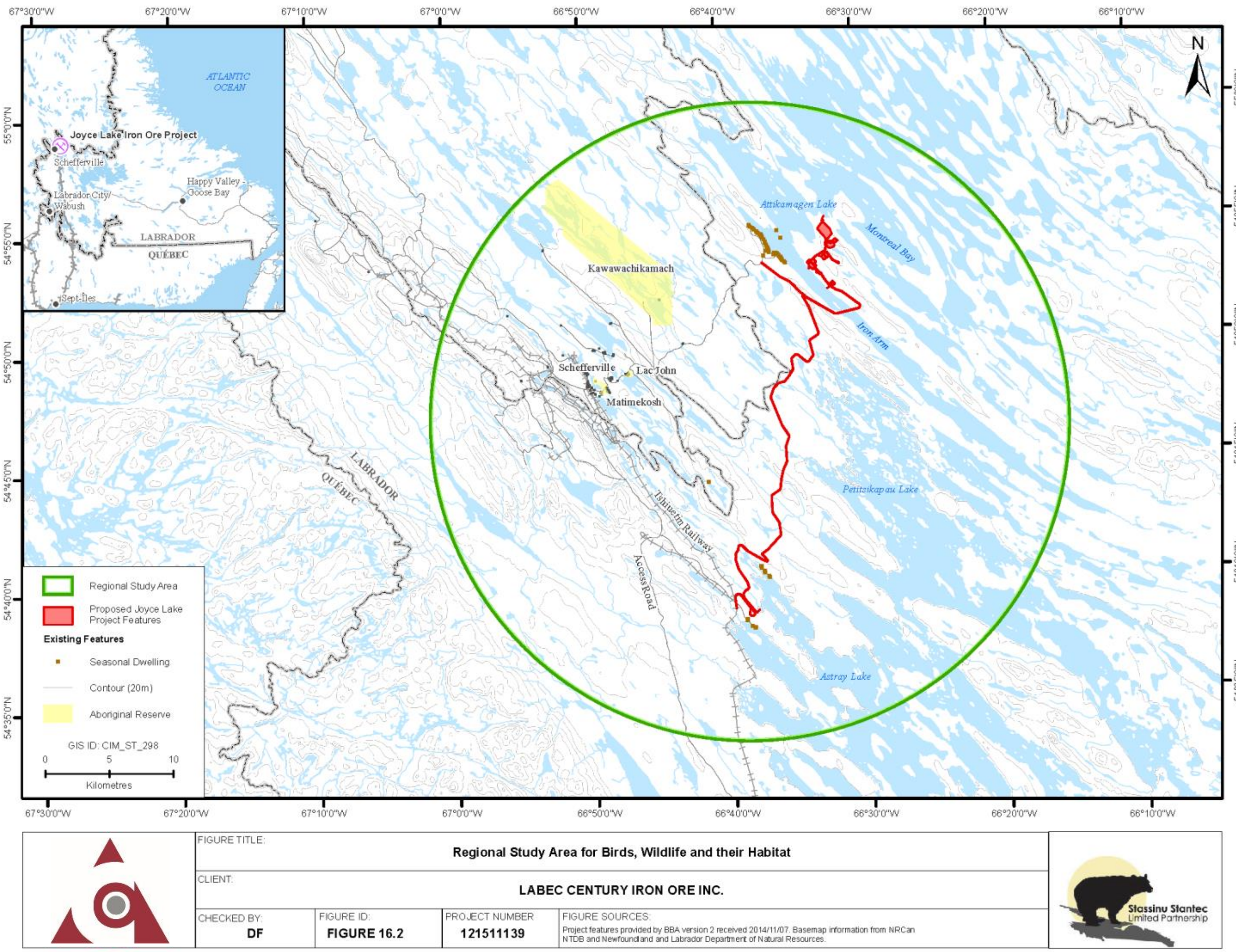

Figure 16.2 Regional Study Area for Birds, Wildlife and their Habitat

16.2.4 Selection of Environmental Effects and Measurable Parameters

Measurable parameters used in the assessment of environmental effects, and rationale for their selection, are summarized in Table 16.2.

Table 16.2 Measurable Parameters for Birds, Wildlife and their Habitat

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Habitat	• Area (ha) of primary or other sensitive or limiting habitat lost or altered relative to the availability (%) in the RSA	The *MBCA* and NNLWLA afford protection of habitat for species of migratory birds and other species. Habitat loss (e.g., ground clearing) or alteration (e.g., creation of dust or other sensory disturbance) can lead to changes in wildlife abundance, behaviour and/or breeding success.
Change in Distribution and Movement	• Density and distribution of species on the landscape; • Sensory disturbance – e.g., noise (dBA), or qualitative effects (e.g., visual)	Sensory disturbance influences wildlife behavior and may result in a change in behaviour, either temporarily or permanently, including feeding, breeding, migration and movement, in response to: • Physical hazards and attractants or deterrents for wildlife (e.g., roads and other structural features, light, noise); • Chemical hazards and attractants for wildlife (e.g., wastes); and • Other disturbances causing wildlife attraction or deterrence (e.g., human presence).
Change in Mortality Risk	• Mortalities (estimated based on likelihood of occurrence in the PDA) • Amount of new access (linear distance in km)	Direct mortality can occur through collisions with trains or construction vehicles. Indirect mortality can result from an increase in predation, hunting and/or poaching resulting from improved access or other habitat changes. A change in mortality risk may occur as a result of contamination from emissions (e.g., effluent discharge).
Change in Health	• Reproductive success (number of young produced)	Physiological effects from stress and/or contamination (e.g., effluents, hydrocarbons) could cause reduced fitness amongst wildlife breeding in the LSA.
Change in Protected Areas	• Area of designated Protected Area function lost or altered (ha)	Examines the spatial and other sensory emissions (e.g., visual, noise or air) that overlap Protected Areas in a manner that compromises the effectiveness of the protection status. Important to resource managers and the local community.

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

Terms that will be used to characterize residual environmental effects for Birds, Wildlife and their Habitat are in accordance with reference guidance provided under CEAA (Federal Environmental Assessment Review Office 1994).

- Direction:
  - **Adverse:** a decrease or undesirable change in habitat, distribution and movement, mortality risk, and/or health of birds and wildlife.
  - **Positive:** an increase or beneficial change in habitat, distribution and movement, mortality risk, and/or health of birds and wildlife.
  - **Neutral:** no net change in habitat, distribution and movement, mortality risk, and/or health of birds and wildlife.
- Magnitude:
  - **Negligible:** measurable adverse effects are not anticipated.
  - **Low:** no measurable change in the existing bird or wildlife community is expected; residual Project environmental effects (alteration/loss) are not expected to exceed 5% of preferred habitats or known populations in the RSA.
  - **Moderate:** measurable change occurs; residual Project environmental effects (alteration/loss) are expected to be greater than 5% and not exceed 25% of preferred habitats or known populations in the RSA.
  - **High:** measurable change occurs; residual Project environmental effects (alteration/loss) are expected to exceed 25% of preferred habitats or known populations in the RSA; the effect can be easily observed, measured and described, and may be widespread.
- Geographic Extent:
  - **Site-specific:** residual environmental effect confined to the PDA.
  - **Local:** residual environmental effect extends into the LSA.
  - **Regional:** residual environmental effect extends into the RSA, where indirect or cumulative environmental effects may occur.
- Frequency:
  - **Once:** environmental effect occurs once per month or less (e.g., site preparation/clearing).
  - **Sporadic:** environmental effect occurs sporadically at irregular intervals (e.g., vegetation clearing, road maintenance).
  - **Regularly:** environmental effect occurs on a regular basis and at regular intervals (e.g., fuel transport).

  - **Continuous:** environmental effect occurs continuously.
  - **Unlikely:** environmental effect is not likely to occur.
- Duration:
  - **Short-Term:** residual environmental effect occurs during the Construction phase of the Project (i.e., one year).
  - **Medium-Term:** residual environmental effect extends throughout the Construction and Operations and Maintenance phases of the Project (i.e., up to seven years).
  - **Long-Term:** residual environmental effect is greater than seven years.
  - **Permanent:** measurable parameter unlikely to recover to baseline (i.e., residual environmental effect persists).
- Reversibility:
  - **Reversible:** residual environmental effect is reversible following Project closure and reclamation.
  - **Irreversible:** residual environmental effect is permanent.
- Ecological Context:
  - **Undisturbed:** area relatively or not adversely affected by human activity.
  - **Disturbed:** area has been substantially previously disturbed by human development (e.g., urban setting), or human development is still present.
- Prediction Confidence
  - **Low:** there is a low level of confidence in the prediction of environmental effects.
  - **Moderate:** there is a moderate level of confidence in the prediction of environmental effects.
  - **High:** there is a high level of confidence in the prediction of environmental effects.

A residual environmental effect is defined as an effect that remains following the establishment of technically and economically feasible Project mitigation. A significant adverse residual environmental effect on Birds, Wildlife and their Habitat is one that results in the degradation, alteration, or loss of primary or important habitat (either physically, chemically, or biologically), in quality or extent, in such a way that the likelihood of the long-term viability or survival of the population within the RSA is threatened as a result (i.e., that would require regulatory bodies to implement specific management plans for the recovery of the affected bird or wildlife populations). An environmental effect that does not meet this criterion is rated as not significant.

16.4 Potential Project-VC Interactions

Each activity and physical work associated with the Project is listed in Table 16.3. Based on the level of interaction that is expected to occur between each activity or physical work and identified potential environmental effects, interactions were rated as 0 (no interaction occurs), 1 (interaction occurs but can be managed through proven mitigation and codified practice), or 2 (an interaction occurs and requires further assessment). The rating takes a precautionary approach, whereby interactions with a meaningful degree of uncertainty will be assigned a rate of 2, indicating that a detailed environmental effects assessment will be conducted.

Table 16.3 Potential Project Environmental Effects to Birds, Wildlife and their Habitat

Project Activities and Physical Works	Potential Environmental Effects			
	Change in Habitat	Change in Distribution and Movement	Change in Mortality Risk	Change in Health
Construction				
Site Preparation (including clearing, grubbing, excavation, material haulage, grading, removal of overburden, ditching, and stockpiling)	2	2	2	2
Construction of Roads	2	2	2	2
Construction of Causeway	2	2	2	2
Construction of Site Buildings and Associated Infrastructure	1	2	1	2
Construction of Rail loop and Associated Infrastructure	2	2	2	2
Construction of Stream Crossings	2	2	1	2
Installation of Water Supply Infrastructure (wells, pumps, pipes)	1	2	1	2
On-site Vehicle/Equipment Operations and Maintenance	1	2	2	1
Waste Management	1	1	1	1
Transportation of Personnel and Goods to Site	1	2	2	1
Expenditures	0	0	0	0
Employment	0	0	0	0
Operations and Maintenance				
Maintenance of Causeway	1	1	1	1
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	1	2	1	2
Dewatering Joyce Lake	2	2	1	2
Ore Processing (including crushing, conveying, storage, screening)	1	2	1	2
Waste Rock Disposal on Surface	2	2	1	2
Water Treatment (including mine water and surface runoff) and Discharge	1	1	1	1
Rail Load-Out and Transport	1	2	2	2
On-site Vehicle/Equipment Operations and Maintenance	1	2	2	1
Waste Management	1	1	1	1

Table 16.3 Potential Project Environmental Effects to Birds, Wildlife and their Habitat

Project Activities and Physical Works	Potential Environmental Effects			
	Change in Habitat	Change in Distribution and Movement	Change in Mortality Risk	Change in Health
Transportation of Personnel and Goods to Site	1	1	2	1
Fuel Transport	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
Closure and Decommissioning				
Site Decommissioning	1	2	1	2
Site Reclamation (building demolition, grading, scarifying)	2	2	2	2
Accidents and Malfunctions				
Hydrocarbon Spill	2	2	2	2
Train Derailment	2	2	2	2
Forest Fire	2	2	2	2
Settling/Sedimentation Pond Overflow	2	2	2	2
Premature or Permanent Shutdown	2	2	1	2

Key:
0 No interaction.
1 Interaction occurs; however, based on past experience, the resulting effect is can be managed to acceptable levels through standard operating practices and/or or through the application of best management or codified practices. No further assessment is warranted.
2 Interaction occurs, and the resulting environmental effect may exceed acceptable levels without implementation of specific mitigation. Further assessment is warranted.

As there are no designated sensitive areas or special areas in the PDA, including designated wildlife areas, stewardship zones, parks and natural areas, Protected Areas were not considered further in the assessment of Project-VC interactions.

This assessment focused on the following four environmental effects, for non-listed species (SAR and SOCC are assessed separately in Chapter 17):

- Change in habitat;
- Change in distribution and movement;
- Change in mortality risk; and
- Change in health.

16.4.1 Interactions Rated as 0

Certain Project activities are not anticipated to interact adversely with Birds, Wildlife and their Habitat. Specifically, expenditures and employment will not have adverse residual environmental effects on Birds, Wildlife and their Habitat.

16.4.2 Interactions Rated as 1

Project activities rated as 1 may have effects on Birds, Wildlife and their Habitat; 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 EMP, prepared in support of the EIS, prior to the start of construction. The EMP will describe the specific environmental protection and mitigation measures that will be applied throughout the life of the Project to avoid or reduce potential effects as a result of the Project. Final decisions on mitigation measures will be made in consultation with experts, and where appropriate, the regulatory authority (e.g., NLDFFA). To promote effectiveness of the EMP, Labec Century will have a full-time on-site environmental inspector (or equivalent), who will inspect worksites and activities for conformance with the EMP, and compliance with government regulations and permits.

The potential effects of the Project activities rated as 1 are discussed below for each environmental effect (i.e*.,* change in habitat, distribution and movement, risk of mortality, and health), and for each Project activity within each Project phase (i.e*.,* Construction, Operations and Maintenance, and Closure and Decommissioning).

16.4.2.1 Change in Habitat

Several Project activities may alter habitat, but can be mitigated using standard operating procedures and/or through application of BMP or codified practices. This includes alteration of habitat as a result of sensory disturbances or potentially through contamination (e.g., hydrocarbon spill, site runoff).

During the Construction phase, the construction of site buildings and associated infrastructure, installation of water supply infrastructure, on-site vehicle/equipment operation and maintenance, waste management, and transportation of personnel and goods to site are expected to be within the area cleared during site preparation (and assessed in detail in Section 16.6), and thus not anticipated to result in an increase in the amount of habitat lost. However, increased sensory disturbance (e.g., dust and noise) associated with these activities may reduce the suitability of habitats in the surrounding environment. For example, dust may have an environmental effect on habitat quality for some species, through direct effects on growth of the surrounding vegetation (e.g., Boulanger et al. 2012). Mosses in particular may be sensitive to dust exposure along roads (Male and Nol 2005). Noise produced as a result of activities during Construction may also reduce the suitability of habitats for some species. Dust and noise may be generated by vehicles travelling on unpaved roads, blasting (pits and/or quarries), or during other activities throughout the life of the Project. There is also the potential for small fuel spills (leaks) or release of other hazardous materials with potential effects on habitat. 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.

During Operations and Maintenance, all Project activities are rated as 1 with the exception of progressive rehabilitation, dewatering Joyce Lake and waste rock disposal on surface. Aside from these, Project activities will occur within an area that will have been already cleared during site preparation and similarly not anticipated to involve further ground disturbance activities (or the addition of any infrastructure). Vegetation management will also be required during Operations and Maintenance periodically to control the growth of trees and tall shrubs. This will primarily involve mechanical control of vegetation (e.g., access road grading), although the use of herbicides may be considered. This activity is unlikely to cause further disturbance to habitat, as clearing activities will be of short duration, limited to the PDA, and in the area already disturbed as a result of Project construction. Furthermore, standard mitigation measures will be applied to reduce potential effects of sediment (or herbicide) release into watercourses and wetlands during operational maintenance activities.

During the Closure and Decommissioning phase, site decommissioning will also occur in areas previously disturbed.

In general, Project activities are expected to be local and/or short-term, and sensory disturbances can be mitigated using standard operating practices and/or through the application of BMP or codified practices, including dust and noise suppression, as well as progressive rehabilitation techniques. A site-specific Emergency Spill Prevention and Response Plan will be implemented to reduce and control potential releases of hazardous materials.

16.4.2.2 Change in Distribution and Movement

Several Project activities will interact with the distribution and movement of birds and wildlife, but can be mitigated through standard operating procedures and/or the application of BMP or codified practices. These include maintenance of the causeway, water treatment and discharge, waste management, transportation of personnel and goods to site, fuel transport, and fuel storage and dispensing. Disturbance associated with these activities include primarily chemical hazards and attractants, as well as potentially other sensory disturbances (e.g., dust, wastes). On-site wastes, if not disposed of properly, as well as human presence in general, may attract species such as bear, fox, and some birds that associate these with a potential food source.

Environmental protection and mitigation measures will be applied to avoid or reduce potential effects on distribution and movement, including avoidance of sensitive species and their habitats, allowing wildlife to pass through the PDA without harassment, and nuisance bear management programs. Specific mitigation measures related to the distribution and movement of wildlife will be detailed in the EMP.

16.4.2.3 Change in Risk of Mortality

A variety of Project activities have the potential to increase risk of mortality, but not to an extent that would affect the sustainability of the population, given implementation of standard operating procedures and/or through the application of BMP or codified practices. These include the construction of site buildings and associated infrastructure, construction of stream crossings, installation of water supply infrastructure, and waste management. Direct mortality related to these activities is likely to be negligible to low, given that birds and wildlife are likely to be displaced due to ongoing sensory disturbance (e.g., noise, visual) associated with site preparation (discussed in Section 16.6). Furthermore, stream crossings will be constructed according to applicable standards and legislation, and will permit drainage to freely pass underneath the roadway, and the number of crossings will be limited to reduce mortality risk.

During Operations and Maintenance, maintenance of the causeway, open pit mining, dewatering Joyce Lake, ore processing, waste rock disposal on surface, water treatment and discharge, waste management, fuel storage and dispensing, and progressive rehabilitation will similarly occur in an area where few birds and wildlife will likely be associated with these activities, as they are expected to have been already displaced as a result of Project construction activities. Activities associated with mine and surface water treatment and discharge (e.g., diversion ditches, settling ponds, testing, treatment and monitoring) will be conducted in compliance with relevant legislation and regulated limits will be met prior to discharge.

During site decommissioning, the risk of mortality is also low, given the anticipated previous displacement of birds and wildlife.

In terms of emissions (e.g., effluents) or other potential sources of contamination (e.g., fuel spill), staff will be trained in handling, storage and disposal methods, and activities will be conducted in accordance with manufacturer recommendations and in compliance with applicable legislation. Infrastructure and activities associated with mine and surface water treatment (e.g., settling ponds, testing, treatment and monitoring) will be conducted in compliance with relevant legislation so that regulated limits are met prior to discharge. A site-specific Emergency Spill Prevention and Response Plan will be implemented to reduce, maintain and control potential releases of hazardous materials.

Specific environmental protection and mitigation measures that will be applied to avoid or reduce potential effects on risk of mortality will be detailed in the EMP.

16.4.2.4 Change in Health

During Construction, Project activities that can be mitigated using standard operating procedures and BMP or codified practices, are on-site vehicle/equipment operation and maintenance, waste management, and transportation of personnel and goods to site. Activities during Operations and Maintenance include maintenance of causeway, water treatment and discharge, on-site vehicle/equipment operation and maintenance, waste management, transportation of personnel and goods to site, fuel transport, and fuel storage and dispensing.

Changes in health may occur indirectly through stress (e.g., from dust), or directly through contamination. Standard and proven mitigation measures will be implemented to reduce the amount of dust produced, including the use of water on roads and progressive rehabilitation to reduce dispersal of particulates.

Direct effects on change in health of birds and wildlife include sources of contaminants including used oil, lubricants, solvents, grease, and batteries associated with site waste management, and equipment and camp operations. Species that may be attracted to areas of food preparation and waste management areas have the greatest potential for exposure. Staff will be trained in handling, storage and disposal methods, and activities will be conducted in accordance with manufacturer recommendations and in compliance with applicable legislation. A site-specific Emergency Spill Prevention and Response Plan will be implemented to reduce, maintain and control potential releases of hazardous materials. Specific environmental protection and mitigation measures that will be applied to reduce potential effects on health will be detailed in the EMP.

16.4.3 Interactions Rated as 2

A detailed environmental effects analysis (Section 16.6) was completed for interactions that have the potential to result in significant adverse environmental effects on habitat, distribution and movement, mortality risk, and/or health of birds and wildlife in the existing environment. Key or representative species, in particular species known to be important to Indigenous people, were identified for the effects assessment. Project-VC interactions assessed in detail include the following activities, by Project phase:

- Construction: site preparation, construction of roads, construction of causeway, construction of site buildings and associated infrastructure, construction of rail loop and associated infrastructure; construction of stream crossings, on-site vehicle/equipment operation and maintenance, and transportation of personnel and goods to site.

- Operations and Maintenance: open pit mining, dewatering Joyce Lake, ore processing, waste rock disposal on surface, rail load-out and transport, on-site vehicle/equipment operation and maintenance, transportation of personnel and goods to site, fuel transport, and progressive rehabilitation.

- Closure and Decommissioning: site decommissioning and site reclamation.

Note that each Project activity does not necessarily interact with all four environmental components assessed. For example, on-site vehicle/equipment operation and transportation of personnel and goods to site are rated as 2 for Change in Distribution and Movement and Mortality Risk, but rated as 1 for Change in Habitat and Health. Refer to Table 16.3 for ratings of interactions. In addition, potential Accidents and Malfunctions have the potential to result in significant adverse environmental effects; these are discussed in detail in Section 16.8.

16.5 Existing environment

16.5.1 Information Sources

Information used to determine the known or likely presence of wildlife species in the RSA was derived from a variety of baseline data sources, including traditional knowledge, reviews of literature and other information sources, avian field surveys conducted in 2012, incidental observations during field surveys, and an ELC habitat analysis.

16.5.2 Methodology for Characterization of Baseline Conditions

16.5.2.1 Bird Surveys

Avian surveys were conducted in the LSA, and designed to coincide with the breeding season of raptors, waterfowl and other aquatic birds (e.g., shorebirds) and terrestrial birds (e.g., songbirds). Survey methods are summarized below. Detailed methods can be found in the Avifauna Baseline Study (Appendix X). Several studies conducted in the RSA were accessed, including scientific journals, government reports, and available studies conducted in the Schefferville area. Electronic databases were also consulted, including the AC CDC status ranks.

Waterbirds

Breeding waterfowl and other aquatic birds were inventoried using methods consistent with the Black Duck Joint Venture helicopter surveys, conducted by the Canadian Wildlife Service in the boreal forest of Québec (Bordage et al. 2003). The breeding pair survey (May 31 to June 3) was timed to account for the beginning of the incubation period, after migration, but before males leave for moulting areas. The brood survey (July 28) was coincided with the median dates for their observation.

Raptors

Aerial bird of prey nest surveys were conducted concurrently with breeding waterfowl surveys (May 31 to June 3). Targeted habitats included cliffs and rocky outcrops for cliff-nesting species such as Peregrine Falcon (*Falco peregrinus*), Golden Eagle (*Aquila chrysaetos*), Rough-legged Hawk (*Buteo lagopus*), and Great Horned Owl (*Bubo virginianus*), as well as Common Raven (*Corvus corax*), and large trees along a 500-m wide contour of large lakes mainly for Bald Eagle (*Haliaeetus leucocephalus*) and Osprey (*Pandion haliaetus*).

Terrestrial Birds

Two complementary surveys were used to document habitat use by terrestrial birds in the Project Development Area: point count stations and transect counts. Point counts were used in upland habitats, whereas transect counts were conducted in wetlands. Data collected by point counts were analyzed first by considering the observations inside the 75-m fixed-radius point count (FRPC) in order to obtain densities per habitat type. Data were also analyzed without consideration of the radius (i.e., unlimited distance point count) to obtain a point index of abundance (PIA) (e.g., Blondel et al. 1970). Surveys were conducted between June 26 and July 4, consistent with the Guide for Impact Assessment on Birds (Environment and Climate Change Canada 1997).

Shorebirds

Information on shorebirds was obtained through transect counts in wetlands and other suitable nesting habitat, such as lake margins. Surveys were conducted between June 26 and July 4, targeting breeding shorebirds. The protocol for shorebird surveys and habitat characterization was the same as for terrestrial birds (refer to Section 3.5.1.2 of the Avifauna Baseline Study, Appendix X).

16.5.2.2 Mammals and Other Wildlife

During the course of 2012 field surveys for other baseline studies in support of the Project EIS, all wildlife sightings or evidence of their presence were recorded. These observations are provided in this report as complementary information to the literature review which was carried out to determine the wildlife species present or likely to be present within the LSA and RSA. Information concerning large mammals, furbearers, small mammals, bats, and amphibians was taken from existing documents, including scientific journals, government reports, and available studies conducted in the Schefferville area. In addition, electronic databases were also consulted: the AC CDC and the CDPNQ. The NLDFFA and Québec's *Ministère de l'Environnement et de la Lutte contre les changements climatiques*[1] were consulted to obtain information concerning large mammal and furbearer harvests as well as caribou collar data.

A photo-interpretation of caribou tracks based on high resolution 3D imagery was undertaken to document the travel corridors used by the George River Herd in the LSA (note that this analysis was based on the Project footprint identified in 2013; since this time the Project footprint has been reduced in size). Detailed methods can be found in the Mammal and Herpetofauna Baseline Study (Appendix Y).

16.5.3 Baseline Conditions

16.5.3.1 Ecological Context

The RSA is entirely within Bird Conservation Region 7: Taiga Shield and Hudson Plains, as defined by the North American Bird Conservation Initiative (Rich et al. 2004). The subarctic climate found here is characterized by relatively short, cool summers with prolonged periods of daylight and long, very cold winters. Large numbers of lakes and wetlands occur in glacially carved depressions, and peat-covered lowlands are commonly waterlogged or wet for prolonged periods due to discontinuous but widespread permafrost. This abundance of water provides important habitat for breeding waterfowl and shorebirds (North American Waterfowl Management Plan 2004). Terrestrial bird abundance is lower than in the boreal softwood shield to the south (barely extending into Labrador to the Wabush area), in great part due to lower tree diversity and density.

16.5.3.2 Birds

In total, 66 bird species were identified during surveys in 2012: 17 species of waterfowl and waterbirds (geese and loons), 4 species of raptors, 8 species of shorebirds and 37 species of terrestrial birds. Breeding was confirmed for 23 of the 66 species (see Appendix H in the Avifauna Baseline Study for the full list of species).

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[1] Formely the wildlife division of the The Ministère du Développement durable, de l'Environnement et des Parcs

Waterfowl and Waterbirds

Species Richness

In total, 17 species of waterfowl and waterbirds were detected during surveys. Breeding was confirmed for nine species, and an additional four are considered probable breeders. The only non-waterfowl species observed were Common Loon, Herring Gull (*Larus argentatus*) and tern species (*Sterna sp.*; either Common Tern, *Sterna hirundo,* or Arctic Tern, *Sterna paradisaea*). Of note was the high density of White-winged Scoter (*Melanitta fusca*) pairs and confirmation of breeding in Labrador (one brood). Although not observed due to a lack of spring and fall surveys, other species potentially present during migration are Black Scoter (*Melanitta americana*) and Long-tailed Duck (*Clangula hyemalis*) (Lepage and Bordage 2010).

Breeding Pair Survey

Waterfowl/waterbird density was comparable to published densities from spring surveys at similar latitude, further to the west (Guérette Montminy et al. 2009; Lepage and Bordage 2010). However, Canada Goose (*Branta canadensis*) and American Black Duck (*Anas rubripes*) densities were lower here than reported in those surveys, and Green-winged Teal (*Anas crecca*), common in the Taiga Shield and Hudson Plains Bird Conservation Region, was not recorded at all. The most common species in terms of indicated pairs per area in the spring survey were Red-breasted Merganser (*Mergus serrator*), Common Merganser (*Mergus merganser*), Lesser Scaup (*Aythya affinis*), Common Goldeneye (*Bucephala clangula)* and White-winged Scoter (Table 16.4).

Table 16.4 Mean Area (number/25 km²) and Linear (number/10 km of shoreline) Densities for Total and Indicated Pair Abundances during Waterfowl and Waterbird Breeding Pair Surveys

Species	Total				Indicated Pairs			
	Area Density (#/25 km^2)		Linear Density (#/10 km of shoreline)		Area Density (#/25 km^2)		Linear Density (#/10 km of shoreline)	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Canada Goose	4.0	6.1	1.0	1.4	0.7	0.6	0.2	0.1
American Black Duck	2.3	4.0	0.6	1.0	0.7	1.2	0.2	0.3
Ring-necked Duck	2.3	2.5	0.6	0.6	0.3	0.6	0.1	0.2
Lesser Scaup	6.7	11.5	1.6	2.7	1.0	1.7	0.2	0.4
White-winged Scoter	6.0	10.4	1.4	2.5	1.3	2.3	0.3	0.5
Surf Scoter	2.0	2.0	0.5	0.5	1.0	1.0	0.3	0.3
Common Goldeneye	2.0	2.0	0.5	0.5	1.3	1.2	0.3	0.3
Hooded Merganser	0.7	1.2	0.2	0.3	0.3	0.6	0.1	0.1
Common Merganser	7.7	10.0	1.9	2.3	1.7	1.5	0.4	0.4
Red-breasted Merganser	6.0	7.8	1.6	2.1	4.0	5.2	1.1	1.4
Merganser sp.	1.0	1.7	0.3	0.5	1.0	1.7	0.3	0.5
Diving duck sp.	0.3	0.6	0.1	0.1	-	-	-	-
Overall - Divers	**34.7**	**32.1**	**8.6**	**7.3**	**12.0**	**4.4**	**3.1**	**1.1**
Overall	**41.0**	**42.0**	**10.1**	**9.6**	**13.3**	**4.7**	**3.4**	**1.1**

Notes:
SD: standard deviation; Surveys were conducted on May 31 and June 3, 2012

Brood Survey

The number of adults observed during the late summer (brood) survey was greater than the total number in the spring (Table 16.4). A number of these are likely moulting migrants, including Canada Geese and Hooded Mergansers (*Lophodytes cucullatus*), two species for which no broods were observed. The species with the highest brood density was Surf Scoter (*Melanitta perspicillata*), followed by American Black Duck and Lesser Scaup (Table 16.5).

Table 16.5 Mean Area (number/25 km²) and Linear (number/10 km of shoreline) Densities for Waterfowl and Waterbird Broods, Adults without Broods, and Total Abundance during the Brood Survey

Species		Number of individuals[1]				Number of Broods				Number of adults without Broods			
		Area Density (#/25 km²)		Linear Density (#/10 km of shoreline)		Area Density (#/25 km²)		Linear Density (#/10 km of shoreline)		Area Density (#/25 km²)		Linear Density (#/10 km of shoreline)	
		Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Geese	Canada Goose	20.3	38.5	4.8	9.1	-	-	-	-	20.3	38.5	4.8	9.1
Dabblers	Mallard	0.5	1.0	0.1	0.2	-	-	-	-	0.5	1.0	0.1	0.2
	American Black Duck	13.5	18.8	3.3	4.4	0.8	1.0	0.2	0.3	10.3	20.5	2.4	4.8
	American Black Duck x Mallard hybrid	0.3	0.5	0.1	0.1	-	-	-	-	0.3	0.5	0.1	0.1
	Overall - Dabblers	**14.3**	**20**	**3.5**	**4.7**	**0.8**	**1.0**	**0.2**	**0.3**	**11.0**	**22.0**	**2.6**	**5.2**
Divers	Ring-necked Duck	4.8	5.6	1.2	1.4	0.3	0.5	0.1	0.1	2.8	5.5	0.6	1.3
	Lesser Scaup	6.2	6.8	3.1	4.6	0.7	1.0	0.4	0.6	1.5	1.9	0.5	0.6
	Common Goldeneye	0.3	0.5	0.1	0.1	0.3	0.5	0.1	0.1	-	-	-	-
	Common Merganser	0.3	0.5	0.1	0.1	-	-	-	-	0.3	0.5	0.1	0.1
	Hooded Merganser	4.5	7.7	1.3	1.8	-	-	-	-	4.5	7.7	1.3	1.8
	Red-breasted Merganser	1.5	3.0	0.4	0.8	-	-	-	-	1.5	3.0	0.4	0.8
	White-winged Scoter	1.5	3.0	0.4	0.7	0.3	0.5	0.1	0.1	1.0	2.0	0.2	0.5
	Surf Scoter	6.5	12.9	4.0	8.1	1.0	2.0	0.6	1.2	-	-	-	-
	Overall - Divers	**25.4**	**18**	**10.4**	**11.7**	**2.5**	**2.5**	**1.2**	**1.7**	**11.5**	**15.9**	**3.2**	**3.6**
Loons	**Overall - Waterfowl**	**59.9**	**68**	**18.7**	**16.6**	**3.2**	**2.2**	**1.4**	**1.6**	**42.7**	**76.2**	**10.6**	**18**
	Common Loon	2.2	0.5	0.8	0.3	0.5	0.6	0.1	0.2	1.2	1.0	0.5	0.5
	Overall	**62.2**	**68.0**	**19.5**	**16.7**	**3.7**	**2.1**	**1.5**	**1.5**	**44.0**	**76.7**	**11.1**	**17.7**

Notes:

[1]Total number of adults (with and without broods) and ducklings observed.

SD: standard deviation.

Surveys were conducted on June 28, 2012

Habitat Use

Breeding habitat used by pairs varied. Ponds and lakes from 10 to 100 ha in area were most frequently used, while larger lakes (100 to 500 ha) and brooks were rarely used. Most scaup and scoter broods were found on ponds or on surfaces of smaller waterbodies (mainly 10 to 100 ha). The only duck broods found on lakes larger than 100 ha were American Black Ducks. The vast majority of adults without broods were on lakes 10 to 100 ha in size, likely a suitable habitat for moulting. Fen and bog wetland habitats were rarely used by any waterfowl or other aquatic birds.

Raptors

Three diurnal bird of prey species were observed during surveys (Osprey, Bald Eagle and Red-tailed Hawk [*Buteo jamaicensis*]), as well as one nocturnal species (Great Horned Owl). Nests were identified for Osprey (n=4) and Bald Eagle (n=2), and three immature Bald Eagles were observed. Red-tailed Hawk and Common Raven pairs were recorded, but no nests were found. Only one Great Horned Owl was sighted.

Species that are uncommon, such as Northern Hawk Owl (*Surnia ulula*) or difficult to detect through aerial surveys, such as Boreal Owl (*Aegolius funereus*), have suitable breeding habitat within the RSA and may also be present. Suitable nesting habitat for Gyrfalcon (*Falco rusticolus*) is not present in the RSA, however it may occur outside the breeding season.

Terrestrial Birds

A total of 85 point count stations were established across five upland habitat types (Table 16.6) and 18 transects were surveyed within wetland habitats (four in shrub swamp, eight in small fen and/or bog wetlands, and six in extensive fen and/or bog wetlands).

Table 16.6 Number of Point Count Stations per Upland Habitat Type

Habitat	Point Counts		Habitat Within LSA	
	Number	Proportion (%)	Area (ha)	Proportion (%)
Spruce-moss	39	45.9	6,674	47.9
Spruce-lichen	28	32.9	3,695	26.5
Post-fire conifer regeneration	8	9.4	1,758	12.6
Bare dry ground	5	5.9	1,022	7.3
Shrubland	5	5.9	721	5.2
Other	0	0	70	0.5
Total	**85**	**100**	**13,940**	**100**
Note: Habitat descriptions are provided in the baseline report (Appendix X)				

Species Richness

In total, 37 terrestrial bird species were encountered, comprising 35 migratory species and two resident species. Breeding was confirmed for eight of the 37 species, including Rusty Blackbird (*Euphagus carolinus*), that is a designated SAR. Seven additional species were considered probable breeders. Only one species, Snow Bunting (*Plectrophenax nivalis*), was considered to be a late migrant.

Based on available references, regular winter visitors likely include Willow Ptarmigan (*Lagopus lagopus*), Common (probably breeding also) and Hoary Redpolls (*Acanthis flammea* and *Acanthis hornemanni*, respectively). Species breeding in nearby tundra such as Horned Lark (*Eremophila alpestris*), American Pipit (*Anthus rubescens*) and Lapland Longspur (*Calcarius lapponicus*) likely pass through on migration (Groupe Hémisphère 2008; LIM 2009; eBird 2013).

A comparison of mean species richness among upland habitat types showed little variation (Table 16.7). Cumulative species richness, however, varied among habitat types and is likely a reflection of sampling effort; sampling effort was uneven between habitat types, and therefore the differences in species richness cannot be solely explained by true differences in habitat richness. Overall cumulative species richness varied little among sampling method used: 28 based on FRPC and 31 based on PIA (Table 16.7). Sampling of the LSA was believed to be thorough, and likely detected almost all songbird species. Thus, this information was used to estimate songbird population densities in upland habitats in the LSA.

Table 16.7 Species Richness per Point Count Habitat Type (Upland Habitats)

Habitat	Species Richness – FRPC			Species Richness – PIA		
	Mean	SD	Cumulative	Mean	SD	Cumulative
Spruce-moss forest	4.31	1.76	22	5.67	1.88	24
Spruce-lichen forest	3.43	1.67	16	4.75	2.08	18
Post-fire conifer regeneration	4.38	2.07	14	7.88	1.25	18
Shrubland	4.40	1.67	10	5.40	1.14	13
Bare dry ground	4.00	1.87	10	5.60	3.05	15
Overall	**4.01**	**1.76**	**28**	**5.59**	**2.11**	**31**

Notes:
FRPC: fixed-radius point count; PIA: point index of abundance; SD: standard deviation
Species richness differs between methods, as some elusive species were only detected outside the 75 m radius.

Cumulative species richness in the four wetland habitat types surveyed was similarly calculated based on linear abundance indices (transects). Eight species were found in extensive fen and/or bog wetlands, five in small fen and/or bog wetlands, and 12 in shrub swamps (Table 16.8).

Table 16.8 Species Richness per Transect Habitat Type (Wetland Habitats)

Habitat	Species Richness		
	Mean	SD	Cumulative
Extensive fen and/or bog complex	3.00	1.83	8
Small fen and/or bog wetland	1.38	1.30	5
Shrub swamp	4.75	2.75	12
Overall	**4.06**	**3.11**	**16**

Population Estimates

Population estimates of terrestrial birds in each upland habitat type are summarized in Table 16.9. Population estimates were calculated for upland habitats by multiplying the mean number of indicated pairs/ha by the total number of hectares in the LSA (Table 16.9).

Table 16.9 Population Estimates of Terrestrial Birds in Upland Habitats of the LSA

Habitat	PIA (IP)		FRPC (IP/ha)		Area (ha)	Estimated Population (IP)		
	Mean	SD	Mean	SD		Minimum	Mean	Maximum
Spruce-lichen forest	5.89	2.92	2.16	1.19	3,695	3,584	7,981	12,378
Spruce-moss forest	7.28	2.64	2.87	1.33	6,674	10,278	19,154	28,031
Post-fire conifer regeneration	10.13	2.40	3.04	1.78	1,758	2,215	5,344	8,474
Shrubland	6.80	2.61	2.94	1.18	721	1,269	2,120	2,971
Bare dry ground	6.70	3.91	2.77	1.75	1,022	1,042	2,831	4,619
Overall	**7.03**	**2.73**	**2.65**	**1.36**	**13,870**	**17,892**	**36,755**	**55,619**

Notes:
1. FRPC: fixed-radius point count; PIA: point index of abundance; IP: Indicated pairs; SD: standard deviation
2. Habitats based on available data in the LSA (i.e., habitats that were photo-interpreted as part of baseline studies, refer to Appendix X).

Population estimates were calculated for wetland habitats by multiplying the mean density of indicated pairs found by the total number of hectares surveyed through wetland transects (Table 16.10). As such, standard deviation values are not available.

Table 16.10 Population Estimates of Terrestrial Birds in Wetland Habitats of the LSA

Wetland Habitat	Mean Density (IP/ha)	Area (ha)	Estimated Population (IP)
Extensive fen and/or bog complex	0.17	376	64
Small fen and/or bog wetland	0.24	631	154
Shrub swamp	0.75	276	206
Overall	**0.33**	**1,283**	**424**

Notes:
1. IP: Indicated pairs
2. Refer to Appendix X for habitat descriptions.

The lower density and population estimate for extensive fen and/or bog habitats compared to smaller wetland habitats may be attributed to the vastness of the former. This vastness may hinder the observers' capacity to record all birds, thus resulting in artificially lower density values than those found in smaller, more constrained wetlands. Also, the larger wetlands were only covered in parts (within 200 m of the transect line).

Species Density/Abundance

Density was calculated for each species recorded within the 75 m fixed radius of point counts, for each habitat type. The relative abundance of species is consistent with other studies carried out in Bird Conservation Region 7 (Groupe Hémisphères 2008; LIM 2009; NML 2009). Dark-eyed Junco (*Junco hyemalis*) and Ruby-crowned Kinglet (*Regulus calendula*) were most abundant in the most common habitat type, spruce-moss forest. In the second most prevalent habitat, spruce-lichen forest, Dark-eyed Junco and Yellow-rumped Warbler (*Setophaga coronata*) were most common. In shrubland, Fox Sparrow (*Passerella iliaca*) and Swainson's Thrush (*Catharus ustulatus*) were most common. In post-fire conifer regeneration habitats, White-crowned Sparrow (*Zonotrichia leucophrys*) was most abundant, followed by American Robin (*Turdus migratorius*) and Fox Sparrow. Yellow-rumped Warbler, Fox Sparrow and White-throated Sparrow (*Zonotrichia albicollis*) were the most common species in the habitat classified as bare ground.

In extensive fen and/or bog complexes, Savannah Sparrow (*Passerculus sandwichensis*) was the most abundant landbird, followed by Rusty Blackbird. In small fen and/or bog wetlands, American Robin was most common, followed by Rusty Blackbird and Lincoln's Sparrow (*Melospiza lincolnii*). In shrub swamps, White-crowned Sparrow and American Robin were the most abundant species.

Shorebirds

Species Richness

Eight species of shorebirds were recorded during surveys, with breeding confirmed for Solitary Sandpiper (*Tringa solitaria*), Greater Yellowlegs (*Tringa melanoleuca*), Lesser Yellowlegs (*Tringa flavipes*) and Least Sandpiper (*Calidris minutilla*). Short-billed Dowitcher (*Limnodromus griseus*) and Spotted Sandpiper (*Actitis macularius*) were identified as probable breeders, while Wilson's Snipe (*Gallinago delicata*) and Red-necked Phalarope (*Phalaropus lobatus*) were considered possible breeders. Extensive fen and/or bog complexes held the highest shorebird diversity of any habitat type, with seven of eight shorebird species recorded.

Population Estimates

Shorebird density was measured by multiplying the mean density of indicated pairs found by the total number of hectares surveyed through wetland transects (Table 16.11). As such, standard deviation values are not available.

Table 16.11 Population Estimates of Shorebirds in Wetland Habitats of the LSA

Habitat	Mean Density (IP/ha)	Area (ha)	Estimated Population (IP)
Extensive fen and/or bog complex	0.18	376	68
Small fen and/or bog wetland	0.10	631	60
Shrub swamp	0.08	276	23
Total	**0.12**	**1,283**	**151**

Notes:
1. IP: Indicated pairs
2. Refer to Appendix X for habitat descriptions.

Species Density/Abundance

Least Sandpiper, Greater Yellowlegs and Short-billed Dowitcher were the most abundant species in extensive fen and/or bog complexes. Of the species recorded in this habitat, only the Greater Yellowlegs, Solitary Sandpiper and Wilson's Snipe were found in other wetland types. Wilson's Snipe and Solitary Sandpiper were most common in small fen and/or bog wetlands, while Spotted Sandpiper was found most commonly in shrub swamp habitat.

16.5.3.3 Mammals and Other Wildlife

Large Mammals

Caribou

The RSA falls within the documented wintering range of the George River Caribou Herd (GRCH), the only caribou (*Rangifer tarandus caribou*) population likely to be found within the Project's RSA (Couturier et al. 2004). The winter range of the GRCH is unpredictable in regard to site fidelity, but the herd aggregates each June on traditional calving grounds (Schmelzer and Otto 2003), which are approximately 200 km northeast of the RSA. The Leaf River Herd generally occupies northern Québec only, but its fall and winter ranges have often overlapped with that of the GRCH (Crête et al. 1990). None of the four sedentary ecotype populations recognized in Labrador currently inhabit the RSA. Historically, the McPhayden Herd has been reported in the Schefferville area, but this sedentary population has declined or disappeared since the 1960s (Bergerud et al. 2008; LIM 2009).

Caribou sightings occur mainly during winter, though they are relatively uncommon in the RSA. Based on migration patterns defined by Jean and Lamontagne (2004) from 1991-2002 collar data, caribou could be expected in the Schefferville region in particular from mid-July to mid-May (seasonal occurrences include fall migration, rutting period, pre-winter migration, winter range and spring migration).

Data from satellite-collared caribou of the GRCH indicate some movements within the RSA (Figure 16.3), although based on the available data (i.e., date and location only) it was not possible to infer the number of collared individuals detected. The vast majority of locations were from November to April which mainly corresponds to the periods of pre-winter migration, wintering and spring migration. The closest caribou location to Schefferville was recorded on November 17, 2007 near Barry Lake, approximately 7 km east of the town and approximately 7 km west of the proposed haul road. Caribou locations were also observed near the Joyce Lake peninsula at the end of November 2005. In 2009, an aerial survey conducted within an approximate 50 km radius of Schefferville identified only seven caribou, with the closest sightings more than 20 km southwest of Schefferville (D'Astous and Trimper 2009, 2010). More recently in 2011, a collar was >25 km east of the Project (i.e., outside the RSA) from the end of November to mid-December.

The annual distribution area of the GRCH decreased simultaneously with the decline of the population. If the population increases to a size similar to that observed in the 1990's, the LSA would likely be frequented by the GRCH, particularly since this species tends to use ungrazed winter habitats from year to year (Schmelzer and Otto 2003). Within the LSA, there are approximately 1470 ha of suitable foraging habitat for caribou, composed of lichen shrub barrens and open spruce-lichen forest (19% of the LSA surface area). These habitats are relatively common in the Mid Subarctic Forest and the High Subarctic Tundra ecoregions. Other potential foraging areas for caribou within the LSA include highly, moderately and slightly weathered rock barrens with patches of lichen (377 ha, or 5% of the LSA).

Caribou trail photo-interpretation indicated a network of 2,192 geo-referenced lines corresponding to presumed caribou tracks, with a total of 922 lines occurring within the LSA (Figures 16.4 and 16.5). These imprints in the lichen and especially sphagnum moss ground cover can sometimes be several years of age. The majority of these lines (n=668) were characterized as small networks (1 to 5 roughly parallel caribou tracks), 216 were considered medium size (6 to 10 tracks) and 38 were indicative of large passages (>10 tracks). Visual observation of tracks in the LSA (Figures 16.4 and 16.5) suggests an orientation generally along the ENE-WSW axis or ESE-WNW axis. This is consistent with the general knowledge of the GRCH migration pattern to travel in a general East-West axis because of the orientation of the tree line (Jean and Lamontagne 2004).

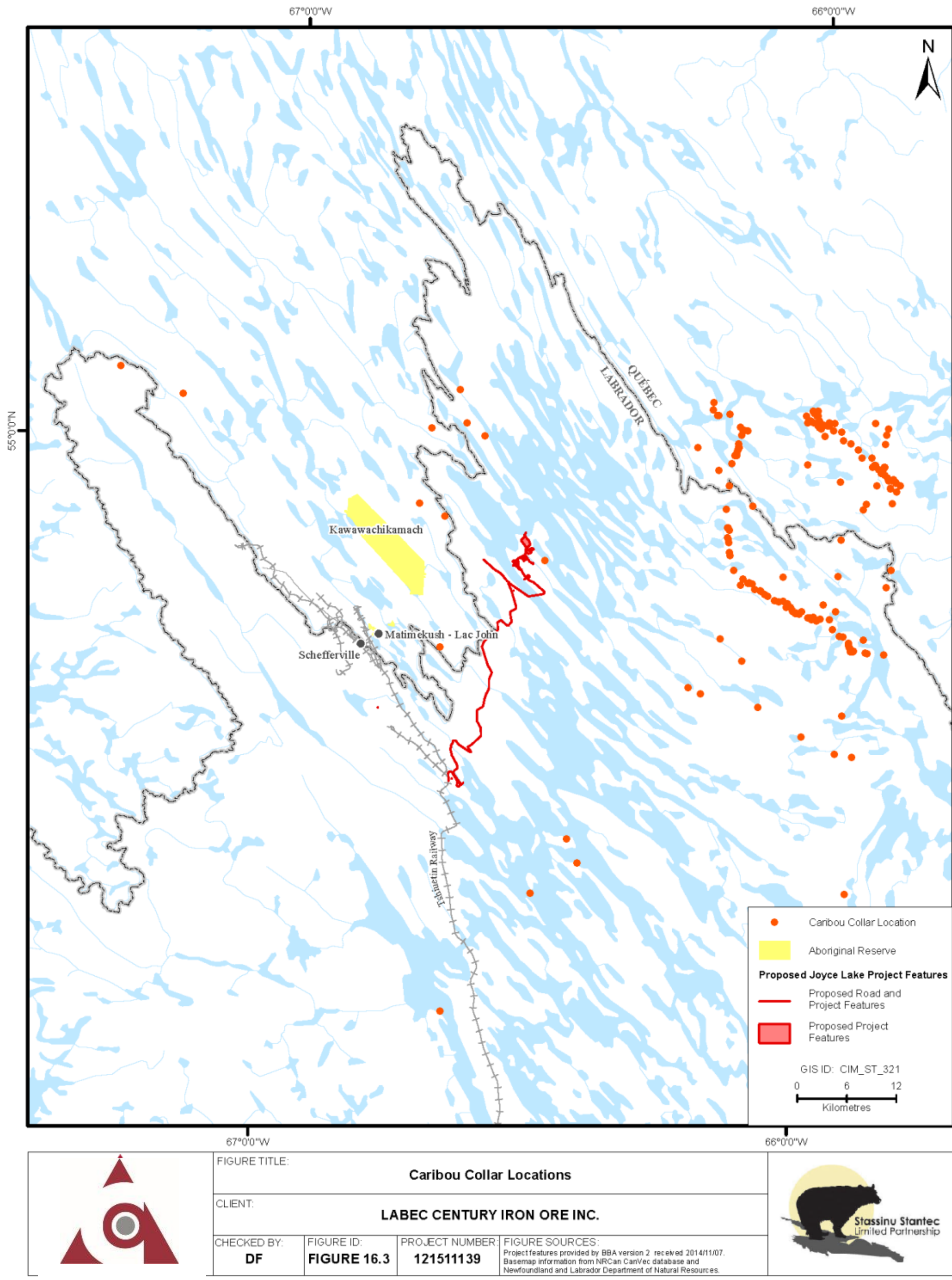

Figure 16.3 Locations of Caribou in Proximity to the Project based on 2002-2012 Satellite Collar Data

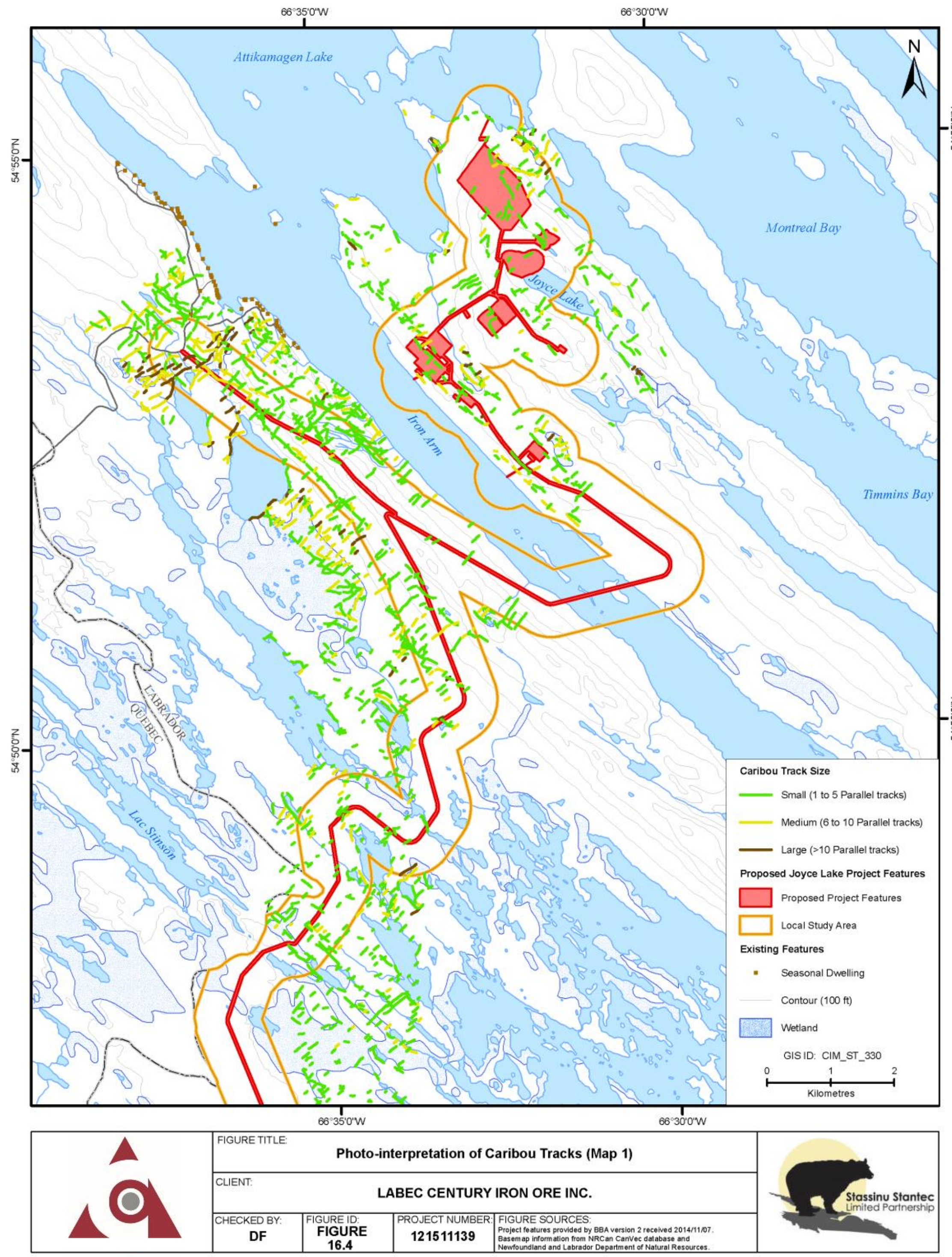

Figure 16.4 Photo-Interpretation of Caribou Tracks

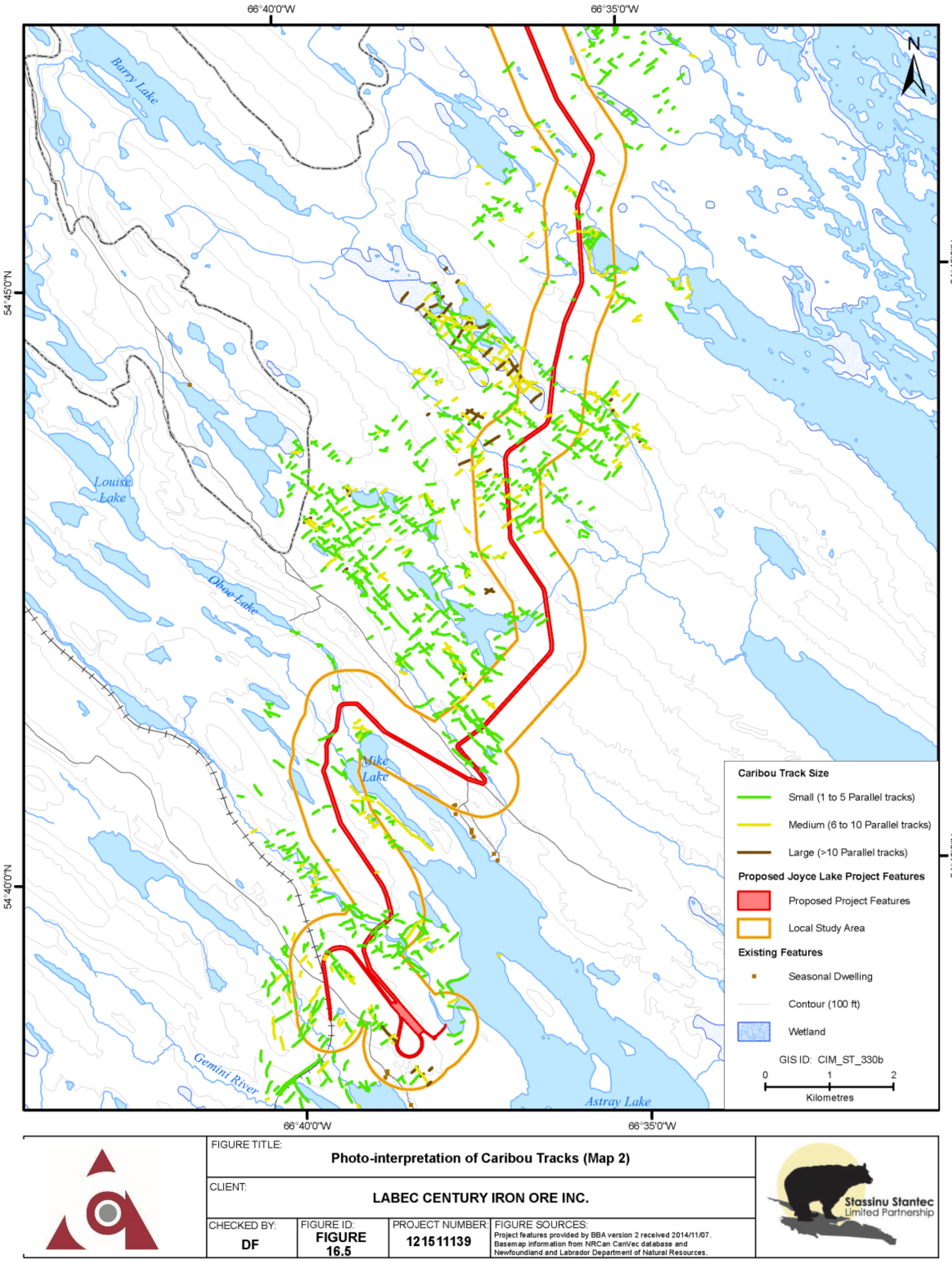

Figure 16.5 Photo-Interpretation of Caribou Tracks

Moose

Habitats favourable to moose (*Alces alces*) are uncommon in the RSA and consequently, population density is likely low, as in other areas in central Labrador and northeastern Québec (Trimper et al. 1996, Jones 2008). Some incidental observations have been made in the RSA, including a female and her fawn, but none have been seen in winter (D'Astous and Trimper 2009). It is likely that moose retreat south of the RSA in winter, possibly due to the scarcity of dense cover and adjacent quality winter browse areas (NML 2009). Innu of Matimekush-Lac John report that moose are present in very low numbers, and sightings are rare. Given their relatively low numbers, moose are of limited importance for subsistence hunting (Clément 2009).

Moose hunting is prohibited in the RSA. In western Labrador, hunting is allowed in only one Moose Management Area (48), which is located approximately 150 km south of the RSA, and only one license is authorized annually in this Moose Management Area. In Québec, moose hunting is prohibited in the area around Schefferville, which is part of hunting Zone 23.

Given the absence of a major river valley, limited amount of deciduous forest in the RSA in general, and the high proportion of open areas (mainly fens and rock barrens), there is likely a low potential for moose in the LSA. Potential suitable habitat for moose represents approximately 720 ha (11%) of the LSA.

Black Bear

The RSA includes a portion of Québec's hunting Zone 23 (Figure 16.6), which ends at the Québec-Labrador border. Black bear (*Ursus americanus*) density within this zone was estimated to be 0.10 bear/10 km^2 in 2005 (Lamontagne et al. 2006). There was no similar information regarding bear harvest available for Labrador; however, other studies in Labrador have shown that habitat and home range varies greatly depending on sex, time of year and individual foraging habits (Leblanc and Huot 2000; Minaskuat Inc. 2009). The variety of habitats found in the LSA may be suitable to black bears.

Observations reported in the RSA are fairly numerous. The presence of black bear was confirmed in the LSA during 2012 surveys, with records of black bear trails and feces, as well as observation of one individual. In addition, Labec Century employees reported black bears near the Iron Arm accommodation camp, also in 2012.

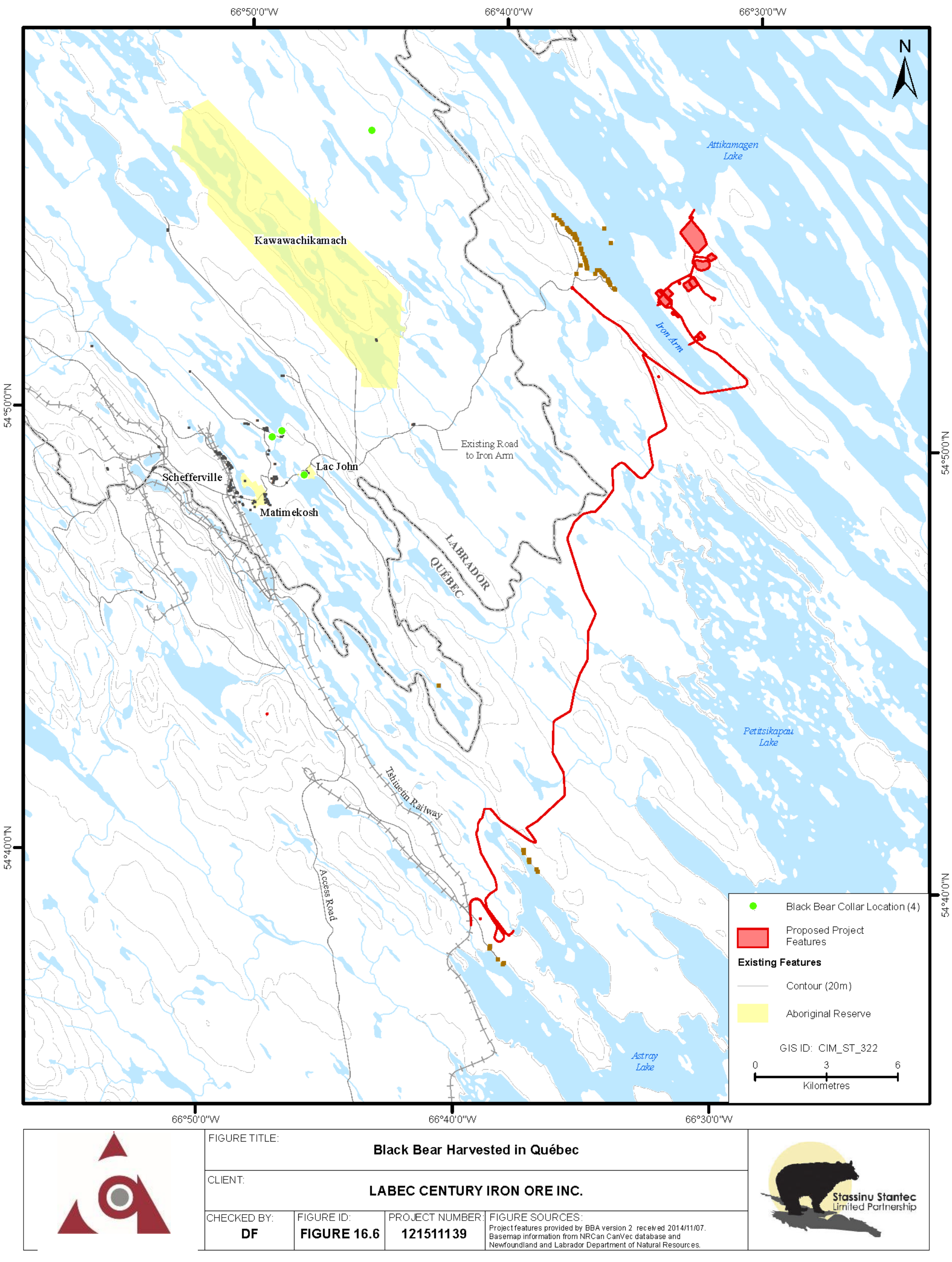

Figure 16.6 Locations where Black Bear were Harvested in Québec, 2007-2011

Furbearers

Based on distributions presented in Banfield (1977) and Prescott and Richard (1996), 17 furbearer species could potentially be found in the RSA. According to traditional knowledge presented in NML (2009), red fox (*Vulpes vulpes*), red squirrel (*Tamiasciurus hudsonicus*) and porcupine (*Erethizon dorsatum*) can be found almost everywhere in the Schefferville region, and snowshoe hare (*Lepus americanus*) can be found in large numbers. In addition, NML (2009) confirmed the presence of several other species in the Schefferville area: grey wolf (*Canis lupus*), woodchuck (*Marmota monax*), northern river otter (*Lontra canadensis*), mink (*Mustela vison*), American marten, beaver, ermine (*Mustela erminea*), muskrat (*Ondatra zibethicus*), northern flying squirrel (*Glaucomys sabrinus*) and Canada lynx (*Lynx canadensis*). Least weasel (*Mustela nivalis*) is not confirmed to occur in the area according to published literature, but several Innu of Matimekush-Lac John recognize the existence of two species of weasel in the area, one smaller than the other (Clément 2009).

Four species of furbearers were confirmed to be present in the LSA during the field surveys in 2012: beaver, snowshoe hare, red fox, and grey wolf. Photo-interpretation of the LSA (for caribou) also identified one beaver dam and lodge within the LSA, along the southern half of the haul road. This lodge was later confirmed to be active.

There are no data available concerning furbearer population densities in the PDA or LSA. However, trapping and hunting by the Naskapi in the RSA suggest an abundance of American marten, snowshoe hare, red fox, mink and muskrat. Some harvesting by the Naskapi has been reported within the LSA, including porcupine hunting on the mainland and beaver trapping in the Attikamagen Lake area across from Iron Arm (Weiler 2009 in NML 2009).

Small Mammals

Fourteen species of small mammals potentially occur in the Schefferville region (Desrosiers et al. 2002; Fortin et al. 2004; NML 2009; Rodrigues 2011). However, only six species have been confirmed present in the RSA through various surveys and incidental observations: southern red-backed vole (*Myodes gapperi*), masked shrew (*Sorex cinereus*), eastern heather vole (*Phenacomys ungava*), northern bog lemming (*Synaptomys borealis*), meadow jumping mouse (*Zapus hudsonius*) and star-nosed mole (*Condylura cristata*).

According to Brunet and Duhamel (December 2005 in NML 2009), small mammal population densities were low in their study area within the RSA, and significant inter-annual variations in population size were noted. Southern red-backed vole was most abundant, followed by the eastern heather vole. Other studies in similar habitats in Québec and further south in Labrador indicated that meadow vole (*Microtus pensylvanicus*) and masked shrew were most abundant.

Bats

Two species of bats have been confirmed to this date in Labrador: little brown myotis (*Myotis lucifugus*) and more recently, northern myotis (*Myotis septentrionalis*) from two locations in southern Labrador (NLDOECC 2012; Broders et al. 2013; T. Parr pers. comm.).

Echolocation calls were recorded from within the RSA in 2005, in the Howell's River catchment area (NML 2009). While calls could not be assigned to a particular species, one was assigned to the genus *Myotis* (NML 2009). In addition, bats have been reported by Innu as close as Hope Lake, roughly 4 km to the closest point in the LSA (Clément 2009). Bat density in the area over a two-year period between 2005 and 2006 was estimated to be very low (Envirotel 3000 Inc. 2008 in NML 2009). Both species are possible in the LSA in low numbers, though the little brown myotis is the more likely of the two based on current knowledge on distribution.

Amphibians

According to NLDOECC (2012), seven amphibian species are present in Labrador: northern two-lined salamander (*Eurycea bislineata*), blue-spotted salamander (*Ambystoma laterale*), American toad (*Anaxyrus americanus*), mink frog (*Lithobates septentrionalis*), wood frog, northern leopard frog (*Lithobates pipiens*), and spring peeper (*Pseudacris crucifer*). Of these, American toad, mink frog, wood frog and spring peeper were recorded within the RSA (NML 2009). Incidental observations of mink frog (n=1) and wood frog (n=1) were recorded in the LSA during field surveys in support of the Project in 2012.

In the RSA, wood frog (more frequent) and spring peeper (less frequent) were encountered in all four areas sampled in the Howell's River valley, while American toad was found in only one (NML 2009).

A summary of Local and Indigenous Traditional Knowledge pertaining to Birds, Wildlife and their Habitat is presented in Table 16.12.

Table 16.12 Local and Indigenous Traditional Knowledge: Birds, Wildlife and their Habitat

Group	Source	Page or Date Reference	Comment or Excerpt	Map Reference (Figure 3.1)
Birds and Wildlife				
Naskapi 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	p. 8	"Small game harvesting in the Schefferville region was reported to occur to the northwest and the south and southeast of Attikamagen Lake. These areas show the highest level of small game harvesting activity based on the sample of interviewed harvesters."	2
Naskapi of Kawawachickamach	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	p. 7	The area of Attikamagen Lake and the series of lakes to the northwest of it was one of three core areas for hunting caribou in the early decades of settlement near Schefferville.	2

Table 16.12 Local and Indigenous Traditional Knowledge: Birds, Wildlife and their Habitat

Group	Source	Page or Date Reference	Comment or Excerpt	Map Reference (Figure 3.1)
Birds and Wildlife				
Naskapi of Kawawachikamach	Consultation Assessment Report CEAR Doc#501		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.	NA
Naskapi of Kawawachikamach/ Innu (Schefferville)	Consultation		Ptarmigan hunting takes place in winter, primarily on the islands, on Petitisikapau Lake. For both Innu and Naskapi	11
Naskapi of Kawawachikamach/ Innu (Schefferville)	Consultation		Many years (decades) ago caribou hunting took place near Joyce Lake.	7
Naskapi of Kawawachikamach/ Innu (Schefferville)	Consultation		Caribou seen near to the cabins on Iron Arm approx. 3 years ago.	6
Naskapi of Kawawachikamach/ Innu (Schefferville)	Consultation		Near cabins (Iron Arm and Astray) As soon as the ice melts, travel by boat to fishing or other harvesting areas is staged from areas near cabins.	1 and 6
Naskapi of Kawawachikamach/ Innu (Schefferville)	Consultation		There appear to be more bears where development takes place – i.e., where there are people.	NA
Naskapi of Kawawachikamach/ Innu (Schefferville)	Consultation		Trapping of small mammals: fox, marten, otter, rabbit, and porcupine Furs are used for various purposes, and sometimes sold. Porcupine is "like caviar" to the Naskapi.	NA
Innu (Matimekush – Lac John)	Clément, D. 2009. Innu Use of the Territory and Knowledge of its Resources. Prepared as an Appendix to the Environmental Assessment of the Direct Shipping Ore Project.		Attikamagen Lake has been identified as a rutting area for Caribou. Peat bogs are the preferred location for calving, which occurs in May or June.	2

Table 16.12 Local and Indigenous Traditional Knowledge: Birds, Wildlife and their Habitat

Group	Source	Page or Date Reference	Comment or Excerpt	Map Reference (Figure 3.1)
Birds and Wildlife				
Naskapi Nation of Kawawachikamach	Alderon Iron Ore Corp. 2012. Environmental Impact Statement: Kami Iron Ore Mine and Rail Infrastructure, Labrador	Vol. II, Chapter 22	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 (2012), and this was the first in 6 years.	12
Naskapi Nation of Kawawachikamach	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.	NA

16.6 Assessment of Project-Related Environmental Effects

To assess potential Project-related environmental effects, key or representative species were selected based on their affinities for a particular habitat type (e.g., wetlands), their representation of a wildlife group (migratory and non-migratory birds, ungulates, furbearers, and small mammals), and/or species known to be important to Indigenous people (e.g., caribou) (Table 16.13).

Table 16.13 Key or Representative Species

Species	Rationale for Selection
Caribou (*Rangifer tarandus caribou*)	Recent declines in population and distribution, traditionally harvested for subsistence, migratory
American black bear (*Ursus americanus*)	Resident mammal species, known predator of caribou calves, commonly attracted to anthropogenic disturbances
Canada lynx (*Lynx canadensis*)	Furbearer, specialized predator, high on food chain but low in numbers, fur of value to trappers
American marten (*Martes americana*)	Furbearer of value to trappers, relatively high numbers harvested by Naskapi hunters in the past
North American beaver (*Castor canadensis*)	Furbearer, herbivore, has an effect on ecosystem structure, trapped in the area
Southern red-backed vole (*Clethrionomys gapperi*)	Small mammal, important prey for some species
Canada Goose (*Branta canadensis*)	Migratory waterfowl, prefers open grassy areas for feeding and nesting (e.g., fens or marshes), valued as food source; confirmed breeding in the RSA

Table 16.13 Key or Representative Species

Species	Rationale for Selection
Spruce Grouse (*Falcipennis canadensis*)	Upland game bird, non-migratory, found mainly in coniferous forests in winter; confirmed breeding in the RSA
Osprey (Pandion haliaetus)	Migratory bird of prey, high on food chain; confirmed breeding in the RSA
Greater Yellowlegs (*Tringa melanoleuca*)	Migratory shorebird; confirmed breeding in the RSA
Tennessee Warbler (*Oreothlypis peregrina*)	Migratory songbird, found in open areas of boreal forest containing dense understory vegetation for nesting; possible breeding in the RSA
Lincoln's Sparrow (*Melospiza lincolnii*)	Migratory songbird, prefers shrubby wet habitats with scattered trees; possible breeding in the RSA

Notes:
1. Amphibians are discussed in Chapter 17.
2. Species not included in this list are represented by other species on this list that occupy similar habitats in the RSA, for example porcupine (*Erethizon dorsatum*) are represented by species such as American black bear and Canada lynx.

Each environmental effect (i.e., change in habitat, change in distribution and movement, change in mortality risk and change in health) is assessed for each Project phase (i.e., Construction, Operations and Maintenance, and Closure and Decommissioning), where interactions are expected to have the potential to result in adverse environmental effects on birds, wildlife and/or their habitat. For each environmental effect, mitigation measures that will be implemented to reduce environmental effects are summarized, with details to be provided in the Project-specific EMP. The EMP will 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.

Residual environmental effects, or effects remaining after mitigation is applied, are then characterized for change habitat, distribution and movement, mortality risk and health. Linkages between residual effects are also considered (e.g., change in habitat may affect a change in distribution and movement). The characterization of residual environmental effects includes quantification (where possible) of the probable magnitude, geographic scope, duration, frequency, reversibility, and ecological/socio-economic context of the environmental effect. The determination of the significance of residual effects of the Project considers the combined effects of all identified pathways and provides an overall prediction of the potential risk posed by the Project for birds, other wildlife and their habitat.

A conservative (or precautionary) approach was taken that reduces the chances for a mistaken determination that an effect is not significant, when in fact it likely would be. This includes the development of conservative assumptions (i.e., assumptions that err on the side of over-stating an effect) and recommending mitigation measures that are more than adequate to address environmental effects. Some of the assumptions and considerations made in this effects assessment are:

- Spatial limitations (i.e., minor data gaps) in existing vegetation map products (i.e., ELC) are primarily related to minor changes in the Project LSA. Specifically, re-routing of the proposed haul route resulted in a few small segments of the LSA not characterized (5%

of the LSA). The inclusion of ancillary data to address the minor data gaps would likely reduce the accuracy of the assessment. The vegetation map produced for the LSA is considered to represent the most accurate data available.

- Habitat types (identified in the ELC) used to assess Project-related environmental effects containing only elements or portions of primary habitat of a species were ranked entirely as primary, so that loss of important habitats would be over- versus under-estimated.

- The area of primary habitat lost and/or altered to assess environmental effects assumes that the available habitat is saturated. As a conservative measure, with respect to characterization of the magnitude of the residual effect, <5% loss of habitat was used to represent a low effect, 5-25% loss of habitat was used to represent a moderate effect, and >25% was used to indicate a high environmental effect.

- Because many species are expected to occupy mainly primary habitat, the amount of primary habitat lost and/or altered as a result of Project activities can be viewed as a reflection of the population. Bender et al. (1998) investigated landscapes undergoing habitat loss and found that:

  - for generalist species (i.e., species that use both edge and interior habitat), the amount of habitat lost should account for declines in population size associated with habitat loss;

  - for edge species (i.e., species primarily associated with the perimeter of a patch versus the interior), the amount of habitat lost will overestimate the decline in population size (i.e., estimates would be conservative); and

  - for interior species (i.e., species associated with the center of patches and avoid edges), the amount of habitat lost will likely underestimate population declines for those species.

Key or representative species considered interior species, based on the definition in Bender et al. (1998), will be given additional attention in this regard.

- Populations of key or representative species selected for this assessment are believed to be indicative of the effects of management activities, and as such can be used to indicate effects on other functionally related species.

16.6.1 Assessment of Change in Habitat

Project activities during the Construction, Operations and Maintenance, and Closure and Decommissioning phases that may have an environmental effect on habitat are assessed based on the area of primary or other limiting habitat lost or altered as a result of these activities.

Habitats in the RSA were classified as primary, secondary or tertiary for birds and wildlife, based on a review of existing literature and locally relevant studies, where available. Primary habitat was defined as habitat that provides all of the main requirements for a species (i.e., foraging, breeding, and protection). Secondary habitat was defined as providing an abundance of one or more of the three elements (or marginal amounts of all). Tertiary habitat was considered habitat providing few or no habitat requirements, and may be used as a travel corridor or avoided. As a conservative measure, habitat types (as identified in the Project ELC) with elements of primary habitat, but not composed entirely of primary habitat, were identified as such.

Construction

Project activities associated with site preparation (e.g., clearing, excavation), and the construction of the roads, causeway, rail loop, and stream crossings will result in the loss or alteration of important habitat (i.e., primary, secondary, and tertiary) for birds and other wildlife species (e.g., Fahrig 2003; Ewers and Didham 2006; Valiela and Martinetto 2007; Fletcher and Hutto 2008). This change in habitat may result in adverse environmental effects such as the loss of breeding, nesting, rearing, or other habitat (e.g., foraging).

Habitat in the Project Development Area comprises primarily forested and non-forested uplands (e.g., spruce-moss forest and shrub lichen barrens, respectively). Clearing of upland forest can change the quality of the habitat along the edge of the Project footprint. Exposure of what was previously forest interior habitat may attract more disturbance-tolerant and edge species to the forest habitat adjacent to the Project. Indirect effects may also occur, resulting from changes in substrate composition, moisture, drainage and temperature, or as a result of increased human activity (i.e., sensory disturbance).

Wetland habitats are relatively less common in the Project Development Area and include fens, bogs, swamps, and ponds. Wetlands are an important feature of the landscape, performing many biological, hydrological, social/cultural, and socio-economic functions. A detailed environmental effects assessment on wetlands is provided in Chapter 14.

Patterns of ice formation and melting within wetlands and other waterbodies may be altered as a result of activities during Construction, including the construction of roads and the causeway. Migratory waterfowl such as Canada Goose may depend on areas of open water for staging in early spring (i.e., before the spring thaw), that may be affected by Project construction.

Many species are expected to mainly occupy suitable primary habitat (i.e., habitat that provides food, protection, resting, spatial separation from predators and/or habitat used for breeding, denning or other activities). Thus, the change in habitat resulting from Project activities can be evaluated based on the amount of primary habitat lost and/or altered within the PDA relative to the availability of primary habitat in the region (i.e., the RSA) for selected key or representative species, or for species such as Osprey and beaver, the location and number of nests and colonies. In general, the magnitude of Project effects on a change in habitat will be low, as the amount (percent) of primary habitat expected to be altered or lost as a result of Project activities, relative to the availability of primary habitat within the RSA is less than 0.5% for all representative species (Table 16.14; refer to Appendix Z for descriptions of primary habitat).

Table 16.14 Percent of Primary Habitat Altered/Lost for Key or Representative Species Relative to the Availability of Primary Habitat in the RSA

Species	Primary Habitat		
	Total Area in PDA (ha)	Total Area in RSA (ha)	% Altered/Lost
Caribou	357.9	111,323.9	0.3
American black bear	357.9	111,323.9	0.3
Canada lynx	257.7	74,572.5	0.3
American marten	193.8	56,473.9	0.3
North American beaver	73.0	75,577.2	0.1
Southern red-backed vole	257.7	74,572.5	0.3
Spruce Grouse	257.7	74,572.5	0.3
Osprey	7.7	8,797.6	0.1
Greater Yellowlegs	63.9	18,098.7	0.4
Canada Goose	79.8	22,102.2	0.4
Lincoln’s Sparrow	63.9	18,098.7	0.4
Tennessee Warbler	357.9	111,323.9	0.3

Notes:

1. Primary habitat provides all of the main habitat requirements for a species (e.g., food, protection, and habitat for breeding).
2. Habitat descriptions for key/representative species are provided in Appendix Z.
3. Due to the specific habitat requirements of Osprey, primary habitat could not be categorized based on the available imagery used to identify ELC habitat units (satellite mapping of the RSA cannot accurately separate out such fine-scale features).

Bender et al. (1998) suggest that for edge habitat and generalist species, the loss of habitat should account for or overestimate population declines, but for interior habitat species the decline in population size will be greater than predicted by pure habitat loss. Using definitions in Bender et al. (1998) and descriptions in Whitaker and Montevecchi (1997), representative species that are considered interior habitat species are American marten and southern red-backed vole. For these species, the amount of primary habitat that will be lost or altered relative to its availability in the RSA is 0.3% for both species (Table 16.14). Furthermore, neither of these species is believed to be low in numbers or under legal protection.

Operations and Maintenance

Project effects on habitat will occur primarily during the Construction phase. Activities during the Operations and Maintenance phase that will have an environmental effect on habitat for birds and wildlife are dewatering Joyce Lake, waste rock disposal on surface, and progressive rehabilitation.

Dewatering of Joyce Lake will commence after the start of pit construction and may continue throughout the life of the Project. While the lake in general is considered relatively unproductive in terms of fish and fish habitat compared to adjacent waterbodies (GENIVAR 2013), it may provide forage, cover, or possibly breeding habitat for some birds and aquatic mammals. Species confirmed in the RSA potentially affected by the dewatering of Joyce Lake include beaver, Canada Goose, Greater Yellowlegs, and Osprey.

The waste rock disposal area will be progressively infilled with material as required, and thus habitat within the footprint of the waste rock piles will be disturbed throughout operations. The total amount of habitat lost and/or altered for each representative species is included in the calculations provided in Table 16.14.

Progressive rehabilitation will be implemented during Project operations and may include rehabilitation of construction-related buildings and laydown areas, re-vegetation studies and trials, stabilization and re-vegetation of waste rock disposal areas, and development and implementation of an integrated Waste Management Plan. For most birds and wildlife, these activities will result in a net increase in habitat. An environmental monitoring program will be conducted as part of Project development, and the resulting information will be used to evaluate the progressive rehabilitation program on an ongoing basis.

Closure and Decommissioning

Activities during site reclamation will have direct effects on potential habitat for birds and wildlife. As sites are reclaimed, habitat of varying quality will become available, and thus will result in a net increase in habitat, when compared to the Construction phase. As such, some bird and wildlife species may benefit.

A Rehabilitation and Closure Plan will be developed in accordance with the Newfoundland and Labrador *Mining Act*. The Rehabilitation and Closure Plan will describe the process of rehabilitation of the project up to and including closure (e.g., decommissioning, removal, and disposal of site equipment and structures, site remediation), and will define in detail the actions necessary to achieve plan objectives and requirements.

16.6.1.1 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 reduce environmental effects. This includes the use of appropriate, accepted best practices to limit activities resulting in disturbance to habitat, to the extent practical, and compliance with the requirements of applicable permits (e.g., buffer widths and permitted activities at these locations).

Final decisions on mitigation measures will be made by Labec Century in consultation with experts, and where appropriate, the regulatory authority (e.g., NLDOECC). A Project-specific EMP will be developed for the Project prior to start of the construction phase, and will include measures to reduce the effects of such activities as site clearing and construction activities, temporary access trails, borrow areas, clearing of the right-of-way, and working in and around waterbodies and wetlands, equipment maintenance, and work site cleanup and decommissioning. Reclamation plans will be developed in co-ordination with regulators, and implemented, where practical, to limit potential Project effects.

Standard practices and general environmental protection measures for mining projects will address most outstanding issues likely to arise during the Project. The following mitigation measures are proposed to mitigate Project-related effects related to change in habitat:

- Comply with provincial and federal legislation, permits, approvals and guidelines;
- Reduce construction footprint (i.e., PDA) to the extent feasible;
- Restrict activities associated with maintenance (e.g., vegetation management, periodic grading and ditching) to the PDA;
- Install stream crossings (e.g., bridges, culverts, ditches) in accordance with pertinent regulations and guidelines;
- Conduct progressive rehabilitation;
- Rehabilitate access routes that are no longer needed;
- Flag the boundaries of sensitive areas (e.g., wetlands) before commencing any work in the area, and avoid locations of sensitive species and their habitats to the extent feasible;
- Develop and implement an Avifauna Management Plan;
- Relocate raptor nests where necessary;
- Schedule Project activities and reclamation activities so that not all available habitat is disturbed simultaneously;
- Reduce disturbance and infilling within adjacent wetlands and maintain hydrological conditions to the extent feasible;

- Direct runoff from development away from wetlands;
- 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 minimum vegetation buffer zone of 30 m should be maintained around existing wetland areas);
- Restore banks to original condition where any disturbance has occurred (e.g., causeway construction);
- Consider clearing by mulching and mechanized forestry equipment;
- Dispose of slash from clearing, as specified in permits;
- Implement erosion and sediment control;
- Conduct invasive species management;
- Restore banks to original condition where any disturbance has occurred (e.g., installation of culverts, causeway construction);
- Develop and implement a dewatering plan based on hydrogeological information for Joyce Lake, in consultation with appropriate regulators and consistent with relevant legislation and guidelines; and
- Assign environmental inspectors to oversee implementation of proposed mitigation measures.

Proposed mitigation measures have been shown to be effective for similar projects elsewhere and in the region, and the risk and severity of consequence in the event of mitigation failure is anticipated to be low.

16.6.1.2 Characterization of Residual Project Environmental Effects

Construction

The environmental effects of the Project on important habitat for birds and wildlife during Construction are predicted to be adverse, because there is a permanent alteration and/or reduction in the amount of available habitat.

Adverse residual environmental effects on habitat are geographically limited to the PDA. For most species, the change in habitat availability and resulting displacement of individuals or populations within the RSA is predicted to be low, as less than 0.5% of the primary habitat available is anticipated to be lost or altered (i.e., well below the 5% threshold). Furthermore, this calculation is conservative and represents a “worst case scenario”, as it assumes that primary habitats in PDA are at their maximum carrying capacity, which is likely not the case. Furthermore, Project planning such as limiting the footprint to only those areas that need to be cleared, scheduling activities so that not all habitat is disturbed simultaneously, and progressive rehabilitation, so that the actual amount of primary habitat lost at any one time is likely to be less than what is estimated. Standard mitigation measures to protect species and/or their habitats from direct disturbance will further reduce residual effects.

The magnitude of adverse residual environmental effects during Construction on Birds, Wildlife and their Habitat will be low, based on the following:

- The amount of primary habitat lost for representative species will be less than 0.5% of the available primary habitat in the RSA (i.e., well below the 5% threshold), once mitigation is implemented; and
- These species are generally not limited by habitat within their breeding range (i.e., habitats are not at maximum capacity), and the loss or alteration of primary habitat is not believed to accurately reflect potential loss to the population; and

Adverse residual environmental effects on habitat are anticipated to be long-term, or in some cases, permanent. The removal of habitat from some areas of the PDA will be long-term (e.g., access roads), as these areas will ultimately be rehabilitated. However, some rehabilitated areas within the Project footprint will likely not return to pre-Project conditions, and the alteration of those habitats would be permanent (i.e., irreversible).

Operations and Maintenance

Project activities associated with Operations and Maintenance will result in adverse environmental effects on habitat within the PDA. The magnitude of adverse effects will be low, as less than 0.5% of the primary habitat available in the RSA and <1% of the available waterbodies will be lost or altered as result of Project activities. The environmental effect will occur sporadically and is anticipated to be medium-term and irreversible.

Closure and Decommissioning

Site reclamation may result in changes to habitat, but for most birds and other wildlife, this will likely result in a net increase in habitat availability once complete (i.e., net positive effect). Project activities associated reclamation will be restricted to the PDA and are anticipated to be low in magnitude, as not all primary habitat will be restored to its pre-construction condition. The residual environmental effect will be permanent.

16.6.2 Assessment of Change in Distribution and Movement

Project activities during the Construction, Operations and Maintenance, and Closure and Decommissioning phases may have an environmental effect on the distribution and movement of species on the landscape, and are discussed for the following measurable parameters:

- Density and distribution of species on the landscape; and
- Sensory disturbances.

Construction

The density and distribution of species on the landscape may change via several mechanisms as a result of the following construction activities: site preparation, construction of roads, construction of causeway, construction of site buildings and associated infrastructure, construction of rail loop and associated infrastructure, construction of stream crossings, installation of water supply infrastructure, on-site vehicle/equipment operation, and transportation of personnel and goods to site. Potential mechanism for a change in distribution and movement are associated with the following:

- Habitat fragmentation;
- Barriers to movement; and
- Sensory disturbances and avoidance behaviours.

Localized movement corridors and movement patterns may be altered as a result of Project construction activities. Linear features (e.g., access roads), as well as the Project footprint in general, may result in habitat fragmentation on the landscape, hindering accessibility to preferred corridors, home ranges, and habitat connectivity, with potential effects on species such as caribou (Fortin et al. 2013), Canada lynx (Walpole et al. 2012), as well as birds (Giraudo et al. 2008). Individuals of some species, including caribou (Latham et al. 2011; Dussault et al. 2012; Pinard et al. 2012; Fortin et al. 2013), American marten (Cushman et al. 2011), forest songbirds (Bayne et al. 2005), and grouse (Turcotte et al. 2000), may choose to avoid open areas that result from the clearing of vegetation due to the increased risk of predation. Linear features can also act as a barrier to movement for some species (e.g., red-backed voles; Rico et al. 2007). In addition, the creation of new corridors from linear features could help the establishment of invasive species (e.g., plants), creating possible competition with endemic species on the landscape, and may affect movement patterns (Hansen and Clevenger 2005; Tanentzap et al. 2010). Similarly, if open water areas are no longer available as a result of causeway construction and changing ice patterns, migration patterns of waterfowl may be altered.

Caribou are of particular concern to regulators and local and Indigenous communities due to recent dramatic declines in numbers, and sensitivity to disturbance (e.g., Chubbs and Keith 1993; Mahoney et al. 2001; Courtois et al. 2008). Photointerpretation of caribou tracks in the PDA indicate a total of 113 (31.0/km^2) small networks of tracks (defined as comprising one to five parallel tracks), 30 (8.2/km^2) medium networks (six to ten tracks) and six (1.7/km^2) large networks (>10 tracks). Combined, this represents approximately 6.8% of the 2,200 total networks traditionally used by caribou in the RSA. It is anticipated that if caribou were to return to the region in large numbers, they would generally avoid the open habitat created as a result of Project construction (Courtois et al. 2008).

The spatial extent of sensory disturbances (e.g., noise, light, human presence) resulting from Project activities may have an environmental effect on distribution and movement of birds and other wildlife. Sensory disturbances can result in avoidance behaviours, and the potential alteration of migratory routes of birds (Cameron et al. 1992; Gutzwiller et al. 1998; Drapeau et al. 2000; Noel et al. 2004; May et al. 2006; Bayne et al. 2008; Madsena and Boertmann 2008; Sawyer et al. 2009; Leblond et al. 2011; Vegvari et al. 2011; Cuiti et al. 2012; Lesmerises et al. 2012; Boulanger et al. 2012). The degree to which individuals may display avoidance behaviours (i.e., ignore or flight) to an environmental effect from sensory disturbances can vary temporally as individuals may be particularly sensitive during periods of high physiological stress such as migration, reproductive season, rearing young, and wintering conditions (Cameron et al. 1992; Regosin et al. 2003; Burger et al. 2004a; Ewers and Didham 2006; Squires et al. 2008; Rittenhouse and Semlitsch 2009; Faille et al. 2010; Lycke et al. 2011; Pinard et al. 2012; Haapakoski and Ylonen 2013; and Lesmerises et al. 2013). Sensory disturbances are anticipated to be more substantial within the LSA, based on proximity and propagation, but are expected to decrease with increasing distance from Project activities. Habitats within potential zones of influence of sensory disturbance may have reduced use or seasonal avoidance by birds and other wildlife but are anticipated to be recoverable following Project closure.

Operations and Maintenance

Project activities during Operations and Maintenance that may have an environmental effect on the distribution and movement of species on the landscape are: open pit mining, dewatering Joyce Lake, ore processing, waste rock disposal on surface, rail load-out and transport, on-site vehicle/equipment operation and maintenance, and progressive rehabilitation.

The dewatering of Joyce Lake may lead to the displacement of species that may be dependent on the lake, such as migrating waterfowl (Fletcher and Breeze 2000). The loss of this habitat and Project activities associated with dewatering and subsequent mining may hinder access to preferred corridors or home ranges.

Environmental effects on distribution and movement of birds and other wildlife as a result of sensory disturbances associated with Operations and Maintenance activities are the same as during Construction (i.e., primarily through avoidance behaviours), the degree to which can vary temporally and among species. The displacement of caribou associated with sensory disturbance may be greatest during Operations and Maintenance. Boulanger et al. (2012) found that migratory caribou (*Rangifer tarandus groenlandicus*) in the Canadian Arctic were four times more likely to select habitat >14 km from active mines, with reduced occurrence most evident during operation phases at both mines studied.

Closure and Decommissioning

Environmental effects on distribution and movement of birds and wildlife as a result of sensory disturbances associated with site closure activities are the same as described during Construction and Operations and Maintenance. As Project activities cease and the landscape is rehabilitated, individuals may re-establish in the area (Simon et al. 2000; Banville and Bateman 2012).

16.6.2.1 Mitigation of Project Environmental Effects

Mitigation measures will be applied for the duration of the Project to avoid or reduce the potential environmental effects of Project activities on the distribution and movement of birds and wildlife. The mitigation measures will be detailed in the EMP and will include the use of the appropriate and accepted best practices with respect to reducing the potential environmental effects on the distribution and movement of birds and wildlife. Some examples include, but are not limited to:

- Comply with provincial and federal legislation, permits, approvals and guidelines;
- Reduce construction footprint (i.e., Project Development Area) to the extent feasible;
- Avoid sensitive species (e.g., caribou) and their habitats to the extent feasible;
- Allow wildlife to pass through construction sites without harassment;
- Restrict clearing activities to outside of the bird breeding season, whenever feasible, and implement an Avifauna Management Plan;
- Flag the boundaries of sensitive areas (e.g., wetlands, caribou crossings) before commencing any work in the area, and avoid locations of sensitive species to the extent feasible;
- Implement nuisance bear management programs, including awareness training programs, if required;
- Do not feed wildlife;
- Limit noise through the use of mufflers on equipment, enclosed motors and other equipment to attenuate sound propagation, and regular maintenance on vehicles and other equipment to reduce air and sound emissions;
- Limit lighting to that required for safe operation, use motion sensors for security lighting, and/or shield exterior lights from above;
- Restore banks to original condition where any disturbance has occurred (e.g., causeway construction);
- Develop and implement a dewatering plan for Joyce Lake based on hydro-geographical information;
- Maintain hydrology at stream crossings through approved methods to install culverts;
- Grade or engineer slopes along roads at locations of potential crossing points for caribou;
- Dispose of wastes in an approved waste disposal site;

- Regulate discharges (e.g., effluents, site run-off) so that they comply with regulatory standards;
- Control erosion, sediment and dust;
- Manage invasive species;
- Implement progressive rehabilitation;
- Assign environmental inspectors to oversee implementation of proposed mitigation measures.

Proposed mitigation measures have been shown to be effective for similar projects elsewhere and in the region, and the risk and severity of consequence in the event of mitigation failure is anticipated to be low.

16.6.2.2 Characterization of Residual Project Environmental Effects

Construction

Project activities associated with Construction will result in adverse residual environmental effects on distribution and movement of individuals and species within the LSA, primarily through sensory disturbances and the potential alteration of traditional migratory corridors. The magnitude of these effects is anticipated to be low, based on the overall small percentage of bird and wildlife populations potentially vulnerable (by virtue of occurring in or adjacent to the LSA), and the low number of individuals expected to be affected (given the limited availability of primary habitat for many birds and wildlife species in the PDA). Residual environmental effects will be frequent (e.g., sensory disturbances), and are anticipated to be medium-term and reversible.

Operations and Maintenance

Project activities associated with Operations and Maintenance will result in adverse residual environmental effects on distribution and movement of individuals and species within the LSA, primarily through sensory disturbance and/or continued alteration of migratory corridors. The magnitude of adverse effects will be low, similarly based on the low number of individuals anticipated to be affected, as well as their expected previous displacement from the LSA as a result of habitat loss and sensory disturbances during Construction. The residual environmental effects will be frequent, and are anticipated to be medium-term (i.e., lasting throughout operations) and reversible.

Closure and Decommissioning

Activities during Closure and Decommissioning may result in changes to distribution and movement of birds and other wildlife species within the LSA, primarily though ongoing sensory disturbances associated with these activities. The magnitude of residual environmental effects will also be low, given the low numbers of individuals likely to be present in the LSA and thus affected by Project activities. The environmental effects will be frequent, and are anticipated to be short-term and reversible.

16.6.3 Assessment of Change in Mortality Risk

Project activities during the Construction, Operations and Maintenance, and Closure and Decommissioning phases that may have a residual environmental effect on mortality risk are discussed in relation to:

- Number of mortalities or mortality rate, based on existing literature and the amount of primary habitat affected; and
- Amount of new access.

Construction

Project activities associated with site preparation, and the construction of roads, causeway, and rail loop and associated infrastructure, as well as on-site vehicle/equipment operation, and transportation of personnel and goods to site, will have an adverse environmental effect on mortality of birds and wildlife.

Direct mortality may occur during clearing activities or as a result of vehicle collisions. Species that hibernate may be particularly susceptible to direct mortality during winter (i.e., when they are not mobile). Some species may be attracted to open or disturbed sites (e.g., black bear, fox, or some birds) created by clearing and grubbing, and thus may have an increased risk of mortality.

Vehicle collisions may also have a direct environmental effect on mortality, especially during Construction when traffic volumes are expected to be greatest. The extent of this effect will vary depending on species and location. Small mammals, for example, are known to avoid crossing roads (Fuentes-Montemayor et al*.* 2009; McGregor et al*.* 2008) and thus direct mortality from collisions is expected to be relatively uncommon. Erickson et al*.* (2005) estimated that bird fatalities as a result of collisions amounted for less than 0.2% of the adjacent breeding populations investigated, with some variation depending on location and species (passerines were identified as the most common fatalities, followed by waterfowl and raptors). In general, while traffic will increase as a result of the Project, the volume will be overall relatively low, given the remoteness and scale of the Project, and similarly the speed of construction vehicles will also be low. Furthermore, the noise and/or visual stimulus would likely alert most mobile species to move away. Thus, any increased mortality risk as a result of collisions would be low to negligible. Based on a review of the literature surrounding road kills, Spellerberg (1998) concludes that “road kills do not seem to have detrimental effects on animal populations except in those cases of species with small or diminishing populations.”

Indirect mortality as a result of construction activities can include increased poaching, hunting and/or predation that may occur as a result of increased access provided by the creation of roads and other corridors (e.g., railway, temporary trails). The Project will result in the construction of a number of additional access roads and haulage roads in the PDA, including:

- Access roads between the crushing and screening plant, waste and overburden stockpiles, and the explosives storage;
- Rock causeway road across Iron Arm;

- Haulage roads from the causeway to the crushing and screening plant;
- Access road from the haulage road to the existing road; and
- Haulage road from the rock causeway to train loading.

Current access to Iron Arm, where there are numerous seasonal cabins, is via an existing road from Schefferville. The development of access roads, the haulage road to the existing rail line (near Ashtray Lake) and a road connecting the haulage road to an existing, will add additional year-round access to interior habitats (approximately 54 linear km). Wildlife species that have been traditionally harvested in the vicinity of the Project include beaver, American marten, red fox and Canada lynx. Waterfowl (e.g., Canada Goose) and upland game birds (i.e., ptarmigan and grouse) are also harvested annually.

Caribou from the migratory George River herd were also traditionally harvested for subsistence, prior to the implementation of a five-year caribou hunting ban in 2013 in response to a decline of over 70% in the population since 2010 (NLDOECC 2013a). Mortality rates are estimated at 30% annually (NLDOECC 2013a). Although the RSA falls within the documented winter range of this herd, caribou have not been reported in large numbers in the vicinity of the Project in recent years. Aerial surveys in 2009 within an approximate 50 km radius of Schefferville located only seven caribou, with the closest sightings more than 20 km southwest of Schefferville (D'Astous and Trimper 2009, 2010). The thresholds at which increased access will warrant increased management and enforcement will be determined by the responsible authorities.

Indirect mortality may also result when predation is increased in forest edges created during Construction clearing activities. Known avian nest predators, such as fox and Common raven, may be attracted to developments and/or found at higher densities along edges (e.g., Batáry and Báldi 2004, Burger et al. 2004b, Male and Nol 2005). Predation on caribou may also be higher near linear features that are used as corridors by their predators (e.g., wolf), especially within areas identified as caribou habitat (James and Stuart-Smith 2000; Messier et al. 2004).

Operations and Maintenance

Project activities that will have an adverse environmental effect on mortality risk during Operations and Maintenance are rail load-out and transport, on-site vehicle/equipment operation and maintenance, transportation of personnel and goods to site, and fuel transport. These activities have the potential to result in direct effects on mortality as a result of collisions (discussed above under Construction).

Project site lighting can lead to mortality of migrating birds, as these lights may be a source of attraction (Cochran and Graber 1958). Birds may collide with the light or structures near the light (e.g., Jones and Francis 2003), or expend large amounts of their energy reserves (Poot et al. 2008), potentially making them easier prey. Factors that affect the level of attraction to lights include colouration, intensity, spectral characteristics, and also the pattern of lights in the environment. In general, intense lights are more attractive to birds (Jones and Francis 2003), and white and red light are more attractive than green or blue light (Poot et al. 2008). Lights that are shielded from above are generally less attractive than those visible from above. Strobe lighting is less attractive to birds than continuous lighting (Jones and Francis 2003).

Closure and Decommissioning

A Rehabilitation and Closure Plan will be developed in accordance with the Newfoundland and Labrador *Mining Act*. The Rehabilitation and Closure Plan will describe the process of rehabilitation of the project up to and including closure (e.g., decommissioning, removal, and disposal of site equipment and structures, site remediation), and will define in detail the actions necessary to achieve plan objectives and requirements. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EMP.

Increased transportation activities and sensory disturbances (discussed above) associated with vehicle and equipment operations during decommissioning may increase the risk of mortality. Progressive rehabilitation and site remediation activities that reduce the amount of access to primary habitats of some species targeted by hunters or by certain predators may result in a reduction in mortality (i.e., have a net positive effect).

16.6.3.1 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 reduce environmental effects. This includes the use of appropriate, accepted best practices to limit activities resulting in mortality, to the extent practical, and compliance with the requirements of applicable permits (e.g., permitted activities at these locations). Mitigation measures to reduce the risk of mortality will be made by Labec Century in consultation with experts, and where appropriate, the regulatory authority (e.g., NLDOECC) in the Project-specific EMP. Specific mitigation will be developed in the EMP for caribou, should any individuals come within a specified distance from Project activities (to be determined in consultation with regulators). Reclamation plans will be developed in co-ordination with regulators, and implemented, where practical, to limit potential Project effects.

Mortality related to improved access will be offset through measures such as employee education, a policy of no harvesting for all on-site Project personnel and rehabilitation of temporary access roads when they are no longer required. Additionally, work areas and access roads will be off limits to unescorted non-Project personnel, including during the hunting season.

Standard practices and general environmental protection measures for mining projects will address most outstanding issues likely to arise during the Project. Mitigation measures proposed to mitigate Project-related effects related to change in mortality risk include (but are not limited to) the following:

- Comply with provincial and federal legislation, permits, approvals and guidelines;
- Reduce construction footprint (i.e., the PDA) to the extent feasible and restrict construction activities to the PDA;
- Avoid sensitive species (e.g., caribou) and their habitats to the extent feasible;

- Prohibit hunting or harassment of wildlife on Project site;
- Survey for any birds, wildlife, nests or eggs before disposing of any materials on the surface (e.g., stockpiling), using an experienced biologist;
- Construct roads perpendicular to key movement corridors for birds and wildlife (particularly caribou), to the extent feasible, to encourage animals to cross over versus linger alongside roads;
- Record the location and condition/status of new access roads, observations of poaching, and results of any monitoring programs conducted by Labec Century related to wildlife populations in the area, and provide this information to relevant governing departments;
- Implement Avifauna Management Plan to address incidental take;
- Post maximum speed limits on site roads to reduce the potential for vehicle-wildlife collisions;
- Conduct wildlife awareness training for staff and contractors;
- Limit lighting to that required for safe operation; use motion sensors for security lighting and/or shield exterior lights from above;
- Develop and implement a site-specific Emergency Spill Prevention and Response Plan;
- Allow fuel trucks to travel on approved access roads only;
- Use best practices for fuels and other hazardous materials (e.g., herbicides);
- Ensure equipment arrives on site free from fluid leaks;
- Establish a site for equipment maintenance, repair and cleaning that is at least 100 m from any lake, river, stream or wetland; and
- Assign environmental inspectors to oversee implementation of proposed mitigation measures.

Proposed mitigation measures have been shown to be effective for similar projects elsewhere and in the region, and the risk and severity of consequence in the event of mitigation failure is anticipated to be low.

16.6.3.2 Characterization of Residual Project Environmental Effects

Construction

Project activities associated with Construction will result in adverse residual environmental effects on mortality risk for birds and wildlife in the PDA, either through direct or indirect loss. The magnitude of residual effects will be low following mitigation, as only a small percentage of wildlife populations occurring within or adjacent to the PDA are potentially vulnerable, and many are expected to have been already displaced as a result of habitat loss. Residual environmental effects on birds and wildlife during the Construction phase are anticipated to be short-term, occur sporadically (e.g., collisions), and will be reversible.

Operations and Maintenance

Project activities associated with Operations and Maintenance will result in adverse environmental effects on mortality risk for birds and wildlife in the PDA, primarily through vehicle or other collisions. The magnitude of adverse effects will be low, as many individuals are expected to have been previously displaced as a result of Project activities during Construction and thus low number likely vulnerable. Residual effects will continue throughout operations (i.e., are medium-term), occur sporadically, and are anticipated to be reversible.

Closure and Decommissioning

Project activities associated with Closure and Decommissioning will result in adverse residual environmental effects on mortality risk for birds and wildlife in the PDA, through the potential for vehicle or other collisions. Site reclamation activities that reduce the amount of access to primary habitats of some species targeted by hunters may result in a net positive residual effect. The magnitude of residual effects is anticipated to be low, as many individuals are expected to have been already displaced from the area, and thus overall low numbers are likely to be vulnerable, following implementation of mitigation. Residual environmental effects are anticipated to be short-term, occur sporadically, and will be reversible in terms of increased risk of mortality associated with collisions, but permanent in areas where access routes are rehabilitated.

16.6.4 Assessment of Change in Health

Project activities during the Construction, Operations and Maintenance, and Closure and Decommissioning phases may have an environmental effect on change in health of species, and are discussed in terms of potential environmental effects on reproductive success for key or representative species. Changes in health may occur indirectly through stress (e.g., from sensory disturbances and avoidance behaviours), and the reproductive success of some species may also be affected when auditory signals (e.g., mating calls, prey sounds) are masked due to noise.

Construction

Project activities during the Construction phase that may have an environmental effect on change in health are: site preparation, construction of roads, construction of causeway, construction of site buildings and associated infrastructure, construction of rail loop and associated infrastructure, construction of stream crossings, and installation of water supply infrastructure.

Displacement of individuals has the potential to result in higher concentrations of individuals in adjacent habitats, and/or the use of lower quality habitats, with potential effects on individual fitness (e.g., Schmiegelow et al*.* 1997, Fahrig 2003, Laliberte and Ripple 2004, Ewers and Didham 2006, Potvin and Courtois 2006, Fortin et al*.* 2013). Flaspohler et al*.* (2001) found that nest success was negatively correlated with the creation of openings in forested landscapes for ground nesting species such as Hermit Thrush (*Catharus guttatus*), and that this negative relationship may extend up to 300 m into the forest. Other species which prefer earlier successional stands may experience increased fitness and reproductive success in the years following clearing, when regenerating stands offer enhanced foraging opportunities. This may include species such as black bear (Brodeur et al. 2008).

Sensory disturbance (such as noise, light, and human presence) resulting from activities associated with Project construction (and other phases) may have an environmental effect on reproductive success. Physiological responses may result from increased noise and light associated with various activities such as blasting, excavating, grading, installation and construction of infrastructure, and other activities, that may be audible outside the immediate construction area. Noise levels associated with some of the Project's construction activities may mask important environmental cues used by variety of species including birds and mammals, thereby reducing individual survival and recruitment (Laiolo 2010). If sensory disturbances occur in areas near breeding grounds, individuals may display avoidance behaviours that could lower reproductive success (Cameron et al. 1992; Regosin et al. 2003; Burger et al. 2004a; Squires et al. 2008; Faille et al. 2010; Pinard et al. 2012; Haapakoski and Ylonen 2013). The noise level threshold for behavioural responses by waterfowl generally occurs at 80 to 85 dBA (Bowles et al. 1991; Goudie and Jones 2004). Noise levels associated with Project Construction, at the nearest seasonal dwellings, will likely be higher than levels predicted for Operations and Maintenance (<75 dBA), but will be temporary in nature, and likely to fall below the Health Canada recommended levels for day-night sound levels (Ldn), percent highly annoyed (percent HA), or the maximum sound level of 75 dBA.

Operations and Maintenance

Project activities that may influence the health of species include open pit mining, dewatering of Joyce Lake, ore processing, waste rock disposal on surface, rail load-out and transport, and progressive rehabilitation. The mechanisms for effects on health (i.e., stress, sensory disturbance and displacement) are the same as those described for Project construction.

Closure and Decommissioning

Site decommissioning and reclamation activities during the Closure and Decommissioning phase may have an environmental effect on the health of birds and other wildlife. Physiological stress and sensory disturbances are the same as those described during Construction.

16.6.4.1 Mitigation of Project Environmental Effects

Mitigation measures will be applied to avoid or reduce potential environmental effects on health. The mitigation measures will be detailed in the EMP and will include the use of the appropriate and accepted best practices with respect to reducing potential environmental effects. Some examples include, but are not limited to:

- Comply with all provincial and federal legislation, permits, approvals and guidelines;
- Dispose of wastes in an approved waste disposal site;
- Implement nuisance bear management programs, including awareness training programs, if required;

- Use best practices for fuels and other hazardous materials (e.g., herbicides);
- Do not bury waste during progressive rehabilitation activities;
- Develop and implement a site-specific Emergency Spill Prevention and Response Plan;
- Allow fuel trucks to travel only on approved access roads;
- Ensure equipment arrives on site free from fluid leaks, and 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.
- Flag the boundaries of sensitive areas before commencing any work in the area, and avoid locations of sensitive species to the extent feasible;
- Limit noise through the use of mufflers on equipment, enclosed motors and other equipment to attenuate sound propagation, and regular maintenance on vehicles and other equipment to reduce air and sound emissions;
- Limit lighting to that required for safe operation, use motion sensors for security lighting and/or shield exterior lights from above; and
- Assign environmental inspectors to oversee implementation of proposed mitigation measures.

Proposed mitigation measures have been shown to be effective for similar projects elsewhere and in the region, and the risk and severity of consequence in the event of mitigation failure is anticipated to be low.

16.6.4.2 Characterization of Residual Project Environmental Effects

Construction

Project activities during Construction are predicted to have an adverse residual environmental effect on the health of birds and wildlife in the LSA, primarily through sensory disturbances and potential avoidance behaviours. The magnitude of adverse effects will be low, as few birds and wildlife would likely be exposed to sources of contamination, and the overall low proportion of populations likely affected given the low amount of suitable habitat for most species in the PDA. Environmental effects during Construction are anticipated to be short-term, occur frequently, and are anticipated to be reversible.

Operations and Maintenance

Project activities during Operations and Maintenance are predicted to have an adverse environmental effect on the health of birds and wildlife species in the LSA. The magnitude of adverse effects will be low as few individuals would likely be exposed to sources of contamination and the expected previous displacement of many individuals as a result of habitat loss and sensory disturbances during Construction. Environmental effects during Operations and Maintenance are anticipated to be medium-term (i.e., throughout operations), occur frequently, and are anticipated to be reversible.

Closure and Decommissioning

Project activities during Closure and Decommissioning are predicted to have an adverse environmental effect on the health of birds and wildlife species in the LSA. The magnitude of adverse effects will be low, similarly based on the low number of individuals likely to be affected, given their expected previous displacement as a result of Construction activities. Environmental effects during Closure and Decommissioning are anticipated to be short-term, frequent, and reversible.

A summary of residual adverse environmental effects on change in habitat, change in distribution and movement, change in mortality, and change in health is provided in Table 16.15.

16.7 Assessment of Cumulative Environmental Effects

In accordance with IAAC and NLDOECC EIS Guidelines, other projects and activities that have the potential to overlap in space and time with the Project are considered in assessing cumulative effects to VCs. Ongoing and reasonably foreseeable future projects with environmental effects considered in the cumulative effects assessment include the following:

- Champion Iron Ltd. Kami Iron Ore Project;
- Champion Iron Ltd. Fire Lake North Iron Ore Project;
- IOC Carol Mining Project;
- Tacora Resources Inc. Scully Mine;
- Arcelor-Mittal Mont Wright Mine;
- Champion Iron Ltd. Bloom Lake Mine and Rail Spur;
- Labrador Iron Mines Houston 1&2;
- Tata Steel Minerals Canada DSO Iron Ore Project;
- Lower Churchill Hydroelectric Generation Project; and
- Maritime Link Project.

Table 16.15 Summary of Residual Environmental Effects – Birds, Wildlife and their Habitat

Project Phase	Mitigation/ Compensation Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-economic Context			
Change in Habitat											
Construction	See Section16.6.1	A	L	S	LT/P	O	R/I	U	N	M	Monitor for compliance with mitigation measures
Operations and Maintenance		A	L	S	MT	S	R	D	N	M	
Closure and Decommissioning		P	L	S	P	O	R	D	N	M	
Change in Distribution and Movement											
Construction	See Section16.6.2	A	L	L	MT	R	R	U	N	M	Monitor for compliance with mitigation measures
Operations and Maintenance		A	L	L	MT	R	R	D	N	M	
Closure and Decommissioning		A	L	L	ST	R	R	D	N	M	
Change in Mortality Risk											
Construction	See Section16.6.3	A	L	S	ST	S	R	U	N	M	Monitor for compliance with mitigation measures
Operations and Maintenance		A	L	S	MT	S	R	D	N	M	
Closure and Decommissioning		A/P	L	S	ST/P	S	R	D	N	M	
Change in Health											
Construction	See Section16.6.4	A	L	L	ST	R	R	U	N	M	Monitor for compliance with mitigation measures
Operations and Maintenance		A	L	L	MT	R	R	D	N	M	
Closure and Decommissioning		A	L	L	ST	R	R	D	N	M	

Table 16.15 Summary of Residual Environmental Effects – Birds, Wildlife and their Habitat

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

Key:

Direction:
P Positive,
A Adverse,
N Neutral

Magnitude:
L Low,
M Moderate,
H High

Geographic Extent:
S Site-specific: environmental effect confined to the PDA.
L Local: environmental effect extends into the LSA.
R Regional: environmental effect extends into the RSA, where indirect or cumulative environmental effects may occur.

Duration:
ST Short-term: residual environmental effect occurs during the Construction phase (i.e., one year)
MT Medium-term: residual environmental effect extends through the Operations and Maintenance phase (i.e., up to seven years)
LT Long-term: residual environmental effect is greater than seven years
P Permanent: measurable parameter unlikely to recover to baseline

Frequency:
Quantitative measure; or
O Once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.
U Unlikely to occur

Reversibility:
R Reversible: effect is reversible following closure and reclamation
I Irreversible: residual environmental effect 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 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.

Residual environmental effects associated with the Project are primarily associated with the Construction phase and the loss or alteration of habitat that occurs as a result of site preparation. Residual environmental effects also include a potential change in distribution and movement of some individuals (through ongoing sensory disturbances and avoidance behaviours), increased risk of mortality (direct and indirect effects associated with collisions and increased access/hunting, respectively), and changes in individual health (through sensory disturbances and increased stress and/or masking of auditory signals).

Cumulative environmental effects on Birds, Wildlife and their Habitat may occur as a result of residual environmental effects from Project activities in combination with those of other projects or activities. Table 16.16 rates each potential interaction with other projects as 0, 1, or 2 with respect to the nature and degree to which environmental effects overlap with those of other projects and activities.

Table 16.16 Potential Cumulative Environmental Effects

Other Projects and Activities with the Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects			
	Change in Habitat	Change in Distribution and Movement	Change in Mortality Risk	Change in Health
Champion Iron Ltd. Kami Iron Ore	0	0	0	0
Arcelor-Mittal Mont Wright Mine	0	0	0	0
Champion Iron Ltd. Fire Lake North Iron Ore Project	0	0	0	0
Tacora Resources Inc. Scully Mine	0	0	0	0
Champion Iron Ltd. Bloom Lake Mine and Rail Spur	0	0	0	0
IOC Labrador Operation	0	0	0	0
Labrador Iron Mines Houston 1&2	1	2	2	2
Tata Steel Minerals Canada - DSO Iron Ore Project	1	2	2	2
Nalcor Energy - Lower Churchill Hydroelectric Generation Project	0	0	0	0
Maritime Transmission Link Project	0	0	0	0

Key:
0 No interaction (i.e., no potential for activity to result in the effect).
1 Interaction may occur; however, based on past experience and professional judgment, the resulting effect is well understood and can be managed to negligible or acceptable levels through standard operating procedures or through the application of management or codified practices. No further assessment is warranted.
2 Interaction may occur and the resulting effect may exceed negligible or acceptable levels without implementation of project-specific mitigation. Further assessment is warranted.

Environmental effects identified in Table 16.16 and their potential to interact cumulatively with residual effects of other projects and activities are discussed below by rate (i.e., 0, 1, or 2). Cumulative environmental effects that are likely to result from the Project in combination with other projects and activities are discussed in greater detail.

16.7.1 Interactions Rated as 0

A number of potential interactions are not expected to occur (i.e., Rated “0”) or might occur, but do not warrant further assessment because Project environmental effects do not act cumulatively with those of other projects and activities (Table 16.16).

16.7.2 Interactions Rated as 1

Other projects and activities rated as 1 may have cumulative environmental effects on Birds, Wildlife and their Habitat (Table 16.16); however, standard environmental protection practices and BMP are available and will be implemented to effectively mitigate potential effects. Environmental protection measures designed to manage effects associated with the Joyce Lake Direct Shipping Iron Ore Project will be detailed in a separate EMP. To promote effectiveness of the EMP, Labec Century will have a full-time on-site environmental inspector, who will inspect worksites and activities for conformance with the EMP, and compliance with government regulations and permits.

Cumulative environmental effects rated as 1 are limited to potential changes in habitat for other projects and activities within the RSA [i.e., Schefferville Iron Ore Mine and Houston 1&2 project (approximately 25 km away) and the Tata DSO Iron Project (approximately 35 km away)]. Interactions may occur for individuals of species with home ranges that potentially overlap the project footprint of adjacent mining developments [e.g., American black bear (NLDOECC 2013b) and Canada lynx (Burdett et al. 2007)]. However, given the high mobility of potentially affected individuals, and the general availability of primary habitat in the RSA and adjacent areas, it is anticipated that few individuals would be adversely affected following the implementation of standard mitigation measures and BMP.

16.7.3 Interactions Rated as 2

An assessment of Project environmental effects was completed for Project activities that have the potential to act cumulatively with those of other projects and activities that have the potential to result in significant adverse environmental effects without implementation of project-specific or regional mitigation. This assessment was limited to the Schefferville Iron Ore Mine and Houston 1&2 project, and the DSO Iron Ore Project.

16.7.4 Assessment of Cumulative Environmental Effects

Environmental effects that have the potential to interact cumulatively with other projects and activities and rated as “2” (Table 16.16) are a change in distribution and movement, change in mortality risk, and change in health.

16.7.4.1 Change in Distribution and Movement

Existing projects rated as “2” (Table 16.16) have the potential to affect the distribution and movement of birds and wildlife via activities that result in habitat fragmentation and the creation of sensory disturbance (lighting, noise, human presence). Potential interactions with the Joyce Lake Direct Shipping Iron Ore Project may occur, particularly during seasonal/annual migrations.

Given the distance between projects, and following implementation of standard mitigation measures (including reducing site lighting and noise levels, and restricting all activities to the PDA or respective footprints of other projects), a relatively small proportion of populations is likely vulnerable to these effects.

Change in Mortality Risk

Existing projects near the Joyce Lake Direct Shipping Iron Ore Project have an environmental effect on mortality through vehicle collisions, collisions associated with light attraction, and direct mortality associated with clearing activities. The cumulative risk of mortality may therefore be elevated for species with home ranges that have the potential to overlap both the Project Development Area and nearby projects (e.g., black bear and lynx).

Change in Health

Existing projects in and adjacent to the RSA may have an environmental effect on health via increased stress via sensory disturbances and as a result of displacement. For species with home ranges that overlap these projects, there is a potential for cumulative environmental effects.

16.7.4.2 Mitigation of Cumulative Environmental Effects

Labec Century will comply with all provincial and federal legislation, permits, policies, and guidelines, and current and future projects are and will also be subject to such regulations aimed at protecting migratory birds, wildlife, and their habitat. Mitigation measures that will be untaken for the Project are identified in Sections 16.6.2 to 16.6.4. These same mitigation measures apply to address cumulative environmental effects on a change in distribution and movement, change in mortality risk, and change in health of birds and wildlife. Additional mitigation may include the support of any future initiatives, including collaboration with other proponents, government agencies, or other third parties, in regards to mitigation, environmental management planning, BMP, or research and recovery planning (e.g., caribou).

16.7.4.3 Characterization of Residual Cumulative Environmental Effects

Residual cumulative environmental effects are anticipated to be adverse and low in magnitude, following implementation of standard and proven mitigation measures and BMP. Environmental effects are likely to be sporadic (e.g., mortality as a result of collisions), medium- to long-term in duration, and reversible.

16.8 Accidents and Malfunctions

Reasonable worst-case scenarios for accidents and malfunctions that may result from the Project and that may have an environmental effect on Birds, Wildlife and their Habitat include:

- Hydrocarbon Spill;
- Train Derailment;
- Forest Fire;

- Settling/Sedimentation Pond Overflow; and
- Premature or Permanent Shutdown.

16.8.1 Hydrocarbon Spill

Fuel storage on the site will include diesel and fuel oil tanks located at the rail unloading area, near the diesel generators at the mine site, and the process plant area. The maximum total storage capacity for diesel fuel will be 250,000 L. The fuel storage tanks will be located in secondary containment to control spills and will comply with requirements of the applicable provincial and federal acts and regulations, as well as the conditions of the permit and authorizations. The control measures will be able to contain the maximum capacity of all tanks in a storage area.

16.8.1.1 Emergency Response/Mitigation of Environmental Effects

The main mitigation measures for a hydrocarbon spill relate to prevention and rapid and effective cleanup. As part of the Emergency Response and Spill Response Plan, spill prevention and response protocols will include the inspection of vehicles and hydraulics on a daily basis for leaks or damage that could cause minor spills and rapid spill response. Vehicles and equipment will be stored in controlled areas where secondary containment of spills can be provided. Staff will be trained in the handling of emergency response and spill scenarios. Response equipment stored on site will include containment and absorbent booms, pads, barriers, sand bags, and skimmers, as well as natural and synthetic sorbent materials.

16.8.1.2 Characterization of Residual Environmental Effects

The environmental effects of a fuel spill on Birds, Wildlife and their Habitat are predicted to be adverse, but localized and temporary. The magnitude and duration of any environmental effect depends on a number of factors including the nature of material spilled, the quantity spilled, the location of the spill, and the time of year in which the incident occurs. Large spills are unlikely to occur, and with appropriate mitigation, the magnitude of the environmental effects is likely to be low, or under potentially worst case scenarios, moderate. Spill prevention and response protocols included in the Emergency Response and Spill Response Plan will further reduce the likelihood of a fuel spill. Reversibility of the environmental effects will depend on the specific habitat involved, the proportion of habitat affected, and the potential for those habitats to be used by species, but would be anticipated to occur naturally over a number of years. Significant effects on Birds, Wildlife and their Habitat (e.g., population level effects) are not anticipated; this prediction is made with a moderate level of confidence.

16.8.2 Train Derailment

Iron ore product will be transported by truck from the Project site to the Astray rail loop which connects directly to the Tshiuetin/QNS&L railway for transport to Sept-Îles. Diesel fuel will be transported by rail to Schefferville and then by contracted trucker to site. On average, iron ore will be transported on approximately four trains each week during summer months between the Astray rail loop and the Sept-Îles port. Each train set will carry approximately 24,000 tonnes of ore in 240 gondola cars. Based on the speed the train will be travelling in the rail loop (5 miles per hour or 8 km/h), the reasonable worst case is the derailment of a maximum of four to five cars. This could result in the iron ore being spilled onto the ground or at stream crossings. Such an event is highly unlikely.

It is estimated that diesel fuel transport frequency will be a maximum of six 96,000 L tank cars per week for all site purposes.

Fuel tank car numbers are based on shipment in standard 96,000 L tank cars similar to those already in fuel haulage service between Sept-Îles and Labrador City. In a reasonable worst case scenario (i.e., where six tanks of diesel fuel are de-railed), approximately 576,000 L (127,000 Imperial gallons) of diesel fuel could be released.

16.8.2.1 Emergency Response/Mitigation of Environmental Effects

The trains will be operated under current Tshiuetin/QNS&L environmental and safety procedures. A detailed Emergency Response and Spill Response Plan will also be developed by Labec Century. This plan will include measures such as:

- Immediate response through the use of absorbent booms and pads;
- Liquid clean up using a vacuum truck (both fuel and groundwater);
- Reclamation of contaminated soils, removal of contaminated soils and replacement with clean soil.

Additional mitigation measures to be implemented to limit the potential for a train derailment include:

- Manual inspection of rolling stock to confirm there are no problems with the wheels, couplers, carbody or brakes;
- Track inspections in accordance with Transport Canada regulations;
- Properly maintained equipment; and
- Fuel transport amounts will be limited to the amounts required by the Project.

To reduce the likelihood of such an event, emphasis will be placed on safety and accident prevention. Effective and rapid response procedures will be in place, in the unlikely event of a Train Derailment.

16.8.2.2 Characterization of Residual Environmental Effects

A train derailment may occur during any phase of the Project resulting in the deposition of hazardous materials and/or crushed and screened iron ore 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. 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 wildlife populations that use these habitats. The magnitude and duration of any environmental effect depends on a number of factors including the nature of material spilled, the quantity spilled, the location of the spill, and the time of year in which the incident occurs. With appropriate mitigation, the magnitude of the environmental effects attributable to these infrequent and unlikely accidents and malfunctions is likely to be low, or under potentially worse case scenarios, moderate. 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 used by species, but would be anticipated to occur naturally over a number of years. Significant effects on Birds, Wildlife and their Habitat (e.g., population level effects) are not anticipated; this prediction is made with a moderate level of confidence.

16.8.3 Forest Fire

Although unlikely, Project activities involving the use of heat or flame could result in a fire. Fires can alter habitat and cause direct mortality for wildlife. The extent and duration of a fire would be dependent on response efforts and meteorological conditions.

16.8.3.1 Mitigation of Environmental Effects

Fire suppression water systems will be maintained on site. The fire suppression water supply at the mine and processing site will be extracted from Attikamagen Lake wells and stored in a 200,000 L water tank prior to use. The fire suppression water at the rail loop will be extracted from Astray Lake. 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 Spill Response Plan.

The nearest district forest management unit office in Labrador is in Wabush, which has staff and equipment to provide initial suppression activities. The Town of Schefferville also provides fire control services. Labec Century is discussing a reciprocal response arrangement with the Town of Schefferville, approximately 20 km away from the site. In the event of a fire, the on-site response and proximity of fire suppression services in Schefferville will limit the size of any burn.

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 in Labrador is in Wabush, which has staff and equipment to provide initial suppression activities.

16.8.3.2 Characterization of Residual Environmental Effects

The effects of a forest fire on important habitat are predicted to be adverse, because it would reduce availability of habitat for most birds and wildlife. The magnitude and geographic extent of the environmental effect is largely dependent on the scale and intensity of the forest fire and extensive fires may result in significant adverse residual environmental effects if uncontrolled. Reversibility of the physical effects of a fire is high, but would be anticipated to occur over a number of years. The restoration of important habitats would rely upon the re-establishment of vegetation communities through succession and the maintenance of those ecological conditions that existed prior to disturbance, and thus environmental effects on habitat may be of short to long duration. The likelihood of a forest fire occurring naturally is low; fire cycles in Labrador can exceed 400-500 years (Elson 2009). The prediction of significant effects (e.g., potentially affecting wildlife species at a population level) in the unlikely event of a very large fire is made with a moderate level of confidence.

16.8.4 Settling/Sedimentation Pond Overflow

Settling/sedimentation ponds will be established at waste rock, overburden, run-of-mine stockpile areas, at the crushing and screening plant area, at the accommodation camp area, and at the rail loop. Run-off from the stockpiles and site run-off will be directed to the settling/sedimentation ponds prior to discharge to the receiving environment. The likelihood of an overflow is low because the ponds will be designed to contain run-off associated with a 1:100 year precipitation event. In such an event, settling/sedimentation ponds could overflow, releasing untreated water. Untreated water could have elevated levels of total suspended solids. No other contaminants are anticipated.

16.8.4.1 Emergency Response/Mitigation of Environmental Effects

In the unlikely event of an overflow, contingency plans will be in place as part of the Emergency Response and Spill Response Plan to mitigate environmental effects to the receiving environment. Water sampling of TSS and other MDMER parameters will be conducted in downstream water bodies.

16.8.4.2 Characterization of Residual Environmental Effects

The magnitude of adverse residual environmental effects of a settling/sedimentation pond overflow is largely dependent on the volume released, but anticipated to be low following design measures and implementation of mitigation and emergency response procedures. In the unlikely event of an overflow, environmental effects are anticipated to be short- to long-term in duration and reversible over a number of years. Significant effects on Birds, Wildlife and their Habitat (e.g., population level effects) are not anticipated; this prediction is made with a high level of confidence.

16.8.5 Premature or Permanent Shutdown

As currently planned, the mine will have an operational production period of approximately seven years, (following approximately one year of construction) at which time decommissioning and rehabilitation will commence. However, should factors arise that result in the premature shutdown of the mine, regulatory requirements include provision for financial assurance from Labec Century

16.8.5.1 Emergency Response/Mitigation of Environmental Effects

Rehabilitative measures may be implemented by the NLDIET, in which case costs incurred by the Crown in implementing these measures may be recovered by drawing on the financial assurance provided by the proponent. Any required cost expenditures over and above the financial assurance provided would be considered debt by Labec Century to the Crown.

16.8.5.2 Characterization of Residual Environmental Effects

In the event of a premature or permanent shutdown, it is anticipated that adverse environmental effects would be low, under the assumption that rehabilitative measures would be realized following implementation by the Crown. Residual environmental effects would be site-specific and short- to long-term duration for some habitats following site rehabilitation, or permanent for other habitats that may not return to pre-Project conditions (e.g., open pit). Significant effects on Birds, Wildlife and their Habitat (e.g., population level effects) are not anticipated; this prediction is made with a high level of confidence.

16.8.6 Summary of Residual Effects Resulting from Accidents and Malfunctions

A summary of residual environmental effects resulting from accidents and malfunctions is summarized in Table 16.17.

16.9 Determination of Significance of Residual Adverse Environmental Effect

In the approach to the assessment, effect pathways for Project and cumulative effects for birds and other wildlife were change in habitat, change in distribution and movement, change in mortality risk, and change in health. Within the EIS, effect pathways are first considered separately, for each phase of the Project and associated activities, to demonstrate that the full range of potential effects of the Project has been assessed and characterized. The determination of the significance of residual effects of the Project considers the combined effects of all identified pathways and provides an overall prediction of the potential risk posed by the Project.

16.9.1 Project Residual Environmental Effects

The Project will result in a change in the baseline condition for habitat, distribution and movement, mortality risk, and health of birds and other wildlife. Residual environmental effects associated with the Project are associated primarily the loss or alteration of habitat associated with Project Construction, as well as potential changes in distribution and movement of individuals of some species, increased risk of mortality, and changes in individual health associated with collisions, increased access, ongoing sensory disturbances and avoidance behaviours.

Standard and proven mitigation measures and BMP will be applied to reduce the residual environmental effects of the Project, and Labec Century will comply with all provincial and federal legislation, permits, approvals and guidelines. Specific mitigation measures and BMP that will be implemented to reduce potential environmental effects associated with the Project are summarized in Sections 16.6.1 through 16.6.4. Details related to these measures will be provided in the EMP and the Emergency Response and Spill Response Plan for the Project.

Table 16.17 Summary of Residual Environmental Effects – Accidents and Malfunctions

Project Phase	Emergency Response/Contingency Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-economic Context			
Operations and Maintenance											
Fuel Spill	• Develop and implement an Emergency Response and Spill Response Plan	A	L/M	S	ST/MT	U	R	U	N	M	Monitor success of response measures and habitat effects.
Train Derailment	• Develop and implement an Emergency Response and Spill Response Plan	A	L/M	S	ST/MT	U	R	U	N	M	Monitor success of response measures and habitat effects.
Forest Fire	• Develop and implement an Emergency Response and Spill Response Plan.	A	H	S/R	ST	U	R	U	S	M	Monitor success of response measures.
Settling/Sedimentati on Pond Overflow	• Develop and implement an Emergency Response and Spill Response Plan	A	L/M	S	ST/LT	U	R	U	N	H	Monitor success of response measures and habitat effects.
Premature or Permanent Shutdown	• Work with NLDIET to implement rehabilitative measures.	A	L	S	ST/P	U	R/I	U	N	H	Monitor for compliance with mitigation measures;

Table 16.17 Summary of Residual Environmental Effects – Accidents and Malfunctions

Project Phase	Emergency Response/Contingency Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental or Socio-economic Context			

Key:

Direction:
P Positive,
A Adverse,
N Neutral

Magnitude:
L Low,
M Moderate,
H High

Geographic Extent:
S Site-specific: environmental effect confined to the PDA.
L Local: environmental effect extends into the LSA.
R Regional: environmental effect extends into the RSA, where indirect or cumulative environmental effects may occur.

Duration:
ST Short-term: residual environmental effect occurs during the Construction phase (i.e., one year)
MT Medium-term: residual environmental effect extends through the Operations and Maintenance phase (i.e., up to seven years)
LT Long-term: residual environmental effect is greater than seven years
P Permanent: measurable parameter unlikely to recover to baseline

Frequency:
Quantitative measure; or
O Once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.
U Unlikely to occur

Reversibility:
R Reversible: effect is reversible following closure and reclamation
I Irreversible: residual environmental effect 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 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.

With the proposed mitigation and environmental protection measures, the environmental effect of the Project on Birds, Wildlife and their Habitat is anticipated to be not significant, as there are no unique or limiting habitats within the PDA, and the species occurring in the RSA are expected to maintain sustainable populations outside the PDA. There is a moderate degree of confidence that the level of effect will not be greater than predicted, based on the following:

- Baseline data for bird and wildlife species in the RSA incorporated field studies and a review of relevant literature. While the abundance of some species may be uncertain, the biological processes (e.g., behavioural responses to stimuli) are well understood;
- ELC habitat data used to assess Project environmental effects were based on the most accurate and appropriately scaled data sources available;
- Habitats used to assess Project-related environmental were ranked so that the loss of such habitats would be over- versus under-estimated. As a conservative measure, <5% loss of habitat was used to represent a low effect, 5-25% loss of habitat was used to represent a moderate effect, and >25% was used to indicate a high environmental effect;
- Populations of key or representative species selected for this assessment are believed to be indicative of the effects of management activities, and as such can be used to indicate effects on other functionally related species.
- Conclusions are conservatively made and assumed that an effect was more rather than less adverse.
- Mitigation measures proposed have been proven successful and will be followed by monitoring to assess effectiveness; and
- Mechanisms to evaluate monitoring results and provide for subsequent/additional mitigation or project modification will be implemented, as necessary.

16.9.2 Cumulative Environmental Effects

Project residual environmental effects on a change in habitat, distribution and movement, mortality risk, and health of birds and other wildlife will act cumulatively with similar residual effects resulting from other projects and activities (current and future). The contribution of the Project to potential cumulative environmental effects is anticipated to be low, as the Project will not result in a significant change in the quality or extent of primary or important habitat (either physically, chemically, or biologically) for birds and other wildlife. It is assumed that other projects are or will be subject to federal and provincial policies that protect migratory birds, wildlife and their habitat, and will be required to implement similar well-established and proven mitigation measures to reduce or limit adverse environmental effects. It is expected that the likelihood of the long-term viability or survival of populations within the RSA will not be threatened, and therefore residual cumulative environmental effects on Birds, Wildlife and their Habitat are predicted to be not significant.

16.9.3 Accidents and Malfunctions

Residual adverse environmental effects on Birds, Wildlife and their Habitat resulting from accidents and malfunctions are predicted to be not significant, as design features and engineering techniques will be incorporated to reduce potential effects, with the exception of forest fires that may result in significant effects depending on scale and intensity. In the unlikely event of an accident or malfunction, an Emergency Response and Spill Response Plan will be implemented to further reduce adverse environmental effects.

16.10 Follow-up and Monitoring

Monitoring is a necessary component and will inform future mitigation strategies. In the unlikely event it is found that mitigation measures are not effective, adaptive management measures will be developed to address potential issues and government departments responsible for the species in question would be engaged in reviewing the proposed measures.

In consultation with the appropriate regulatory authorities, Labec Century will evaluate the need for monitoring plans to verify predicted effects on Birds, Wildlife and their Habitat. Pre-Construction surveys have already been completed (i.e., field surveys and literature reviews as part of baseline studies) and additional monitoring, including compliance monitoring, will be conducted during Construction, Operations and Maintenance, and at Closure and Decommissioning, as appropriate.

Final details of the monitoring requirements and adaptive management strategies required to achieve intended goals will be included in the detailed EMP to be developed in consultation with the appropriate regulatory agencies and stakeholder groups. Monitoring plans are conceptual at this time and will be developed upon release of the Project from the EIS process. The following monitoring plans (or documentation of information) are recommended for the Project:

- Monitoring Project-related activities for compliance with mitigation, particularly during Construction;
- Documentation of the mortalities related to road kills or associated with site lighting or other activities;
- Documentation of Project-wildlife interactions or relevant observations (e.g., raptor nests, waterfowl use of open water areas within the PDA, wildlife-vehicle collisions) and reporting to the appropriate regulatory authority;
- In the year following Construction, monitoring following spring run-off may be considered to review the effectiveness of the bank and slope re-vegetation, to check bank and slope stability, to determine if surface drainage has been maintained, and habitat protection measures (e.g., silt fencing) remain functional. Appropriate remedial measures will be completed as necessary and additional follow-up monitoring conducted as appropriate; and

- Monitoring and remediation following the unlikely event of contamination from an accidental spill or malfunction.

In addition, monitoring will be necessary following the unlikely event of contamination from an accidental spill or malfunction. Required monitoring will be detailed in the Emergency Response and Spill Response Plan.

16.11 Summary

Standard and proven mitigation measures and BMP designed to limit the area disturbed by the Project and to manage emissions and discharges, will be applied to mitigate environmental effects of the Project on Birds, Wildlife and their Habitat. Site-specific procedures will be outlined in the EMP, the Emergency Response and Spill Response Plan, and an Avifauna Management Plan. With the proposed mitigation and environmental protection measures, adverse residual environmental effects on Birds, Wildlife and their Habitat are anticipated to be not significant, as it relates to changes in habitat, distribution and movement, mortality risk, and health.

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Joyce Lake Direct Shipping Iron Ore Project:

Chapter 17:

Species at Risk and Species of Conservation Concern

File No. 121416571

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17.0 SPECIES AT RISK AND SPECIES OF CONSERVATION CONCERN

As detailed in chapter 1, Joyce Direct Iron Inc. succeeded Labec Century Iron Ore Inc. ("Labec Century") as the Project Proponent on February 18, 2021 following an internal reorganization. All references to Labec Century as the Project proponent may be interpreted as now referring to Joyce Direct Iron Inc.

17.1 VC Definition and rationale for Selection

This VC was selected for environmental assessment to satisfy requirements under Section 4.22 of the Newfoundland and Labrador EIS Guidelines for the Joyce Lake Direct Shipping Iron Ore Project (the Project). EIS Guidelines for the Project have specified that SAR and SOCC be considered as there are concerns about the vulnerability of SAR and SOCC to potential Project-related effects and thus a need for the implementation of policies intended to protect species at risk, significant wildlife habitat, and the biodiversity and ecological integrity of their habitats. Provincial and federal legislation provides protection to designated SAR and there are various government policies regarding the conservation of rare and/or sensitive flora and fauna. Additionally, SAR and SOCC contribute to overall species diversity in an area and, in terms of rare plant species, are often associated with unusual or uncommon habitats. Furthermore, some plant communities (i.e., wetlands) contain a comparatively large number of rare plant species or uncommon species assemblages and federal/provincial policy is directed at preventing loss of important wetland functions.

For this environmental assessment, SAR and SOCC have been classified here as “species at risk” or “species of conservation concern” based on rankings provided by various acts, agencies and listings and were defined on the basis of the component meeting one or more of the following criteria:

- Species at Risk:
  - A species listed as “Extirpated”, “Endangered” or “Threatened” under Schedule 1 of SARA, or protected under the NLESA; and
  - A species assessed by COSEWIC as “Endangered”, “Threatened”, or “Special Concern, and that may be under consideration for such legislative protection (i.e., listed in Schedule 2 and 3 of SARA) as assessed by COSEWIC.
- Species of Conservation Concern:
  - A species not under the protection of SARA or the NLESA (e.g., listed as “Special Concern” in Schedule 1 of SARA);
  - A species assessed by the Newfoundland and Labrador SSAC as “Vulnerable”; “Threatened”, “Endangered”, but still under consideration for listing under the NLESA;

- A species considered for listing under Quebec's Act respecting threatened or vulnerable species or Loi sur les espèces menacées ou vulnérable (LEMV);

- A species ranked as "S1", "S2", "S3", or combinations thereof, either provincially or regionally, by the Atlantic Canada Conservation Data Centre (AC CDC) and/or Centre de données sur le patrimoine naturel du Québec (CDPNQ) and with a Newfoundland and Labrador General Status ranking of "At Risk", "May Be At Risk", "Sensitive" or "Undetermined" by NLDOECC or MELCC; and/or

- A species not previously reported from Labrador.

Unlike SAR, SOCC are not afforded any direct protection by either federal or provincial legislation. SOCC are included in this VC as a precautionary measure, reflecting observations and trends in their provincial population status, and are often important indicators of ecosystem health and regional biodiversity. Rare plants are often an indicator of the presence of unusual and/or sensitive habitat, and their protection as umbrella species can confer protection on their associated unusual habitats and co-existing species.

Species of SAR and SOCC are important to government agencies (e.g., IAAC, NLDOECC), Indigenous peoples and/or the general public. As such, there are linkages between this VC and Chapter 19: Current Use of Lands and Resources for Traditional Purposes by Indigenous Persons, and Chapter 18: Historic and Cultural Resources.

17.1.1 Approach to Assessment of Effects

The assessment considers the environmental effects of the Project on SAR and SOCC identified in the vicinity of the Project PDA. Information on the presence of individual species or populations of SAR and 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:

- Project field data collected (2011-2013) as a part of the environmental baseline program for the Project (GENIVAR 2013a, 2013b, 2013c; WSP 2014);

- *Species at Risk Act* (SARA), Newfoundland and Labrador *Endangered Species Act* (NLESA), Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Status Reports, and Recovery and Management Plans (where available);

- Government and non-government sources, including Wild Species 2015: The General Status of Species in Canada (Government of Canada 2015) [Labrador], NLDFFA General Status Rankings [Labrador]), Birds Canada's "Nature Counts" web portal (e.g., Breeding Bird Survey (BBS) data, eBird data), CDPNQ, Quebec's Biodiversity Atlas - Threatened or Vulnerable Species; the Quebec Breeding Bird Atlas 2010-2014 (Les oiseaux nicheurs du Québec: atlas des oiseaux nicheurs du Québec méridional), and local naturalists;

- 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)); and
- Recent aerial photographs and topographical maps that could indicate the presence of potentially rare plant species or habitats.

Status of Information for SAR and SOCC in Labrador

Spatial analysis of SAR and SOCC is contingent upon the availability of existing data within the area being evaluated. If species within the provincial (i.e., AC CDC) database are not recorded for an 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 and SOCC within the region. For many species, and in particular plants, Labrador has not been as extensively studied as insular Newfoundland. Thus, information and literature on the current known distribution of SAR and SOCC located at or near the Project, and compiled by the AC CDC, is limited. As a result, some species thought to be rare may in fact not be rare. As the Project proceeds, SAR and SOCC and their habitats may be discovered within the PDA and/or LSA. As such information becomes available, or through future surveys performed throughout western Labrador, species and their scarcity ranks may be adjusted accordingly by NLDOECC.

Results of the SARA Public Registry (Government of Canada 2014), AC CDC and CDPNQ database search are not intended as a final statement on the presence, absence, or condition of rare species within a given area, or as a substitute for on-site surveys.

17.2 Scope of the Assessment

17.2.1 Regulatory Setting

Provincial and federal acts and associated regulations that apply to plant and wildlife resources in the Project area include:

- CEAA 2101;
- SARA;
- MBCA.
- *Canada Wildlife Act*;
- NLEPA and associated *Environmental Assessment Regulations*;
- NLESA;
- NLWLA; and
- the Act respecting threatened or vulnerable species, Quebec.

In addition to regulatory requirements, the Project will also be subject to the applicable federal, provincial, and non-governmental policies, guidelines and rankings, including:

- Accord for the Protection of Species at Risk;
- COSEWIC management and recovery plans;
- Recommendations of the Newfoundland and Labrador SSAC;
- Newfoundland and Labrador Species at Risk: A Policy Regarding the Conservation of Species at Risk;
- Wild Species: The General Status of Wild Species in Canada;
- AC CDC Status Rankings; and
- CDPNQ.

17.2.1.1 Federal and Provincial Legislation

Federal and provincial legislation specific to the SAR and SOCC VC includes:

- SARA 2002, c. 29 (Assented to December 12, 2002) of Canada;
- NLESA S.N.L. 2001, c.E.-10.1. (Assented to December 13, 2001) of Newfoundland and Labrador; and,
- An Act respecting threatened or vulnerable species, Quebec. RSQ, c E-12.01 (Assented to May 8, 1997)

Federal Legislation

Species protected federally under SARA are listed in Schedule 1 of the Act. As defined in SARA, "wildlife species" means 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 (a) is native to Canada; or (b) has extended its range into Canada without human intervention and has been present in Canada for at least 50 years. 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 (Government of Canada 2014). Designation under the Act follows recommendation and advice provided by COSEWIC to the Government of Canada. COSEWIC is responsible under SARA for assessing the biological status of each rare species in Canada. SARA is administered by ECCC, Parks Canada Agency, and DFO. Those species listed as Endangered or Threatened in Schedule 2 or 3 of SARA may also be considered as species at risk, pending regulatory consultation. Table 17.1 shows the conservation status categories for the SARA and COSEWIC.

Table 17.1 SARA and COSEWIC 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.
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 2014. Excerpt from web site: http://www.cosewic.gc.ca/eng/sct0/assessment_process_e.cfm#tbl2 ** denotes a COSEWIC risk category (COSEWIC 2014).	

Subsection 79(1) of SARA (Government of Canada 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) (Government of Canada 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 SARA, there are three schedules; species officially protected are listed under Schedule 1 of SARA (Government of Canada 2014) and designated as Extinct, Extirpated, Endangered, Threatened or Special Concern. 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.

Provincial Legislation

Certain wildlife species are also protected under the NLESA. 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 (Table 17.2). Designation under the NLESA follows recommendations from COSEWIC and/or the 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 SARA. Differences in designation are likely to be observed when a species is at risk in a province, but is more common from a national perspective.

Table 17.2 Newfoundland and Labrador *Endangered Species Act* Conservation Status Category Descriptions

Rank	Description
Extinct/Extirpated	Extinct species no longer exist on Earth. Extirpated native species are no longer present in Newfoundland or Labrador, but exist elsewhere.
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.
Data Deficient	All sources of available information have been investigated but the information in the status report is insufficient to determine risk of extinction based on distribution and/or population status.
Not at Risk	Generally applied to widespread and abundant taxa unlikely to fit the criteria for Vulnerable, Threatened or Endangered in the near future.

In order to consider all relevant SAR and 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).

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.

The conservation and recovery of species assessed and legally listed under the NLESA is coordinated by the Wildlife Division of the NLDFFA. There are currently 46 species, subspecies, and populations designated under the NLESA. Twenty-one of these species are listed as Endangered (15 plants, 6 wildlife), 12 as Threatened (4 plants, 8 wildlife), and 13 as Vulnerable (three plants, 10 wildlife).

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.

Additionally, the NLDFFA also makes use of a different ranking system known as *The General Status of Species in Canada* (CESCC 2001). *The General Status* 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 (Table 17.3).

Table 17.3 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.
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.

Table 17.3 Definitions of General Status of Wild Species in Canada

Rank	General Status Category	Category Description
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 online: http://www.wildspecies.ca/ranks.cfm?lang=e		

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 differ from status designations assigned after detailed assessments completed by 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.

The Wildlife Division, in conjunction with the AC CDC, maintains a comprehensive list of vascular plant species which it considers to be rare or uncommon (i.e., species of special conservation concern) in Newfoundland and Labrador. In Québec, CDPNQ is coordinated jointly by the Ministère de l'Environnement et de la Lutte contre les changements climatiques and the Ministre de l'Énergie et des Ressources naturelles in collaboration with the CWS (Gouvernement du Québec 2005). Both the AC CDC and CDPNQ rank species on the basis of their global (G), national (N) and provincial status (S), a system developed by the Nature Conservancy (Natureserve 2013) and used by all Conservation Data Centres and Natural Heritage Programs throughout North America. These ranks are used to determine species status and are assigned a numeric rank ranging from 1 (critically imperiled) to 5 (secure) for each species (Table 17.4). This reflects the relative status of species and is based on the number of occurrences of that species globally or within the province. Plant species considered rare, uncommon, unique or unusual, either locally or regionally, by NLDFFA as recorded by the AC CDC, or in Quebec by the CDPNQ, include all S1, S2 and S3 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, their populations are generally less sensitive. S-ranks therefore provide useful and relevant indication of the relative rarity and current status of plant species in the province. Definitions of the CDC rankings considered relevant to the Project are provided in Table 17.4.

Table 17.4 Definitions of the 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 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).
SNR	Unranked: Provincial conservation status not yet assessed.
SNA	Not Applicable: A conservation status is not applicable because the species is either: a) exotic, b) not definitively known to occur in the province or c) a hybrid not considered to be conservation significance.
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.
Source: Government of Canada 2015	

Species ranked S1, S2 and S3 are therefore considered to be of conservation concern. SNR and SU ranked species are also considered and similarly may be identified as possibly of conservation concern. Although the EIS includes consideration of these potentially “rare” or “uncommon” species, it should be noted that these terms are not synonymous with that of “listed” or “protected” species, in that a majority of species are not designated or protected under federal or provincial legislation.

17.2.2 Influence of Consultation and Engagement on the Assessment

Labec Century recognizes the importance of communications with federal, provincial, and municipal regulatory agencies, stakeholders, and the public, and has conducted a stakeholder consultation program as part of the issues scoping exercise for the Project. The consultation program focused primarily on the area(s) most likely to be affected by the Project, including the Town of Schefferville in the province of Québec and local indigenous groups. Issues are included in the assessment of the VC. Details on the issues raised by stakeholders are provided in Table 17.5.

Table 17.5 Issues Raised by Indigenous Groups and Stakeholders

Issue	Community/Organization	Summary of Comments Raised During Consultation and Engagement Activities	Response/Location in the EIS
No issues related to Species at Risk or Species of Conservation Concern were raised during consultation. Issues related to wildlife are addressed in Chapter 16: Wildlife, Birds and their Habitats.			

17.2.3 Temporal and Spatial Boundaries

The temporal boundaries for the environmental assessment include the Project phases of Construction, Operations and Maintenance, and Closure and Decommissioning. The temporal boundary for Construction is one year (pre-operation), for Operations and Maintenance is approximately seven years, and for Closure and Decommissioning is approximately one year.

Most potential Project environmental effects on SAR and SOCC will begin and peak during Construction of the Project. The Closure and Decommissioning phase includes any monitoring or active site management required so that an appropriate end land use has been established. Plant SAR and SOCC in the Project area are present throughout the year, while some Bird and Wildlife SAR and SOCC may be present only seasonally (e.g., during breeding, or in passage during spring and/or fall migration).

The spatial boundaries for the environmental effects assessment of the SAR and SOCC VC are defined below, and take into account the appropriate scale and spatial extent of potential environmental affects, existing scientific and traditional knowledge, current land and resource use, and biological and ecological considerations.

Project Development Area (PDA): The PDA includes the area of physical disturbance (i.e., footprint of the Project), including the mine site and associated mine infrastructure (e.g., processing plant, settling and sedimentation ponds, waste rock and overburden disposal areas, stockpiles, rock causeway and roadways, rail track yard and, loop, and accommodations camp). The PDA covers an area of approximately 413 ha. Details on these components are provided in Chapter 2: 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 plus a 500 m buffer around the Project footprint (Figure 17.1) where Project-related environmental effects may reasonably be expected to occur. Along the approximately 44 km haul road, the 1 km wide right-of-way corridor (buffered approximately 500 m on either side) allows for minor revisions to the right-of-way alignment, if needed, for environmental (e.g., for mitigation purposes) or technical reasons.

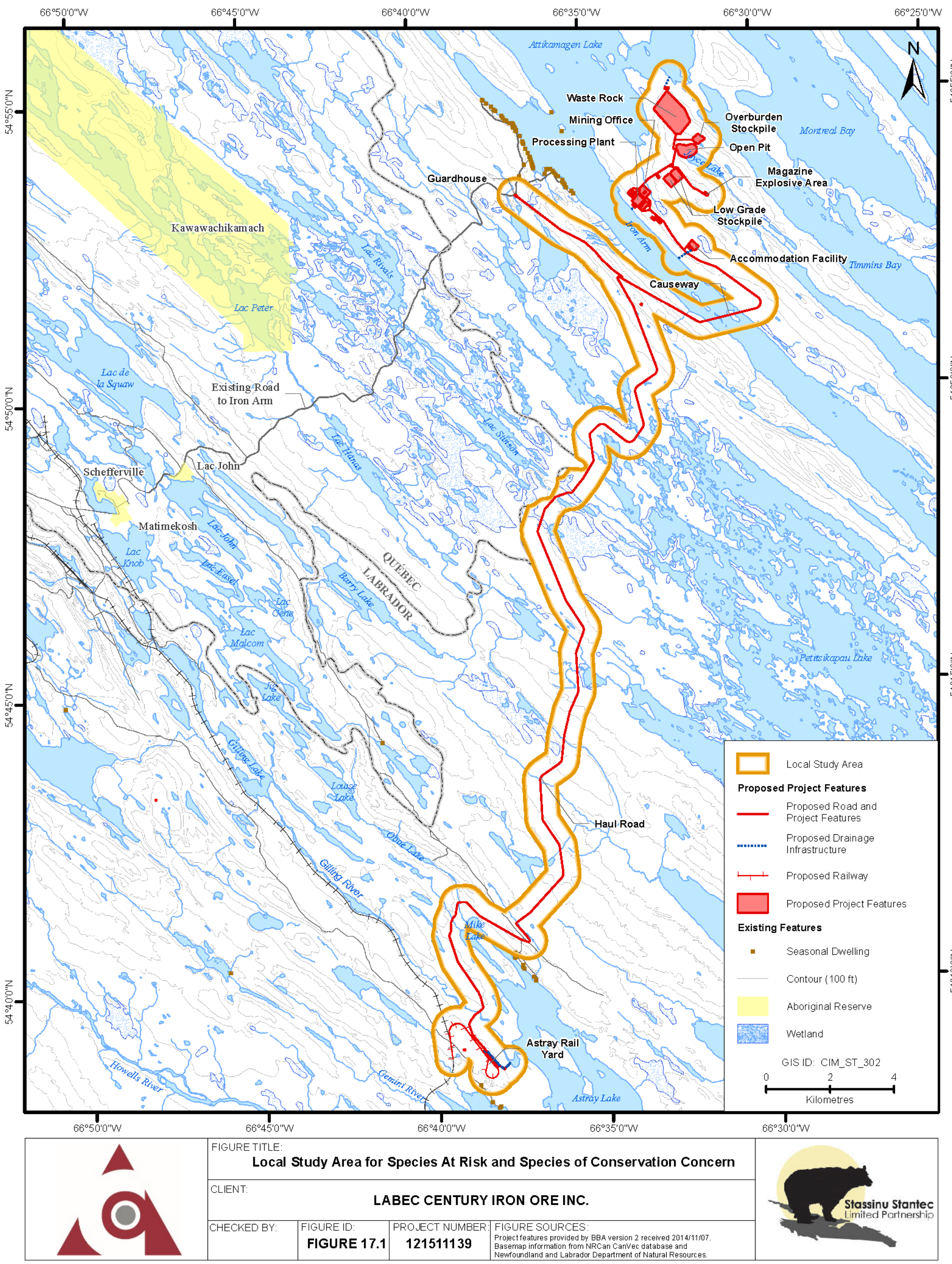

Figure 17.1 Local Study Area for SAR and SOCC

Delineating the LSA based on a 500 m buffer of the Project footprint is a method that has been consistently used, and accepted, in previous EAs completed for similar projects in the region. The buffer represents a zone in which all direct and the majority of potential indirect effects of the Project may occur (e.g., sensory disturbance to wildlife).

The spatial boundary of the LSA for the assessment of SAR and SOCC is approximately 6,174 ha (Figure 17.1)

Regional Study Area (RSA): The RSA includes the LSA and surrounding area (approximately a 25 km radius around a central point in the PDA), and provides a regional context for understanding SAR and SOCC that could potentially interact with the Project. The RSA is a broader area of the SAR/SOCC VC defined to capture the expected overall spatial extent of the Project's effects, based on factors such as the distribution or movement of the SAR/SOCC (e.g., the range of the various animal populations that may be affected). It is also the area within which cumulative effects for each SAR/SOCC may occur, depending on physical and biological conditions and the type and location of other past, present, and reasonably foreseeable projects. The RSA is approximately 196,349 ha in size (Figure 17.2).

Watershed boundaries were not selected as the basis of the RSA, as this would represent a larger area and potentially result in the dilution of predicted environmental effects, particularly given the relatively small size of the PDA.

Technical boundaries for the SAR/SOCC include spatial limitations in existing data sources used to characterize vegetation communities in the LSA and RSA; spatial limitations in the detailed analysis of historical air photo coverage, and field surveys conducted in the PDA (i.e., vascular plants can only be identified where field surveys were conducted, but not beyond); and temporal variations associated with the presence of vascular plants from one growing season to another (i.e., plant communities could be present at one location during one year but not the next [e.g., Norwegian Arctic-cudweed]). To characterize vegetation communities in the LSA and RSA, existing information used for the assessment includes aerial imagery (2012), LiDAR (Light Detection and Ranging) data (2010), remotely-sensed satellite imagery, AC CDC elemental occurrence and expert opinion range map data, and 2012 and 2013 field survey data. These data are sufficient and have been used to accurately describe existing conditions and assess potential Project-related environmental effects.

There are no comprehensive databases for non-vascular plants and other organisms for Newfoundland and Labrador. Regulatory authorities and non-regulatory institutions and professionals have limited expertise and knowledge in the identification of non-vascular plants and other organisms in Newfoundland and Labrador, as in many other jurisdictions. Consequently, there is a technical limitation in the EIS regarding their consideration. This is a standard technical limitation for EIS in Newfoundland and Labrador and Canada, with the consideration of vegetation generally being limited to vascular plants and communities. There are no known occurrences of non-vascular plants with legislative protection in the RSA.

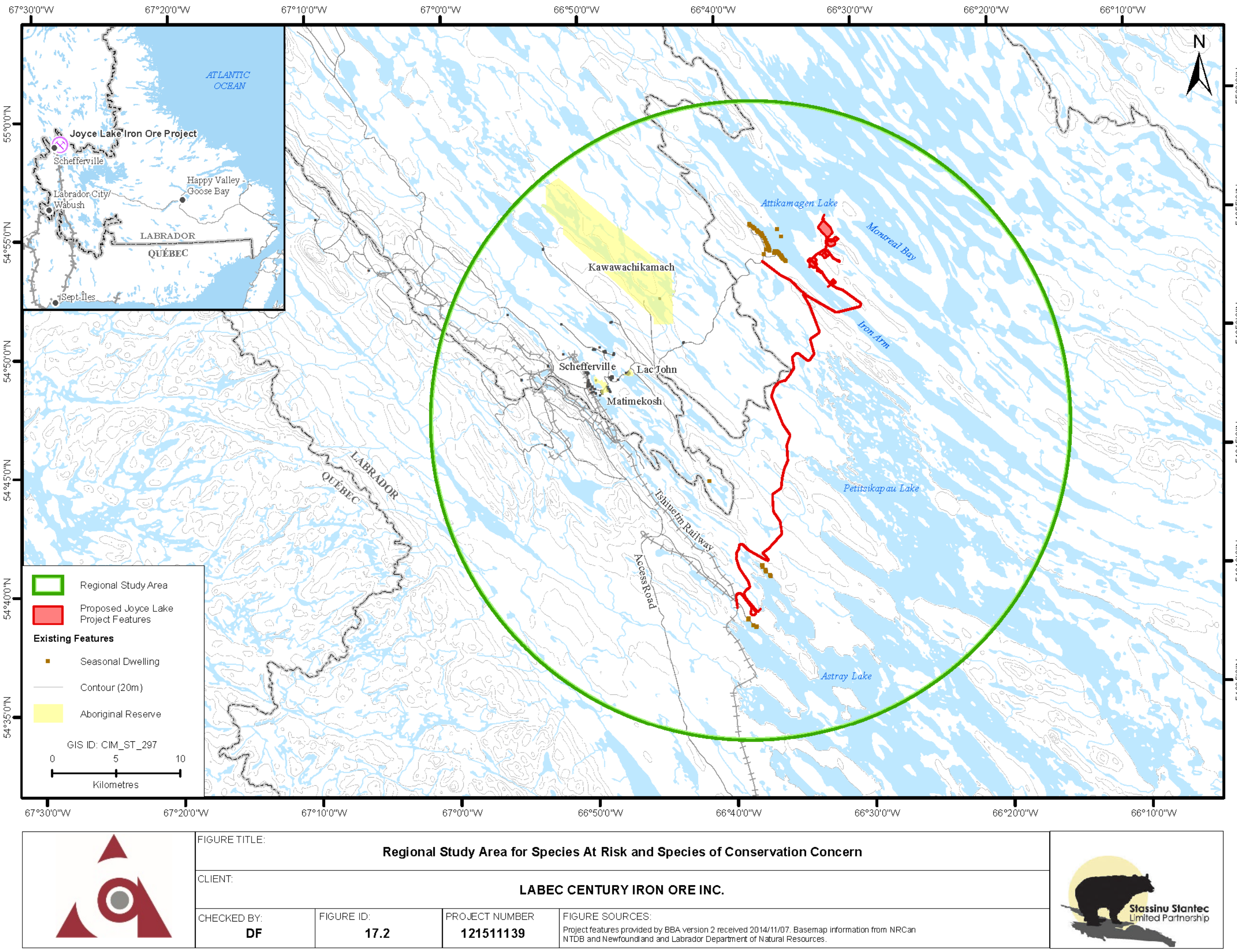

Figure 17.2 Regional Study Area for SAR and SOCC

17.2.4 Selection of Environmental Effects and Measurable Parameters

The environmental effects and associated measurable parameters, with rationale, are summarized in Table 17.6.

Table 17.6 Measurable Parameters for Species at Risk and Species of Conservation Concern

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Rare Plant Species and Uncommon Plant Communities	• Number of occurrences of rare plants likely to be directly disturbed; • Number of rare plant species likely to be directly disturbed; • Area (ha) of uncommon plant communities likely to be directly disturbed; • Number of occurrences of rare plants that are likely to be indirectly influenced through changes in hydrology, contamination of surface runoff, or competition from non-native species introductions; • Area (ha) of vegetation communities likely to be indirectly influenced through changes in hydrology, contamination of surface runoff, or competition from non-native species introductions.	Data on the distribution and abundance of rare plant occurrences will inform the assessment of effects on rare plants by providing a spatial reference to assess potential direct and indirect effects. Similarly, spatial information on the distribution of vegetative communities will inform the assessment of Project activities on these features. Potential changes in the occurrence of rare plants and vegetation through direct interaction (i.e., habitat loss or alteration through disturbance) with Project activities are quantifiable using information on the location and extent of Project components (e.g., infrastructure, waste rock piles, etc.). Spatial information on the likely extent of indirect effects (hydrology, water contamination, species interactions) is more difficult to quantify and requires consideration of the efficacy of mitigative measures in concert with expert opinion.
Change in Habitat (Bird and Wildlife SAR/SOCC)	Area (ha) of primary or other sensitive or limiting habitat lost or altered relative to the availability (%) in the RSA	The MCBA, SARA and NLESA afford protection to habitat for species of migratory birds, SAR and SOCC. Critical habitat as identified in a recovery plan also applies, where identified for a SAR or SOCC. Habitat loss (e.g., ground clearing) or alteration (e.g., creation of dust or other sensory disturbance) can lead to changes in wildlife abundance, behaviour and/or breeding success.
Change in Distribution and Movement (Bird and Wildlife SAR/SOCC)	• Density and distribution of species on the landscape; • Sensory disturbance – e.g., noise (dBA), or qualitative effects (e.g., visual)	Sensory disturbance influences wildlife behavior and may result in a change in behaviour, either temporarily or permanently, including feeding, breeding, migration and movement, in response to: • Physical hazards and attractants or deterrents for wildlife (e.g., roads and other structural features, light, noise); • Chemical hazards and attractants for wildlife (e.g., wastes); and • Other disturbances causing wildlife attraction or deterrence (e.g., human presence).

Table 17.6 Measurable Parameters for Species at Risk and Species of Conservation Concern

Environmental Effect	Measurable Parameter	Rationale for Selection of the Measurable Parameter
Change in Mortality Risk (Bird and Wildlife SAR/SOCC)	• Mortalities (estimated based on likelihood of occurrence in the PDA) • Amount of new access (linear distance in km)	Direct mortality can occur through collisions with trains or construction vehicles. Indirect mortality can result from an increase in predation, hunting and/or poaching resulting from improved access or other habitat changes. A change in mortality risk may occur as a result of contamination from emissions (e.g., effluent discharge).
Change in Health (Bird and Wildlife SAR/SOCC)	Reproductive success (number of young produced)	Physiological effects from stress and/or contamination (e.g., effluents, hydrocarbons) could cause reduced fitness amongst wildlife breeding in the LSA.

17.3 Standards or Thresholds for Determining the Significance of Residual Environmental Effects

Terms that will be used to characterize residual environmental effects for SAR and SOCC are in accordance with reference guidance provided under the CEAA (Federal Environmental Assessment Review Office 1994).

- Direction
  - Adverse: a decrease or undesirable change in SAR/SOCC and the habitat for SAR/SOCC, and/or the distribution and movement, mortality risk and health of Bird and Wildlife SAR/SOCC.
  - Positive: an increase or beneficial change in SAR/SOCC and the habitat for SAR/SOCC, and/or the distribution and movement, mortality risk and health of Bird and Wildlife SAR/SOCC.
  - Neutral: no detectable measurable change in SAR/SOCC and the habitat for SAR/SOCC, and/or the distribution and movement, mortality risk and health of Bird and Wildlife SAR/SOCC.
- Magnitude
  - Negligible: measurable adverse effects are not anticipated.
  - Low: no measurable change in the existing SAR/SOCC community is expected; residual Project environmental effects (alteration/loss) are not expected to exceed 5% of the known population or their preferred habitats in the RSA.
  - Moderate: measurable change occurs; residual Project environmental effects (alteration/loss) are expected to be greater than 5% and not exceed 25% of the known population or their preferred habitats in the RSA.

  - High: residual Project environmental effects (alteration/loss) are expected to exceed 25% of the known population or their preferred habitats in the RSA; the effect can be easily observed, measured and described, and may be widespread.

- Geographic Extent
  - Site-specific: residual environmental effect confined to the PDA.
  - Local: residual environmental effect extends into the LSA.
  - Regional: residual environmental effect extends into the RSA, where indirect or cumulative environmental effects may occur.

- Frequency
  - Once: environmental effect occurs once per month or less (e.g., Site preparation/clearing).
  - Sporadic: environmental effect occurs sporadically at irregular intervals (e.g., vegetation clearing, road maintenance).
  - Regularly: environmental effect occurs on a regular basis and at regular intervals (e.g., fuel transport).
  - Continuous: environmental effect occurs continuously.
  - Unlikely: environmental effect is not likely to occur.

- Duration
  - Short-Term: residual environmental effect occurs during the Construction phase of the Project (i.e., one year).
  - Medium-Term: residual environmental effect extends throughout the Construction and Operations and Maintenance phases of the Project (i.e., up to eight years).
  - Long-Term: residual environmental effect is greater than eight years.
  - Permanent: measurable parameter unlikely to recover to baseline (i.e., residual environmental effect persists).

- Reversibility
  - Reversible: will recover after Project closure and reclamation
  - Irreversible: environmental effect is permanent

- Ecological/Socio-economic Context
  - Undisturbed: area relatively or not adversely affected by human activity.
  - Disturbed: area has been substantially previously disturbed by human development, or human development is still present.
- Prediction Confidence
  - Low: there is low confidence in the prediction of effects.
  - Moderate: there is moderate confidence in the prediction of effects
  - High: there is high confidence in the prediction of effects

A significant adverse residual environmental effect on SAR and SOCC is defined as:

- **Species at Risk:**
  - One that results in a non-permitted contravention of any of the prohibitions stated in Sections 32-36 of SARA, or any of the prohibitions stated in Section 3 of the NLESA;
  - One that results in the degradation, alteration or loss of critical or important habitat within the assessment boundaries (either physically, chemically, or biologically), in quality or extent, in such a way as to cause a change or decline in the distribution, abundance, mortality risk, and/or health of a viable population that is dependent upon that habitat, in such a way that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Mid Subarctic Forest and High Subarctic Tundra Ecoregion is substantially reduced as a result; or
- **Species of Conservation Concern:**
  - One that results in the degradation, alteration or loss of critical or important habitat within the assessment boundaries (either physically, chemically, or biologically), in quality or extent, in such a way as to cause a change or decline in the distribution, abundance, mortality risk, and/or health of a viable population that is dependent upon that habitat, in such a way that the likelihood of the long-term survival of these rare, uncommon and/or non-secure population(s) within the Mid Subarctic Forest and High Subarctic Tundra Ecoregion is substantially reduced as a result; or
  - One that results in the direct mortality of individuals or communities such that the likelihood of the long-term survival of these rare, uncommon and/or non-secure or sensitive plant or wildlife population(s) within the Mid Subarctic Forest and High Subarctic Tundra Ecoregion, is substantially reduced as a result; or

- In the case of wildlife species of "Special Concern" listed in Schedule 1 of SARA, where the Project activities are not in compliance with the objectives of management plans (developed as a result of Section 65 of SARA) that are in place at the time of relevant Project activities; or

- One that causes a decline in the abundance or distribution of an uncommon plant community such that its long-term persistence within the Mid Subarctic Forest and High Subarctic Tundra Ecoregion is unlikely.

An environmental effect that does not meet any of the above criteria is rated as not significant.

17.4 Potential Project-VC Interactions

Each activity and physical work associated with the Project is listed in Table 17.7. Based on the level of interaction that is expected to occur between each activity or physical work and identified potential environmental effects, interactions were rated as 0 (no interaction occurs), 1 (interaction occurs but can be managed through proven mitigation and codified practice), or 2 (an interaction occurs and requires further assessment). The rating takes a precautionary approach, whereby interactions with a meaningful degree of uncertainty will be assigned a rate of 2, resulting in a detailed environmental effects assessment.

Table 17.7 Potential Project Environmental Effects to Species at Risk and Species of Conservation Concern

Project Activities and Physical Works	Potential Environmental Effects				
	Change in Rare Plant Species and Uncommon Plant Communities	Change in Habitat (Bird and Wildlife SAR/SOCC)	Change in Distribution and Movement (Bird and Wildlife SAR/SOCC)	Change in Mortality Risk (Bird and Wildlife SAR/SOCC)	Change in Health (Bird and Wildlife SAR/SOCC)
Construction					
Site Preparation (including clearing, grubbing, excavation, material haulage, grading, removal of overburden, ditching, and stockpiling)	2	2	2	2	2
Construction of Roads	2	2	2	2	2
Construction of Causeway	2	2	2	2	2
Construction of Site Buildings and Associated Infrastructure	2	1	2	1	2
Construction of Rail Loop and Associated Infrastructure	2	2	2	2	2
Construction of Stream Crossings	2	2	2	1	2
Installation of Water Supply Infrastructure (wells, pumps, pipes)	2	1	2	1	2
On-site Vehicle/Equipment Operations and Maintenance	1	1	2	2	1

Table 17.7 Potential Project Environmental Effects to Species at Risk and Species of Conservation Concern

Project Activities and Physical Works	Potential Environmental Effects				
	Change in Rare Plant Species and Uncommon Plant Communities	Change in Habitat (Bird and Wildlife SAR/SOCC)	Change in Distribution and Movement (Bird and Wildlife SAR/SOCC)	Change in Mortality Risk (Bird and Wildlife SAR/SOCC)	Change in Health (Bird and Wildlife SAR/SOCC)
Waste Management	0	1	1	1	1
Transportation of Personnel and Goods to Site	1	1	2	2	1
Expenditures	0	0	0	0	0
Employment	0	0	0	0	0
Operations and Maintenance					
Maintenance of Causeway	1	1	1	1	1
Open Pit Mining (including drilling, blasting, ore and waste haulage, stockpiling, dewatering)	1	1	2	1	2
Dewatering Joyce Lake	2	2	2	1	2
Ore Processing (including crushing, conveying, storage, screening)	1	1	2	1	2
Waste Rock Disposal on Surface	2	2	2	1	2
Water Treatment (including mine water and surface runoff) and Discharge	2	1	1	1	1
Rail Load-Out and Transport	0	1	2	2	2
On-site Vehicle/Equipment Operation and Maintenance	1	1	2	2	1
Waste Management	0	1	1	1	1
Transportation of Personnel and Goods to Site	1	1	1	2	1
Fuel Transport	1	1	1	2	1
Fuel Storage and Dispensing	0	1	1	1	1
Progressive Rehabilitation	1	2	2	1	2
Expenditures	0	0	0	0	0
Employment	0	0	0	0	0
Closure and Decommissioning					
Site Decommissioning	1	1	2	1	2
Site Reclamation (building demolition, grading, scarifying)	1	2	2	2	2

Table 17.7 Potential Project Environmental Effects to Species at Risk and Species of Conservation Concern

Project Activities and Physical Works	Potential Environmental Effects				
	Change in Rare Plant Species and Uncommon Plant Communities	Change in Habitat (Bird and Wildlife SAR/SOCC)	Change in Distribution and Movement (Bird and Wildlife SAR/SOCC)	Change in Mortality Risk (Bird and Wildlife SAR/SOCC)	Change in Health (Bird and Wildlife SAR/SOCC)
Accidents and Malfunctions					
Hydrocarbon Spill	2	2	2	2	2
Train Derailment	2	2	2	2	2
Forest Fire	2	2	2	2	2
Settling/Sedimentation Pond Overflow	1	2	2	2	2
Premature or permanent shutdown	1	2	2	1	2

Key:
0 No interaction (i.e., no potential for activity to result in the effect).
1 Interaction occurs; however, based on past experience, the resulting effect is can be managed to acceptable levels through standard operating practices and/or or through the application of best management or codified practices. No further assessment is warranted.
2 Interaction occurs, and the resulting environmental effect may exceed acceptable levels without implementation of specific mitigation. Further assessment is warranted.

Interactions rated as 0 or 1 are discussed in this section, whereas those that are rated as 2 are assessed in detail under Section 17.6.

17.4.1 Interactions Rated as 0

Certain Project activities are not anticipated to interact adversely with Plant SAR and SOCC. These include the following, by Project phase:

- Construction – waste management, expenditures, and employment; and
- Operations and Maintenance – maintenance of causeway, rail load-out and transport, waste management, fuel storage and dispensing, expenditures, and employment.

These activities have limited potential to interact with rare plant species and uncommon communities as they are to be contained within areas or structures that are removed from the terrestrial habitats in the area. Fuel storage and dispensing will follow applicable laws, regulations, and standards for safe use, handling and storage. Waste management will follow applicable laws, regulations, and standards for safe use, handling, storage, and disposal will be followed, and will use existing facilities as feasible. The activities of ore processing and concentrating, and rail load out and transport, will not affect rare plant species and uncommon communities.

In terms of Bird and Wildlife SAR/SOCC, only expenditures and employment are not anticipated to interact adversely. Expenditures and employment are not physical works or activities, and will therefore not interact with either Plant or Bird and Wildlife SAR/SOCC.

17.4.2 Interactions Rated as 1

Project activities rated as 1 may have effects on SAR and SOCC; however, standard environmental protection and BMP, including adherence to regulations, standards, and policies and procedures 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 EMP, prepared in support of the EIS, and prepared prior to Construction. The EMP will describe the specific environmental protection and mitigation measures that will be applied throughout the life of the Project to reduce potential effects as a result of the Project. Mitigation measures will be finalized by Labec Century in consultation with experts, and where appropriate, the regulatory authority (e.g., NLDOECC). To promote effectiveness of the EMP, Labec Century will have a full-time on-site environmental inspector (or equivalent), who will inspect worksites and activities for conformance with the EMP, and compliance with government regulations and permits.

The potential effects of the Project activities rated as 1 are discussed below for each environmental effect (i.e., change in rare plant or uncommon plant communities, change in habitat, change in distribution and movement, and change in health), and for each Project activity within each Project phase (i.e., activities within Construction, Operations and Maintenance, and Closure and Decommissioning).

17.4.2.1 Change in Rare Plant Species and Uncommon Plant Communities

During Construction, mitigation measures are available and will be implemented for on-site vehicle/equipment operation and maintenance and transportation of personnel and goods to the site. These activities have the potential to facilitate the dispersal, propagation, and establishment of non-native and invasive species through increased generation of air or waterborne particulates, or transferred soil and propagules (e.g., by tires). Changes to rare plants or uncommon plant communities may result 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 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.

During the Operations and Maintenance phase, potential environmental effects associated with maintenance of causeway, open pit mining, ore processing, on-site vehicle/equipment operation and maintenance, transportation of personnel and goods to the site, fuel transport, and progressive rehabilitation can managed using standard mitigation and/or through the application of BMP, or codified practices.

The mining and ore processing are expected to be within the area already cleared during site preparation (assessed in detail in Section 17.6), and thus not anticipated to result in further ground disturbance activities. It is not anticipated that these activities will involve the addition of Project-related infrastructure in areas within or directly adjacent to known individuals or populations of plant SAR and SOCC and/or their habitats. Thus, these activities have very limited potential to cause direct adverse environmental effects to these resources. Potential environmental effects and mitigation during on-site vehicle/equipment operation and maintenance, transportation of personnel and goods to the site, and fuel transport are the same as those described for the Construction phase above. A site-specific Emergency Spill Prevention and Response Plan will be implemented to reduce and control potential releases of hazardous materials related to fuel transport and potentially other activities.

During the Operation and Management Phase, vegetation management will be periodically required adjacent to the mine site, mine infrastructure, and within the right-of-way for the proposed haulage and access roads. Vegetation management will consist primarily of mechanical control of vegetation, although the use of herbicides may be considered where undesirable species persist. Vegetation control during the Operations and Maintenance phase could pose a hazard to rare plant species, either through direct disturbance or indirectly by modifying their habitat, such as through loss of an overstory canopy and increased competitive pressure from species more adapted to open, disturbed conditions. Furthermore, the release of sediment into watercourses and wetlands during activities associated with road maintenance could have a detrimental effect on the survivability of rare plant species and uncommon communities in these and adjacent habitats. Potential interactions between vegetation management activities within the road right-of-way corridor and the occurrence of rare plants and/or uncommon communities will be reduced through avoidance, where possible. Labec Century will be informed of the occurrence of rare plants along the route, and effects on adjacent habitats, particularly wetlands, will be reduced by avoiding the operation of machinery and controlling for erosion and sedimentation by managing sediment-laden runoff within these habitats, where possible.

The potential effects of progressive rehabilitation during the Operations and Maintenance phase will occur primarily, if not exclusively, within areas already disturbed during site preparation (discussed in detail in Section 17.6). Progressive rehabilitation is a strategy that reduces the extent of disturbance undertaken as a result of the Project at any one time and reclaims disturbances as soon as possible after they are no longer needed. To make progressive rehabilitation possible, soil that is disturbed in the mining and Construction process will be removed, segregated and stockpiled. At the same time, seeds from local native plants, shrubs and trees will be collected and properly stored for future reclamation. This enables the land to be reclaimed to a natural landscape that meets the needs of local stakeholders, and will provide opportunities for improvements to (or the restoration) of wetland function, including the provision of aquatic and wildlife habitat. Rehabilitation initiatives will be conducted in accordance with applicable statutes and regulations and are anticipated to achieve a net positive effect on biodiversity by maintaining, enhancing, or preserving an area of equal or greater habitat value.

During Closure and Decommissioning, potential environmental effects associated with decommissioning and reclamation can be mitigated through the application of BMP, or codified practices. A Rehabilitation and Closure Plan will be developed in accordance with the applicable standards and regulations, guidelines and reference documents at the time of decommissioning. Established procedures are available for 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 EMP. The potential effects of this Project phase are likely to be reduced through adherence to the Project's EMP in strict compliance with applicable federal and provincial Acts and Regulations.

Site decommissioning and reclamation will result in changes to rare plant species and uncommon plant communities, including potential indirect effects through facilitation of competitive interactions with exotic or weedy species; however, the areas affected are likely to be previously disturbed, and the net change in rare plant species and uncommon communities is expected to be positive. With good planning, including the application of appropriate native species using seed mixes that meet the requirements of federal, provincial, and/or municipal weed control regulations and guidelines, there should be a net positive effect on plant as a result of reclamation. Furthermore, transplantation of plant species of conservation concern to alternate sites of suitable habitat will be undertaken, where feasible.

The success of re-vegetation will be monitored annually for the first three years after progressive reclamation, or until re-vegetation is successful.

Dust will be generated throughout the life of the Project by vehicles travelling on unpaved roads, blasting (pits and/or quarries), wind erosion, excavation of soil, overburden and bedrock, or the transportation of materials or processing of iron ore, or potentially other activities. Dust particles suspended in the air can potentially directly affect the surrounding vegetation by physically damaging cells, blocking stomata and affecting plant respiration and transpiration, and reducing the amount of light reaching photosynthetic cells, and overall reductions in growth. The effects of dust have been found to occur up to 200 m from roads, but mostly within a 100 m distance (Santelmann and Gorham 1988). Indirectly, dust can result in increased susceptibility of plants to drought, insects, disease and pathogens, in addition to changes in soil biogeochemistry by affecting soil pH and physio-chemical dynamics. Chemically active dust, such as highly alkaline limestone dust or a highly acidic dust, can affect the pH of the soil and the plant surfaces, becoming toxic to plant life over time (Turner 2012). Peat-dominated communities and epiphytic lichens are particularly sensitive to road dust (Santelmann and Gorham 1988).

The effects of dust can be mitigated using standard operating practices and through the application of BMP or codified practices including the use of dust suppressants, as well as progressive rehabilitation techniques. Although the NLEPA does not require permits for the application of dust suppressants in NL, all suppressants should first be approved in consultation with appropriate regulating agencies in the event that additional conditions may be required on a case by case basis.

17.4.2.2 Change in Habitat (Bird and Wildlife SAR/SOCC)

Several Project activities may alter habitat, but can be mitigated using standard operating procedures and/or through the application of BMP or codified practices, or other mitigation measures. This includes the alteration of habitat as a result of sensory disturbances or potentially through contamination (e.g., hydrocarbon spill, site runoff).

During the Construction phase, the construction of site buildings and associated infrastructure, installation of water supply infrastructure, on-site vehicle/equipment operation and maintenance, waste management, and transportation of personnel and goods to site are expected to be within the area cleared during site preparation (and assessed in detail in Section 17.6), and thus not anticipated to result in an increase in the amount of habitat lost. However, increased sensory disturbances (e.g., dust and noise) associated with these activities may reduce the suitability of (i.e., alter) habitats in the surrounding environment. For example, dust may have an environmental effect on habitat quality for some species, through direct effects on growth of the surrounding vegetation (e.g., Boulanger et al. 2012). Mosses in particular may be sensitive to dust exposure along roads (Male and Nol 2005). Noise produced as a result of activities during Construction may also reduce the suitability of habitats for some species. Dust and noise may be generated by vehicles travelling on unpaved roads, blasting (pits and/or quarries), or during other activities throughout the life of the Project. There is also the potential for small fuel spills (leaks) or release of other hazardous materials with potential effects on habitat. Activities such as handling and storage of fuel and other hazardous materials are regulated by law and will comply with applicable standards and regulations, guidelines and reference documents.

During Operations and Maintenance, all Project activities are rated as 1 with the exception of progressive rehabilitation, dewatering Joyce Lake, and waste rock disposal on surface. Aside from these, Project activities will occur within an area that is already cleared and are not anticipated to involve further ground disturbance activities or the addition of Project-related infrastructure. Thus, these activities have very limited potential to cause direct adverse environmental effects on habitat.

Vegetation management will be periodically required during Operations and Maintenance to control the growth of trees and tall shrubs. This will primarily involve mechanical control of vegetation (e.g., access road grading), although the use of herbicides may be considered. This activity is unlikely to cause further disturbance to habitat, as clearing activities will be of short duration, limited to the PDA, and in the area already disturbed as a result of Project construction. Sediment release into watercourses and wetlands may also occur during activities associated with road maintenance and other vegetation management, and may influence habitat, particularly for SAR/SOCC species associated with wetlands (e.g., spring peeper). The effects due to operational maintenance activities (access road grading and ditching) and sedimentation will be managed using standard measures and BMP to reduce potential interactions.

During the Closure and Decommissioning phase, site decommissioning will also occur in areas previously disturbed.

In general, Project activities are expected to be local and/or short-term, and sensory disturbances can be mitigated using standard operating practices and/or through the application of codified or BMP, including dust and noise suppression, as well as progressive rehabilitation techniques. A site-specific Emergency Spill Prevention and Response Plan will be implemented to reduce and control potential releases of hazardous materials.

17.4.2.3 Change in Distribution and Movement (Birds and Wildlife SAR/SOCC)

Several Project activities will interact with the distribution and movement of Bird and Wildlife SAR/SOCC, but can be mitigated through standard operating procedures and/or the application of BMP or codified practices. These include maintenance of the causeway, water treatment and discharge, waste management, transportation of personnel and goods to site, fuel transport, and fuel storage and dispensing. Disturbance associated with these activities include primarily chemical hazards and attractants, as well as potentially other sensory disturbances (e.g., dust, wastes). On-site wastes, if not disposed of properly, as well as human presence in general, may attract species such as bear, fox, and some birds that associate these with a potential food source.

Environmental protection and mitigation measures will be applied to avoid or reduce potential effects on distribution and movement, including avoidance of sensitive species and their habitats, allowing wildlife to pass through the PDA without harassment, and nuisance bear management programs. Specific mitigation measures related to the distribution and movement of wildlife will be detailed in the EMP.

17.4.2.4 Change in Risk of Mortality (Birds and Wildlife SAR/SOCC)

A variety of Project activities have the potential to increase risk of mortality of Bird and Wildlife SAR/SOCC, but not to an extent that would affect the sustainability of the population, given implementation of standard operating procedures and/or through the application of BMP or codified practices. These include the construction of site buildings and associated infrastructure, construction of stream crossings, installation of water supply infrastructure, and waste management. Direct mortality related to these activities will be negligible, as low numbers of SAR/SOCC are likely to occur in the PDA in general, and any Bird and Wildlife SAR/SOCC would likely be displaced due to ongoing sensory disturbance (e.g., noise, visual) associated with site preparation (discussed in Section 17.6).

An increased risk of mortality during construction of stream crossings and/or the causeway applies primarily to species associated with aquatic habitats in the PDA and with relatively limited mobility during one or more life stage. For Bird and Wildlife SAR/SOCC in the LSA, this is limited to spring peeper. This species is found in ponds surrounded by forest, shrub, swamp and forested wetlands and is likely uncommon in the LSA (GENIVAR 2013b). Stream crossings will be constructed according to applicable standards and legislation, and will permit drainage to freely pass underneath the roadway, and the number of crossings will be limited to reduce potential changes to mortality risk.

During Operations and Maintenance, maintenance of the causeway, open pit mining, dewatering Joyce Lake, ore processing, waste rock disposal on surface, water treatment and discharge, waste management, fuel storage and dispensing, and progressive rehabilitation will similarly occur in an area where few SAR/SOCC will likely be associated with these activities, as they are expected to have been already displaced as a result of Project construction activities. Activities associated with mine and surface water treatment and discharge (e.g., diversion ditches, settling ponds, testing, treatment and monitoring) will be conducted in compliance with relevant legislation so that regulated limits are met prior to discharge. For aquatic species such as amphibians, natural drainage patterns at the open pit and other areas will be maintained, to the extent feasible, to reduce the potential risk of mortality.

During site decommissioning, the risk of mortality is also low, given the anticipated previous displacement of birds and wildlife.

In terms of emissions (e.g., effluents) or other potential sources of contamination (e.g., fuel spill), staff will be trained in handling, storage and disposal methods, and activities will be conducted in accordance with manufacturer recommendations and in compliance with applicable legislation. Infrastructure and activities associated with mine and surface water treatment (e.g., settling ponds, testing, treatment and monitoring) will be conducted in compliance with relevant legislation so that regulated limits are met prior to discharge. A site-specific Emergency Spill Prevention and Response Plan will be implemented to reduce, maintain and control potential releases of hazardous materials.

Specific environmental protection and mitigation measures that will be applied to avoid or reduce potential effects on risk of mortality of Bird and Wildlife SAR/SOCC will be detailed in the EMP.

17.4.2.5 Change in Health (Birds and Wildlife SAR/SOCC)

During Construction, Project activities that can be mitigated using standard operating procedures and BMP, or codified practices, are on-site vehicle/equipment operation and maintenance, waste management, and transportation of personnel and goods to site. Activities during Operations and Maintenance include maintenance of causeway, water treatment and discharge, on-site vehicle/equipment operation and maintenance, waste management, transportation of personnel and goods to site, fuel transport, and fuel storage and dispensing.

Changes in health may occur indirectly through stress (e.g., from dust), or directly through contamination. Standard and proven mitigation measures will be implemented to reduce the amount of dust produced, including the use of water on roads and progressive rehabilitation to reduce dispersal of particulates.

Direct effects on change in health of Bird and Wildlife SAR/SOCC include sources of contaminants including used oil, lubricants, solvents, grease, and batteries associated with site waste management, and equipment and camp operations. Species that may be attracted to areas of food preparation and waste management areas have the greatest potential for exposure. All staff will be trained in handling, storage and disposal methods, and all activities will be conducted in accordance with manufacturer recommendations and in compliance with applicable legislation. A site-specific Emergency Spill Prevention and Response Plan will be implemented to reduce, maintain and control potential releases of hazardous materials. Specific environmental protection and mitigation measures that will be applied to reduce potential effects on health will be detailed in the EMP.

17.4.3 Interactions Rated as 2

A detailed environmental effects analysis (Section 17.6) was completed for interactions that have the potential to result in significant adverse environmental effects on SAR and SOCC (i.e., rated as 2 in Table 17.7; note Accidents and Malfunctions are discussed in Section 17.8). Project-VC interactions assessed in detail include the following activities, by Project phase:

- Construction: site preparation, construction of roads, construction of causeway, construction of site buildings and associated infrastructure, construction of rail loop and associated infrastructure, construction of stream crossings, installation of water supply infrastructure, on-site vehicle/equipment operation and maintenance, and transportation of personnel and goods to site.
- Operations and Maintenance: open pit mining, dewatering Joyce Lake, ore processing, waste rock disposal on surface, water treatment and discharge, rail load-out and transport, on-site vehicle/equipment operation and maintenance, transportation of personnel and goods to site, fuel transport, and progressive rehabilitation.
- Closure and Decommissioning: site decommissioning and site reclamation.

Note that each Project activity listed above does not necessarily interact with all SAR/SOCC. For example, on-site vehicle/equipment operation and maintenance and transportation of personnel and goods to site are rated as 2 for Change in Distribution and Movement and Mortality Risk of Bird and Wildlife SAR/SOCC, but rated as 1 for Change in Habitat and Health of birds and wildlife, as well as rated as 1 for Change in Rare Plant Species and Uncommon Plant Communities. Refer to Table 17.7 for ratings of interactions.

17.5 Existing environment

17.5.1 Information Sources

Information to support the identification of SAR and SOCC with potential to occur in the RSA was based on information provided by the AC CDC and from CDPNQ databases, and a review of existing rare plant literature (Waterway and Lei 1982; Blondeau 2000; CDPNQ 2008; Dignard et al. 2009) and literature related to Birds and Wildlife (e.g., BBS 2013, eBird 2013, QBBA 2013, LIM 2009, Groupe Hémisphères 2008, NML 2009).

17.5.2 Methodology for Characterization of Baseline Conditions

17.5.2.1 Rare Plant and Uncommon Plant Communities

For the purpose of the survey, plant SAR/SOCC, including their habitats, were the focus with an emphasis on species listed nationally as “at risk” (Endangered, Threatened or of Special Concern) under Schedule 1 of SARA; those listed as Endangered, Threatened or Vulnerable under the NLESA; assessed as “at risk” by COSEWIC or the Newfoundland and Labrador SSAC or those listed Threatened, Vulnerable or likely to be designated under Québec’s *Act respecting threatened or vulnerable species*.

The surveys for rare vascular plants were undertaken on August 4 and from August 14 to August 24, 2012 and from August 5 to 12, 2013 (Figure 17.1). Random survey transects were used to locate rare plants. In 2012 and 2013, a total of 95 km (as recorded on the GPS tracklog) of linear transects were visited by the main field botanist. The survey crews made dedicated efforts to record the presence of species of conservation concern during the entire field campaigns. More thorough survey were conducted in habitats where these species were most likely to be found, such as wetlands (fens), flood plains of slow-moving rivers and streams, and unique rock outcrops and landforms (i.e., calcicolous and chionophilic habitats). In the event a community of SOCC was found, the following information was collected: coordinates, number of specimens, plant sociology, digital photographs and a brief description of physical setting and habitat. Details on field surveys are available in the Vegetation Baseline Study and the Rare Plant Survey Report (Appendix U and Appendix AA, respectively).

17.5.2.2 Bird and Wildlife SAR/SOCC

Field surveys for birds were conducted in 2012 to document all species, including SAR/SOCC within the LSA (refer to Appendix X, Avifauna Baseline Study, for details on survey methodology). A review of available literature was carried out to determine the presence of other wildlife species, including SAR/SOCC, present or likely to be present within the RSA. Information concerning large mammals, furbearers, small mammals, bats, and amphibians was searched in existing documents, including scientific journals, government reports, and available studies conducted in the Schefferville are (Mammal and Herpetofauna Baseline Study (Appendix Y).

17.5.3 Baseline Conditions

17.5.3.1 Rare Plant and Uncommon Plant Communities

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 the LSA. One species, Norwegian Arctic-cudweed (*Omalotheca norvegica*) is a rare species in Canada (Argus and Pryer 1990), and on the COSEWIC Candidate List. Norwegian Arctic cudweed was observed more than 25 years ago in the vicinity of Schefferville, on the shore of a creek (CDPNQ 2008; Groupe Hémisphères 2008). It was observed again during surveys of the LSA in 2012 (GENIVAR 2013a) (Table 17.8). Attempts to relocate this occurrence during the 2013 surveys from the gravelly shoreline where it had originally been found were unsuccessful. A lack of success in locating the species may be attributed to 1) having arrived to the site either too early or too late in the season, 2) environmental conditions (especially annual rainfall and water levels in Joyce Lake) being inappropriate in the given year relative to the flowering and development of the plant populations, or 3) the search efforts of the surveyor. For these reasons, except in cases for which the absence of the species is clearly attributable to some disturbance, or drastic alteration of the landscape (e.g., development), a conservative approach to the assessment will be followed and it is expected that occurrences of this species will continue to be found in the area. No other populations were observed during surveys of the PDA and LSA.

A number of vascular plant SOCC have previously been recorded in western Labrador (AC CDC 2012) whose preferred habitat may occur within the Project Study Areas:

- RSA: Based on the AC CDC database, the CDPNQ (2008), existing literature and the 2012-2013 surveys, 143 plant SOCC from within or adjacent to the RSA were identified for the Project area. Of these 143 rare plant species, 73 were observed during field surveys in 2012 (58 species) and/or 2013 (45 total species, including 15 newly identified species), while the remaining species were identified from the review of existing literature.

- Nine species as identified during the surveys in the Schefferville area are considered rare and/or new to the region. These are: field pussitoes (*Antennaria neglecta*), alpine cliff fern (*Woodsia alpina*), auricled twayblade (*Listera auriculata*), northern bog clubmoss (*Lycopodiella inundata*), Michaux's sedge (*C. michauxiana*), white cotton-grass (*Eriophorum scheuchzeri* subsp. *scheuchzeri*), beautiful sandwort (*Minuartia rubella*), Wettstein's eyebright (*Euphrasia wettsteinii*) and timber oatgrass (*Danthonia intermedia* subsp. *intermedia*). None of these were found in the LSA during the 2012 and 2013 surveys.

- LSA: Within the LSA, 36 species with conservation status were found during the 2012 and 2013 surveys (Table 17.8). Among these, 17 were given more attention based on their rate, conservation priority, general status and number of occurrences. After an examination of the number of found and published occurrences, information provided by NLDOECC (C. Hanel, pers. comm. 2013), recent distribution maps (Payette 2013, Vascan Database [Brouillet et al. 2010+], FNA 1993+) and suitable habitats in the region, eight species were considered potentially more vulnerable to the Project, as only one (n=6) or two (n=2) occurrences were found in the LSA. These include: sticky false asphodel (*Triantha glutinosa*), Indian pipe (*Monotropa uniflora*), Richardson's pondweed (*Potamogeton richardsonii*), small pondweed (*Potamogeton pusillus* subsp. *tenuissimus*), Siberian water-milfoil (*Myriophyllum sibiricum*), northern water-starwort (*Callitriche hermaphroditica*), slender stinging nettle (*Urtica dioica* subsp. *gracilis*), lesser-panicled sedge (*Carex diandra*) and creeping sandwort (*Arenaria humifusa*). For some of these eight species, additional population(s) were found in the RSA. The other species among the 17 given more attention were found in higher numbers and are considered to be more common.

Table 17.8 Rare Plant Species Occurrences in the LSA and RSA based on 2012 and 2013 Surveys and Existing Literature

Scientific Name	Common Name	S Rank[1]	NLDOECC Priority[2]	General Status[3]	COSEWIC	LEMV[4]	Occurrence[5]		Total Occurrence	Total with Historical Records[8]
							LSA[6]	RSA[7]		
SAR										
Omalotheca norvegica	Norwegian Arctic-cudweed	S2S3	High	Sensitive	Low Priority Candidate		1		1	3
SOCC										
Potamogeton richardsonii	Richardson's pondweed	S1S3	High	Undetermined			2	1	3	5
Triantha glutinosa	Sticky false asphodel	S1S3	Medium	Undetermined			1	1	2	4
Potamogeton pusillus subsp. *tenuissimus*	Small pondweed	S1S3		Undetermined			1		1	5
Platanthera aquilonis	Northern green orchid	S2S3	Medium	May be at risk			1	3	4	5
Urtica dioica subsp. *Gracilis*	Slender stinging nettle	S2S3	Low	Sensitive			1		1	2
Ranunculus lapponicus	Lapland buttercup	S2S3	Medium	Sensitive			3	1	4	7
Carex glacialis	Glacial sedge	S2S3	Medium	Sensitive		Threatened	2	9	11	14
Salix pedicellaris	Bog willow	S2S4	Low	Sensitive			7	11	18	24
Packera aurea	Golden ragwort	S2S4	Low	Undetermined			1	1	2	5
Pyrola asarifolia	Pink pyrola	S2S4	Low	Undetermined			4	1	5	7
Pedicularis groenlandica	Elephanthead lousewort	S2S4	Low	Undetermined			2	2	4	8
Schizachne purpurascens	False melic	S2S4	Low	Undetermined			2	8	10	13
Salix ballii	Ball's willow	S2S4	Low	Undetermined			5	6	11	13
Vahlodea atropurpurea	Mountain hairgrass	S2S4	Low	Undetermined			3	11	14	17
Carex diandra	Lesser panicled sedge	S2S4	Medium	Undetermined			1	1	2	3
Equisetum variegatum subsp. *variegatum*	Variegated scouring rush	S3	Low	Sensitive			2	1	3	4
Carex chordorrhiza	Creeping sedge	S3	Low	Sensitive			1	3	4	7
Taraxacum lapponicum	Lapland dandelion	S3	Low	Sensitive			4	11	15	20
Arenaria humifusa	Creeping sandwort	S3	Medium	Sensitive			1	1	2	4
Callitriche hermaphroditica	Northern water-starwort	SNA	High	Not Assessed			1		1	1

Table 17.8 Rare Plant Species Occurrences in the LSA and RSA based on 2012 and 2013 Surveys and Existing Literature

Scientific Name	Common Name	S Rank[1]	NLDOECC Priority[2]	General Status[3]	COSEWIC	LEMV[4]	Occurrence[5]		Total Occurrence	Total with Historical Records[8]
							LSA[6]	RSA[7]		
Diphasiastrum sabinifolium	Cedar like clubmoss	SNA	Low	Not Assessed			1	3	4	5
Myriophyllum sibiricum	Siberian water-milfoil	SNR	High	May be at risk			2		2	5
Eriophorum russeolum subsp. *russeolum*	Russet cotton-grass	SNR	Low	Not Assessed			6	11	17	22
Betula pumila var. *glandulifera*	Northern bog birch	SNR		Not Assessed			10	1	11	14
Spinulum canadense	Northern interrupted clubmoss	SNR		Not Assessed			14	13	27	29
Huperzia appressa	Mountain firmoss	SNR	High	Undetermined			2	9	11	15
Carex utriculata	Northwest Territory sedge	SNR	Low	Undetermined			4	3	7	9
Rhinanthus minor subsp. *groenlandicus*	Arctic rattlebox	SNR	Low	Undetermined			1	5	6	10
Fragaria virginiana subsp. *glauca*	Virginia strawberry	SNR	Low	Undetermined			5	7	12	15
Elymus trachycaulus subsp. *trachycaulus*	Slender wheatgrass	SNR	Low	Undetermined			6	12	18	23
Calamagrostis canadensis var. *canadensis*	Bluejoint	SNR	Low	Undetermined			17	27	44	51
Monotropa uniflora	Indian pipe	SNR	Medium	Undetermined			1		1	1
Moehringia macrophylla	Largeleaf sandwort	SNR	Medium	Undetermined			1	2	3	6

Table 17.8 Rare Plant Species Occurrences in the LSA and RSA based on 2012 and 2013 Surveys and Existing Literature

Scientific Name	Common Name	S Rank[1]	NLDOECC Priority[2]	General Status[3]	COSEWIC	LEMV[4]	Occurrence[5]		Total Occurrence	Total with Historical Records[8]
							LSA[6]	RSA[7]		
Carex arcta	Northern cluster sedge	SNR	Medium	Undetermined			1	4	5	7
Viola renifolia	White violet	S1S3	Medium	Undetermined				5	5	6

Note:
Species highlighted with gray shading were given more attention in this report considering their conservation priority, General Status rank and low number of occurrences found during the 2012-2013 surveys.
[1] Priority rank as established by the AC CDC (2010) for Labrador species.
[2] NLDOECC priority after partial consultation of the Vegetation Baseline Rare Plant List
[3] NLDFFA Wildlife Division General Status
[4] *Loi sur les espèces menacées et vulnérables du Québec*: SDMV: Likely to be designated threatened or vulnerable.
[5] Number of plant occurrences in the LSA and RSA as determined through field surveys in 2013 and 2014.
[6] LSA.
[7] RSA (numbers of occurrences found outside of the LSA).
[8] Information sources: Viereck 1957, Dutilly and Lepage 1962,Hustich 1963 and 1965, Dutilly and Lepage 1964, Harper 1964, Hustich 1971, Waterway et al. 1984, Blondeau 2000, CDPNQ 2008, NML 2009, LIM 2009, AC CDC 2012, Payette 2013.

The Project construction is expected to result in a permanent loss of 4.7% (32 ha of 687.5 ha) of wetland area and associated functions, and Project Operation and Maintenance may affect an additional 2.6 ha of wetland area and its associated functions in the LSA. That area may include some of the identified locations supporting plant species of conservation concern. In general, the examination of existing information and the results of field studies illustrated that habitats in the RSA and the LSA support a diversity of flora species common to Labrador. Of the eight species identified as being most vulnerable to the Project, the floristic affinities of most of these indicate that they are associated with wetlands, while some others with calcicolous habitat. Project effects will focus on the occurrence of Norwegian Arctic-cudweed, in addition to eight SOCC species known or thought to be present within (or in close proximity to) the PDA.

17.5.3.2 Birds

Table 17.9 summarizes bird species that may occur in the LSA and their conservation and/or legal status. Several of these species are legally protected under SARA and/or the NLESA and have previously been recorded in western Labrador (Groupe Hémisphères 2008; LIM 2009; NML 2009; BBS 2013; eBird 2013; QBBA 2013;):

- Harlequin Duck *(Histrionicus histrionicus):* Listed as a species of Special Concern under SARA and Vulnerable under NLESA; was not observed during baseline surveys in 2012. This species was identified as possibly occurring the Howells River basin (LIM 2009), located just beyond the RSA boundary.

- Peregrine Falcon (*Falco peregrinus*): Listed as a species of Special Concern under SARA, and Vulnerable under NLESA; was not observed during baseline surveys in 2012 and suitable nesting cliffs were not found in the LSA. No records exist in the Schefferville area based on consulted sources (LIM 2009; NML 2009; Groupe Hémisphères 2008).

- Common Nighthawk (*Chordeiles minor*): Listed as Threatened under SARA; in Labrador, this species is generally found in the south, including areas near Labrador City and Wabush. This species was not observed during baseline surveys in 2012.

- Short-eared Owl (*Asio flammeus)*: Listed as a species of Special Concern under SARA, and Vulnerable under NLESA; was not observed during baseline surveys in 2012 and observations in Labrador are mainly located on the coastline and have occurred near Labrador City and Wabush during spring migration and also during the breeding period (Schmelzer 2005).

- Olive-sided Flycatcher (*Contopus cooperi*): Listed as Threatened under SARA and NLESA; there is one record of this species for the Schefferville area in 2005 (eBird 2013). The next closest records are from BBS route 57037 near Ossok (175 km southeast of the LSA), where it is recorded regularly (BBS 2013). The species was not observed during baseline surveys in 2012.

Table 17.9 Bird Species that May Occur in the LSA and Their Status/Conservation Rank

Species	Legal Status				AC CDC Rank
	COSEWIC	SARA	NLESA	ARTVS	
Canada Goose	-	-	-	-	-
American Black Duck	-	-	-	-	-
Northern Pintail	-	-	-	-	-
Lesser Scaup	-	-	-	-	-
Black Scoter*	-	-	-	-	-
Surf Scoter	-	-	-	-	-
White-winged Scoter	-	-	-	-	S5N
Common Goldeneye	-	-	-	-	-
Bufflehead	-	-	-	-	S1S2?
Hooded Merganser	-	-	-	-	S2B
Harlequin Duck*	SC	SC	V	V	-
Spruce Grouse	-	-	-	-	-
American Kestrel*	C3	-	-	-	S1S2B
Merlin*	-	-	-	-	-
Peregrine Falcon*	SC	SC	V	V	-
Semipalmated Plover*	-	-	-	-	-
Caspian Tern					S1B
Greater Yellowlegs	-	-	-	-	-
Lesser Yellowlegs	T				S3N
Solitary Sandpiper	-	-	-	-	-
Spotted Sandpiper	-	-	-	-	-
Least Sandpiper	-	-	-	-	-
Short-billed Dowitcher	-	-	-	-	-
Wilson’s Snipe	-	-	-	-	-
Red-necked Phalarope	-	-	-	-	-
Short-eared Owl*	SC	SC	V	LDTV	-
Common Nighthawk*	T	T	T	-	S2B

Table 17.9 Bird Species that May Occur in the LSA and Their Status/Conservation Rank

Species	Legal Status				AC CDC Rank
	COSEWIC	SARA	NLESA	ARTVS	
Belted Kingfisher*	C3	-	-	-	-
American Three-toed Woodpecker	-	-	-	-	-
Black-backed Woodpecker*	-	-	-	-	-
Alder Flycatcher	-	-	-	-	-
Yellow-bellied Flycatcher	-	-	-	-	-
Olive-sided Flycatcher*	T	T	T	LDTV	-
Red-eyed Vireo	-	-	-	-	S2B
Northern Shrike	-	-	-	-	-
Gray Jay	-	-	-	-	-
Boreal Chickadee	-	-	-	-	-
Winter Wren*	-	-	-	-	S2B
Golden-crowned Kinglet*	-	-	-	-	S1B?
Ruby-crowned Kinglet	-	-	-	-	-
Gray-cheeked Thrush	-	-	V	-	
Hermit Thrush	-	-	-	-	-
Bohemian Waxwing*	-	-	-	-	-
Cedar Waxwing					S2B
Northern Waterthrush	-	-	-	-	-
Tennessee Warbler	-	-	-	-	-
Nashville Warbler*					S1B?
Orange-crowned Warbler	-	-	-	-	-
Yellow Warbler	-	-	-	-	-
Blackpoll Warbler	-	-	-	-	-
Palm Warbler*	-	-	-	-	-
Yellow-rumped Warbler	-	-	-	-	-
Fox Sparrow	-	-	-	-	-
Lincoln’s Sparrow	-	-	-	-	-

Table 17.9 Bird Species that May Occur in the LSA and Their Status/Conservation Rank

Species	Legal Status				AC CDC Rank
	COSEWIC	SARA	NLESA	ARTVS	
Swamp Sparrow	-	-	-	-	-
White-crowned Sparrow	-	-	-	-	-
Rusty Blackbird	SC	SC	V	LDTV	S3S4B
Pine Grosbeak	-	-	-	-	-
White-winged Crossbill	-	-	-	-	-

Notes:
Sources: COSEWIC (2014), SARA: Government of Canada (2014; 2021), NLESA: NLDOECC (2013), ARTVS: MRN (2013a), AC CDC (2014)
* indicates the species was not observed during field surveys.
Legend: T: threatened, V: vulnerable, SC: special concern, LDTV: likely to be designated threatened or vulnerable, C3: low priority candidate species, S#/S#: a range between two numeric ranks/denotes uncertainty about the exact rarity of the species, S1B?: extremely rare breeder in Labrador -- ? denotes rank uncertainty, S2B: rare breeder, S3N: uncommon migrant (non-breeder), S5N: abundant migrant.

- Grey-cheeked Thrush (*Catharus minimus*): Listed as Vulnerable under NLESA; observed at four locations during baseline surveys in 2012, only in burnt-over areas under various stages of regeneration.

- Rusty Blackbird (*Euphagus carolinus*): Listed as Special Concern under SARA and Vulnerable under NLESA; there were 12 records during baseline surveys in 2012 and its breeding was also confirmed. The species was mainly observed in fen and bog wetlands.

Many of the species in Table 17.9 and noted by Rich et al. (2004) and North American Waterfowl Management Plan (2004), or during baseline surveys in 2012, are likely common in the LSA as they are typical of the taiga shield bird/waterfowl conservation region and/or were observed in prime habitat in the LSA. All of the shorebirds are listed at some degree of conservation concern in the province of Québec or at the continental scale, due to long-term population trends observed on migration and/or total estimated population size (Aubry and Cotter 2007; Donaldson 2000).

There were four species identified in the LSA with small breeding populations in Labrador (AC CDC 2014) and likely at the northern limit of their range: Bufflehead (*Bucephala albeola*), Hooded Merganser (*Lophodytes cucullatus*), Red-eyed Vireo (*Vireo olivaceus*) and Cedar Waxwing (*Bombycilla cedrorum*). In addition, two species previously not thought to breed in Labrador (AC CDC 2014) were confirmed breeding in the LSA: White-winged Scoter (*Melanitta fusca*) and Lesser Yellowlegs (*Tringa flavipes*).

In addition to the SAR discussed above (i.e., Harlequin Duck, Peregrine Falcon, Short-eared Owl and Olive-sided Flycatcher), a number of other species with conservation status listed in Table 17.9 were cited by one or more sources as likely present in the RSA, but were not found during the 2012 field surveys: Black Scoter (*Melanitta americana*), American Kestrel (*Falco sparverius*), Merlin (*Falco columbarius*), Semipalmated Plover (*Charadrius semipalmatus*), Belted Kingfisher (*Megaceryle alcyon*), Black-backed Woodpecker (*Picoides arcticus*), Winter Wren (*Troglodytes hiemalis*), Golden-crowned Kinglet (*Regulus satrapa*), Bohemian Waxwing (*Bombycilla garrulus*), Nashville Warbler (*Oreothlypis ruficapilla*) and Palm Warbler (*Setophaga palmarum*).

17.5.3.3 Other Wildlife

The wolverine is designated Endangered in Labrador under the NLESA (NLDOECC 2013) and federally under SARA (COSEWIC 2013; Government of Canada 2014). Its presence in the RSA is highly unlikely given that there have been no confirmed records in Labrador since 1955 (Knox 1994; NLDOECC 2013). In the past, wolverine was common throughout Labrador and Québec, particularly up until the late 1800s (Fortin et al. 2005; MRN 2010). A Wolverine Recovery Team has established a National Recovery Plan for Wolverine (Eastern Population), tasked with the goal of establishing a self-sustaining population of wolverines in Quebec and Labrador.

In December 2014, two species of bat – little brown myotis (*Myotis lucifugus*) and northern myotis (*Myotis septentrionalis*) – were designated as Endangered under the *SARA*, due to rapid declines and high mortality in hibernacula related to white-nose syndrome (WNS). The predicted rates of decline suggest that these species could be functionally extirpated (<1% of the population remaining) in the near future. The northward spread of the fungus *Geomyces destructans* causing WNS is rapid, spreading 200 to 400 km/year, but could be limited by low temperatures in hibernacula in high boreal and subarctic climates (Frick et al. 2010; Verant et al. 2012; COSEWIC 2013). Mortality linked to WNS has been confirmed in the boreal forest as far north as the regions of Abitibi in 2010-2011 and Saguenay-Lac-Saint-Jean in 2011-2012 (COSEWIC 2013; MRN 2013b). Individual bats (species unconfirmed) were recorded south of Schefferville (inside the RSA) as well as in the Howell's River catchment (just beyond the boundary of the RSA). Their presence in the LSA is possible (NML 2009; Clément 2009).

At least two mammal SOCC may occur in the LSA. Pygmy shrew (*Sorex hoyi*) has an AC CDC rank of S1? and least weasel (*Mustela nivalis*) has an AC CDC rank of S2?. Other SOCC that have a low likelihood of occurrence in the PDA or RSA are Water Shrew (*Sorex palustris*; AC CDC rank of S1?), Rock Vole (*Microtus chrotorrhinus*; AC CDC rank of S1), Woodland Jumping Mouse (*Napaeozapus insignis*; AC CDC rank of S1S2), and Eastern Coyote (*Canis latrans*; AC CDC rank of S3?). These species were not recorded during surveys in support of the Project, or in support of other projects and initiatives in the area.

Limited historical fish and fish habitat information exists for watercourses and waterbodies within the LSA. However, some historical fish and fish habitat information exists for watercourses and waterbodies in the RSA. Additional information was gathered through in-field surveys of select, potentially affected watercourses and waterbodies. None of the fish species recorded in the Attikamagen Lake or Petitsikapau Lake watersheds are listed as Endangered, Threatened or of Special Concern under SARA or COSEWIC (COSEWIC 2014) and no critical habitats were identified in the watercourses. There are no known fish SAR within the RSA. Environmental effects of the Project on Fish and Fish Habitat are addressed in detail in Chapter 15: Fish and Fish Habitat.

Although the George River Caribou Herd has experienced a drastic decline in numbers in recent years, this species is not yet considered a SAR or SOCC. The George River Caribou Herd is addressed in Chapter 16: Birds, Wildlife and their Habitat.

While traditional knowledge pertaining specifically to SAR/SOCC was not identified, the traditional knowledge results identified in Chapter 3: Engagement and Traditional Knowledge have been considered and integrated throughout the assessment.

17.6 Assessment of Project-Related Environmental Effects

In this section, the changes in the immediate vicinity of the PDA (plant, bird and wildlife SAR/SOCC), and the LSA and RSA (bird and wildlife SAR/SOCC only) are assessed on the basis of baseline data, existing inventories and available biological information. Based on the discussion of Project interactions with the environment presented in Section 17.4 above, only the interactions rated as 2 are considered further in the assessment of Project related environmental effects. All other interactions previously rated as 0 or 1 were rated as not significant.

Each environmental effect [i.e., Changes in Rare Plant Species and Uncommon Plant Communities, Change in Habitat (Bird and Wildlife SAR/SOCC), Change in Distribution and Movement (Bird and Wildlife SAR/SOCC), Change in Mortality Risk (Bird and Wildlife SAR/SOCC), and Change in Health (Bird and Wildlife SAR/SOCC)] is assessed below for each Project phase (i.e., Construction, Operations and Maintenance, and Closure and Decommissioning), where interactions are expected to have the potential to result in significant adverse environmental effects on SAR and SOCC. Linkages between potential environmental effects are also considered (e.g., Change in Habitat may affect a Change in Distribution and Movement). Note that Wetlands, discussed in this chapter in relation to habitat, is assessed separately in Chapter 14: Wetlands.

No plant species listed and protected federally or provincially under SARA (Schedule 1) or NLESA were identified within the PDA or LSA for the Project. Additionally, none of the plant species identified during the surveys have been designated by COSEWIC (COSEWIC 2012). Norwegian Arctic-cudweed, a low-priority candidate species on COSEWIC's Vascular Plants Candidate List (COSEWIC 2011), was observed within or adjacent to the LSA (occurring on the gravelly shores of Joyce Lake). Although this species does not occur in the PDA, there is potential for this species to be affected by the Project as a result of the proposed dewatering of the lake.

Plant SOCC that are likely to occur in the LSA and used to assess the environmental effects of the Project are summarized in Table 17.10.

Table 17.10 Plant Species that may occur in the PDA or LSA and evaluated in the Environmental Effects Assessment

Species	Rationale for Selection*
Norwegian Arctic-cudweed (*Omalotheca norvegica*)	Low-priority candidate species on COSEWIC's Vascular Plants Candidate List (COSEWIC 2012). Assigned a priority of High after consultation with NLDOECC. Confirmed in LSA during 2012 field surveys; although attempts to relocate in 2013 were unsuccessful (naturally extirpated)
sticky false asphodel (Triantha glutinosa)	SOCC with AC CDC rank of S1S3. Assigned a priority of Medium after consultation with NLDOECC.
Indian pipe (*Monotropa uniflora*)	SOCC with AC CDC rank of SNR. Assigned a priority of Medium after consultation with NLDOECC.
Richardson's pondweed (*Potamogeton richardsonii*)	SOCC with AC CDC rank of S1S3. Assigned a priority of High after consultation with NLDOECC.
small pondweed (*Potamogeton pusillus* subsp. *tenuissimus*)	SOCC with AC CDC rank of S1S3. Priority status unassigned by NLDOECC.
Siberian water-milfoil (*Myriophyllum sibiricum*)	SOCC with AC CDC rank of SNR. Assigned a priority of High after consultation with NLDOECC.
northern water-starwort (*Callitriche hermaphroditica*)	SOCC with AC CDC rank of SNA. Assigned a priority of High after consultation with NLDOECC.
slender stinging nettle (*Urtica dioica* subsp. *gracilis*)	SOCC with AC CDC rank of S2S3. Assigned a priority of Low after consultation with NLDOECC, but with few recorded occurrences (2) in the RSA.
lesser-panicled sedge (*Carex diandra*)	SOCC with AC CDC rank of S2S4. Assigned a priority of Medium after consultation with NLDOECC.
creeping sandwort (*Arenaria humifusa*)	SOCC with AC CDC rank of S3. Assigned a priority of Medium after consultation with NLDOECC.

Notes:
*Status ranks are described in Table 17.4
Includes species of SAR/SOCC identified during dedicated surveys (GENIVAR 2013b, 2013c) and/or during other surveys or information sources in the general region.

Bird and Wildlife SAR/SOCC that are likely to occur in the RSA and used to assess the environmental effects of the Project are summarized in Table 17.11.

Table 17.11 Bird and Wildlife SAR and SOCC likely to occur in the PDA, LSA and/or RSA and evaluated in the Environmental Effects Assessment

Species	Rationale for Selection*
Little Brown Myotis (*Myotis lucifugus*)	SAR: Endangered under SARA
Pygmy Shrew (*Sorex hoyi*)	SOCC with AC CDC rank of S1?
Least Weasel (*Mustela Nivalis*)	SOCC with AC CDC rank of S2?
White-winged Scoter (*Melanitta fusca*)	SOCC: Confirmed breeding during 2012 field surveys; previously not thought to breed in Labrador (AC CDC rank of S5N, an abundant migrant)
American Kestrel (*Falco sparverius*)	SOCC with AC CDC rank of S1S2B
Lesser yellowlegs (*Tringa flavipes*)	SAR: Threatened under COSEWIC; AC CDC rank of S2N; Confirmed breeding during 2012 field surveys; previously not thought to breed in Labrador
Short-eared Owl (*Asio flammeus*)	SAR: Vulnerable under NLESA and Special Concern under SARA
Common Nighthawk (*Chordeiles minor*)	SAR: Threatened under the NLESA and SARA; AC CDC rank of S2B;
Olive-sided Flycatcher (*Contopus cooperi*)	SAR: Threatened under the NLESA and SARA; AC CDC rank of S2S3
Gray-cheeked Thrush (*Catharus minimus*)	SAR: Vulnerable under the NLESA
Nashville Warbler (Oreothlypis ruficapilla)	SOCC with AC CDC rank of S1B
Rusty Blackbird (*Euphagus carolinus*)	SAR: Vulnerable under NLESA and Special Concern under SARA; AC CDC rank of S3S4B
Golden-crowned Kinglet (*Regulus satrapa)*	SOCC with AC CDC rank of S1B
Spring Peeper (*Pseudacris crucifer*)	SOCC with AC CDC rank of S1S2

Notes:
*Status ranks are described in Table 17.4
Includes species of SAR/SOCC identified during Project-specific surveys (GENIVAR 2013b, 2013c) and/or during other surveys or information sources in the general region (e.g., LIM 2009, NML 2009, Quebec Breeding Bird Atlas 2013, BBS 2013, eBird 2013).

Each environmental effect (i.e., change in rare or uncommon plant communities, or change in habitat, distribution and movement, mortality risk or health of birds and wildlife) is assessed for each Project phase (i.e., Construction, Operations and Maintenance, and Closure and Decommissioning), where interactions are expected to have the potential to result in adverse environmental effects on SAR/SOCC. For each environmental effect, mitigation measures that will be implemented to reduce environmental effects are summarized, with details to be provided in the Project-specific EMP. The EMP will consolidate all the proposed environmental mitigation and is intended to promote effective and efficient implementation and compliance with regulatory and other requirements in relation to effects on SAR/SOCC.

Residual environmental effects, or effects remaining after mitigation is applied, are then characterized for change in habitat, distribution and movement, mortality risk and health. Linkages between residual effects are also considered (e.g., change in habitat may affect a change in distribution and movement). The characterization of residual environmental effects includes quantification (where possible) of the probable magnitude, geographic scope, duration, frequency, reversibility, and ecological/socio-economic context of the environmental effect. The determination of the significance of residual effects of the Project considers the combined effects of all identified pathways and provides an overall prediction of the potential risk posed by the Project for SAR/SOCC.

A conservative (or precautionary) approach was taken that reduces the chances for a mistaken determination that an effect is not significant, when in fact it likely would be. This includes the development of conservative assumptions (i.e., assumptions that err on the side of over-stating an effect) and recommending mitigation measures that are more than adequate to address environmental effects. Some of the assumptions and considerations made in this effects assessment are:

- Spatial limitations (i.e., minor data gaps) in existing vegetation map products (i.e., ELC) are primarily related to minor changes in the Project LSA. Specifically, re-routing of the proposed haul route resulted in a few small segments of the LSA not characterized (5% of the LSA). The inclusion of ancillary data to address the minor data gaps would likely reduce the accuracy of the assessment. The vegetation map produced for the LSA is considered to represent the most accurate data available.

- Habitat types (identified in the ELC) used to assess Project-related environmental effects containing only elements or portions of primary habitat of a species were ranked entirely as primary, so that loss of important habitats would be over- versus under-estimated.

- The area of primary habitat lost and/or altered to assess environmental effects assumes that the available habitat is saturated. As a conservative measure, with respect to characterization of the magnitude of the residual effect, <5% loss of habitat was used to represent a low effect, 5% to 25% loss of habitat was used to represent a moderate effect, and >25% was used to indicate a high environmental effect.

- If sufficient information is available on the habitat requirements of potentially occurring rare plant species (substrate, plant community, etc.), and the site in question is believed to be unsuitable for those species, a field visit may still be recommended to document and validate the assumptions for believing the species to be absent.

17.6.1 Assessment of Change in Rare Plant Species and Uncommon Plant Communities

17.6.1.1 Potential Environmental Effects

Construction

During the Construction of the Project native vegetation will be disturbed as a result of site preparation (i.e., clearing/grubbing of vegetation and excavation) and related construction activities. Areas requiring substantial site surface preparation are waste rock disposal areas, mine infrastructure area, processing plant site, rail loop, rail loading yard, all new roads, ROM ore stockpile, causeway, and ancillary infrastructure such as buildings, drainage infrastructure, fuel storage, sewage and water treatment units. Disturbance related to these activities will be localized (occurring primarily within the PDA) and temporary, lasting the duration of the Construction phase. Causeway construction will follow applicable laws, regulations, and standards, and will be constructed in accordance with recommendations made under approval from DFO.

The most substantive and likely interactions are the direct loss of rare plants and their habitats through ground disturbances associated with site preparation. Clearing and grubbing during site preparation will directly remove or disturb vegetation, and excavation and/or infilling will result in the permanent loss of some vegetation communities (i.e., wetlands). Table 17.12 presents the amounts and types of habitat that will potentially be disturbed or lost as a result of clearing/grubbing of vegetation and excavation of the PDA, where required. Upland ecosystems will be affected primarily by the clearing of 412 ha for the mine and mine infrastructure, with the Open Spruce-Moss Forest habitat type (136 ha or 33% of the PDA) being most affected (Table 17.12). Clearing for the mine site will affect 228 ha of upland, wetland and aquatic habitats and clearing of the haul route will affect 184 ha of these ecosystems. Most of this clearing will occur in the Open Spruce-Moss Forest habitat type. The area of clearing varies considerably among upland ecosystems, ranging from 33% of the PDA in the Open Spruce-Moss Forest habitat type to <1% of the PDA in the Highly Weathered Rock Barren habitat type. Avoidance of wetland ecosystems, where practicable, will affect substantially less habitat, with the clearing of 32 ha (8% of the PDA) for the mine site and associated mine infrastructure, including the haul route. Forested fen habitat types will be the most affected of wetlands by clearing at 20 ha (5% of the PDA).

Site preparation activities can also facilitate opportunities for colonization by non-native and invasive plant species. Because of various characteristics, including strong competitive abilities and diverse and highly effective reproductive strategies, non-native and invasive plants are able to out-compete and replace native species in natural and anthropogenically-altered habitats. Vegetation communities differ in their susceptibility to invasion by non-native species. Non-native and invasive plants could affect rare plant species, as non-native and invasive plants often have higher rates of reproduction when compared to rare plant species and have the potential to outcompete natural vegetation, including rare plant species for resources (e.g., available nutrients) through competitive exclusion. Activities that result in soil disturbances, such as the construction of linear corridors (e.g., roads, conveyors) further favour the establishment of non-native and invasive plants by facilitating the dispersal, propagation, and establishment of these species into natural areas. Once non-native and invasive species are established within areas of recent disturbance, they are often able to successfully colonize natural habitats. Mitigation measures will be implemented during Construction, Operations and Maintenance and Closure and Decommissioning, including a Project-specific strategy to reduce opportunities for the establishment of non-native and invasive plants.

Table 17.12 Vegetation Classification within PDA and LSA of the Project

Ecosystem	Habitat Type[1]	Number of Polygons in LSA	Total Area of Habitat Type in LSA (ha)	Percent of Habitat Type within LSA	Total Area of Habitat Type in PDA (ha)	Percent of Habitat Type within PDA	Area of Habitat Type (change from LSA) (ha)	Area of Habitat Type (change from LSA) (%)
Forested (Upland)	Open Spruce-Moss Forest	119	1499.1	24.0	135.8	32.8	1363.2	23.3
	Open Spruce-Lichen Forest	141	1350.0	21.6	106.5	25.7	1243.5	21.3
	Post-Fire Conifer Regeneration	10	736.6	11.8	34.1	8.2	702.5	12.0
	Closed Spruce-Moss Forest	82	641.5	10.3	51.6	12.5	590.0	10.1
	Birch Forest	0	-	-	-	-	-	-
	Clear Cut	2	8.7	0.1	1.5	0.4	7.2	0.1
	Subtotal	**354**	**4235.8**	**67.8**	**329.5**	**79.6**	**3906.3**	**66.9**
Non-forested (Upland)	Shrubland	14	178.1	2.9	13.8	3.3	164.3	2.8
	Lichen-Shrub Barren	15	94.1	1.5	7.0	1.7	87.1	1.5
	Slightly Weathered Rock Barren	45	152.3	2.4	7.3	1.8	145.0	2.5
	Moderately Weathered Rock Barren	25	44.7	0.7	5.3	1.3	39.4	0.7
	Highly Weathered Rock Barren	18	15.4	0.2	3.0	0.7	12.4	0.2
	Exposed Gravel and Sand	0	-	-	-	-	-	-
	Miscellaneous	0	-	-	-	-	-	-
	Subtotal	**117**	**484.6**	**7.8**	**36.3**	**8.8**	**448.3**	**7.7**
Wetland[2]	Forested Fen	52	266.6	4.3	20	4.8	246.6	4.2
	Horizontal Fen	52	102.4	1.6	2.3	0.6	100.1	1.7
	Northern Ribbed Fen	29	65.2	1.0	1.3	0.3	63.9	1.1
	Shrub Swamp	101	112.8	1.8	0.7	0.2	112.1	1.9
	Forested Bog	37	60.7	1.0	3	0.7	57.7	1.0
	Riparian Fen	27	46	0.7	0.1	0.0	45.9	0.8
	Forested Swamp	9	16.8	0.3	2.5	0.6	14.3	0.2

Table 17.12 Vegetation Classification within PDA and LSA of the Project

Ecosystem	Habitat Type[1]	Number of Polygons in LSA	Total Area of Habitat Type in LSA (ha)	Percent of Habitat Type within LSA	Total Area of Habitat Type in PDA (ha)	Percent of Habitat Type within PDA	Area of Habitat Type (change from LSA) (ha)	Area of Habitat Type (change from LSA) (%)
	Flat Bog	13	8.6	0.1	1.9	0.5	6.7	0.1
	Temporary Pond	15	6	0.1	0.2	0.0	5.8	0.1
	Pond	10	2.2	-	-	-	2.2	-
	Subtotal	**345**	**687.3**	**11.0**	**32.0**	**7.7**	**655.3**	**11.2**
Aquatic	Waterbody[3]	43.00	196.5	3.1	3.3	0.8	193.2	3.3
	Subtotal	**43**	**196.5**	**3.1**	**3.3**	**0.8**	**193.2**	**3.3**
Anthropogenic	Human Disturbance	2.00	0.5	-	-	-	-	-
	NoData[4]	1.00	647.3	10.4	12.7	3.1	634.6	10.9
	Subtotal	**3**	**647.8**	**10.4**	**12.7**	**3.1**	**635.2**	**10.9**
Total		**838**	**6216.6**	**100.0**	**412.8**	**100.0**	**5801.9**	**100.0**

Notes:
1 Vegetation classification data based on results of air photo interpretation and ground-truthing (field surveys) prepared by WSP, previously GENIVAR, (GENIVAR 2013a)
2 Includes bog, fen, marsh, swamp, and shallow water wetland classes; note that environmental effects of the Project on Wetlands is assessed in Chapter 14.
3 Values presented are an underrepresentation of the area covered by waterbodies because shallow open water habitats within wetland and several small ponds have been classified as wetland
4 Data gaps resulting from the change of the project footprint outside of the classification data provided by WSP, previously GENIVAR, (GENIVAR 2013a)

Note: Subtotal and total values may not equal the sum of the individual values, due to rounding.

Project Construction also has potential to affect surface water flows and water levels through ground water withdrawal and surface disturbance from infrastructure as is required in the construction of the mine site and associated mine site infrastructure (i.e., haul road). Groundwater withdrawal for the Project is particularly associated with the dewatering of Joyce Lake, and has the potential to reduce the quantity of groundwater that flows to adjacent water bodies, wetlands and watercourses. Minor disruptions in hydrological flow can alter species composition and various wetland processes, and thus critical habitats for a variety of hydrophytic plant species. Natural surface water flow patterns will be maintained in wetlands through the appropriate use (i.e., adequate sizing and spacing) of water crossing structures, proper choice of the type of crossing structures to be used, installation of drainage structures at a depth adequate to pass subsurface flow and proper maintenance. The drainage structures (e.g., ditches) will also provide storage for sediment and runoff associated with the higher precipitation events.

Riparian and wetland vegetation associated with Joyce Lake will be directly affected by the Project as shoreline emergent and riparian vegetation is removed during site preparation. Similarly, down-gradient wetlands, particularly those with connectivity to Joyce Lake will also be affected through drawdown of the lake.

Reductions of water levels during the dewatering phase are expected to affect aquatic macrophyte communities in the water body and down-gradient wetlands. Rhizomatous aquatic plants of the water body shoreline can withstand and recover from short-term periodic drawdown and freezing provided desiccation of rhizomes is prevented. Although rhizomes will be exposed to drawdown for several seasons (up to seven years), the original community structure is anticipated to naturally re-establish following refilling at the end of the Project.

Draining of Joyce Lake is anticipated to cause temporary stress on surrounding wetlands should the subsurface hydrology be substantially disturbed. Similar to aquatic plants in the water body, conducting the dewatering process will greatly increase the severity of potential effects to wetland's and associated wetland plant communities, and as a result habitat for SAR and SOCC, in relation to the Project. Maintaining natural drainage patterns at the open pit and waste rock disposal areas, and the maintenance of Project infrastructure and vegetation management initiatives in accordance with applicable statutes and regulations, will in part mitigate this effect.

Construction activities also have the potential to introduce sediment or silt into wetlands, watercourses, and surface water and this could have an adverse effect on rare plants and/or uncommon communities. 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.

In addition, a number of indirect effects can result from these site preparation activities. Clearing of forested areas can change the quality of the habitat immediately adjacent to the PDA 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 species to penetrate into adjacent forest habitat.

Site preparation activities can also facilitate opportunities for colonization by non-native and invasive plant species. Because of various characteristics, including strong competitive abilities and diverse and highly effective reproductive strategies, non-native and invasive plants are able to out-compete and replace native species in natural and anthropogenically-altered habitats. Vegetation communities differ in their susceptibility to invasion by non-native species. Non-native and invasive plants could affect rare plant species, as non-native and invasive plants often have higher rates of reproduction when compared to rare plant species and have the potential to outcompete natural vegetation, including rare plant species for resources (e.g., available nutrients) through competitive exclusion. Activities that result in soil disturbances, such as the construction of linear corridors (e.g., roads, conveyors) further favour the establishment of non-native and invasive plants by facilitating the dispersal, propagation, and establishment of these species into natural areas. Once non-native and invasive species are established within areas of recent disturbance, they are often able to successfully colonize natural habitats. Mitigation measures will be implemented during Construction, Operations and Maintenance and Closure and Decommissioning, including a Project-specific strategy to reduce opportunities for the establishment of non-native and invasive plants.

Operations and Maintenance

Activities associated with the Operations and Maintenance phase of the Project that have the potential to interact with rare plant species and uncommon plant communities are dewatering of Joyce Lake, waste rock disposal on surface, and water treatment and discharge, including mine water and surface water runoff.

The waste rock pile located on the northern portion of the peninsula is scheduled to cover an area of approximately 82 ha (20% of PDA). No plant species listed and protected federally or provincially under SARA (Schedule 1) or NLESA were identified within or are presently known to occur in the area identified for waste rock disposal.

Two species, glacial sedge (*Carex glacialis*) *and* Canada bluejoint (*Calamagrostis canadensis var. canadensis*) having provincial sub-rarity ranks of S2S3 (AC CDC)/Threatened (LEMV) and SNR (AC CDC/LEMV), were observed within or adjacent to the PDA. However, with recorded occurrences in the RSA of 9 and 32 locations, respectively, the long-term viability of these plant species does not warrant their further assessment.

While progressive construction of the waste rock pile, over the life of the mine, may further affect native vegetation communities, most of the environmental effects to vegetation will occur during Construction, and any further disturbance of vegetation communities would be limited spatially to areas within the footprint of the waste rock pile which does not include, based on surveys, any SAR or SOCC vascular plants.

Mine water and surface runoff have potential to negatively affect rare plant species and uncommon plant communities, changing the hydrological character of terrestrial and aquatic habitats, as well as their chemical composition. In particular, surface runoff from waste rock piles may affect vegetation if they result in higher than baseline additions to habitats, promote increases in the fluctuation of water levels, or if waters contain materials that change the nutrient status or pH of downstream environments potentially harbouring rare plants. Wastewater generated as a result of mine discharge and site runoff will exhibit similar characteristics of high sediment load, relatively low pH and a presence of heavy metals. Such factors may have an adverse effect on plants if they promote environmental conditions that are outside the range of tolerance for the species, or put them at a competitive disadvantage with other taxa. For example, ARD is an important consideration for both water treatment and discharge, and overburden and waste rock disposal because it has potential to cause important changes in down-gradient systems. Wetland habitats are particularly sensitive to these hydrological changes. Disturbance related to these activities will be localized (occurring primarily within the PDA), highly dependent on seasonal trends in temperature and snowfall/precipitation, and likely to persist for decades or until the overburden/waste rock piles have been appropriately remediated/revegetated.

Closure and Decommissioning

Project effects on SAR/SOCC will occur exclusively during the Construction and Operations and Maintenance phases of the Project. A Rehabilitation and Closure Plan will be developed in accordance with the Newfoundland and Labrador *Mining Act*. The Rehabilitation and Closure Plan will describe the process of rehabilitation of the project up to and including closure, and will define in detail the actions necessary to achieve plan objectives and requirements. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EMP. Given 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 (i.e., some vegetated communities within the Project footprint may not return to pre-Project conditions).

17.6.1.2 Mitigation of Project Environmental Effects

Project planning, design, and the application of known and proven mitigation measures will be carried out as part of the Project by Labec Century to avoid or reduce environmental effects on rare plant species and uncommon plant communities. Final decisions on mitigative measures will be made by Labec Century in consultation with botanical experts, and where appropriate, the regulatory authority (i.e., NLDOECC). A Project-specific EMP will be developed for the Project prior to start of the Construction phase, and will include measures to reduce the effects of such activities as site clearing and construction activities, temporary access trails, borrow areas, clearing of the right-of-way, and working in and around waterbodies and wetlands, equipment maintenance, and work site cleanup and rehabilitation. Reclamation plans will be developed in co-ordination with regulators, and implemented, where practical, to limit potential Project effects. Where necessary, and through consultation with the appropriate regulatory agencies and stakeholder groups, Labec Century will investigate possible mitigation options in those instances where a plant SOCC may be either adversely effected by the Project, fragmented by the disturbance footprint and/or where surveys do not result in the identification of additional records in similar habitats outside the Project footprint. Examples of such mitigation may include transplantation, rare plant seedbank salvage/seed collection, and/or re-establishing suitable habitat.

The following measures are proposed to mitigate Project-related effects related to change in rare plants and uncommon communities. Specific measures will be developed through the EMP to reduce disturbance to rare plant species and uncommon plant communities at each of the Project components, but several general measures include:

- Comply with provincial and federal legislation, permits, approvals and guidelines;
- Scheduling construction in potentially sensitive rare plant habitats (e.g., wetlands, riparian areas) to occur during seasonally dry or frozen ground conditions (i.e., negligible risk of ground disturbance/compaction), if practicable and feasible;
- Reduce construction footprint (i.e., the PDA) to the extent feasible and restrict construction activities to the PDA;
- To preserve growth medium, the topsoil will be stripped and stored for later reclamation (seed source), where feasible;
- Project activities will be located outside areas identified as having a high potential of containing plant SOCC. Where this is not possible, alternate measures including the use of exclusion fencing at specific locations will be applied. Where there is uncertainty regarding the presence of a rare plant species or the extent of its potential habitat, additional measures may be required;
- Delineate locations where rare plants occur, and avoid those locations to the extent feasible;
- Promoting the use of sediment control measures to prevent the release of material into surface water features with bordering Project components during Construction;
- Additionally, natural surface water flow patterns will be maintained in wetlands through the appropriate use (i.e., adequate sizing and spacing) of water crossing structures, proper choice of the type of crossing structures to be used, installation of drainage structures at a depth adequate to pass subsurface flow and proper maintenance. The drainage structures (e.g., ditches) will also provide some storage for sediment and runoff associated with the larger precipitation events throughout the year and snow and ice melting in the spring months;
- Reduce vegetation alterations (including rare plant species and uncommon plant communities) through environmentally sensitive Project design, particularly with regard to the final haul road alignment;
- Implement BMP including the creation of exclusion zones in areas of known rare plant or rare plant habitat occurrences, buffer zones around wetland habitats, maintaining connectivity among wetlands within wetland complexes, and restricting employee and contractor access to these habitats outside of construction or work areas;
- Avoid direct effects to rare plant and/or their habitats to the extent feasible. Where avoidance is not practical, implement mitigation to reduce the magnitude of those effects;

- Transplanting of plant SOCC may be considered, upon consultation with the regulating agencies, and after additional surveys have confirmed that specific SOCC, deemed of conservation concern, are proven to have restricted distribution in the region.;
- Reduce disturbance and infilling within and adjacent to wetlands and maintain hydrological conditions and natural drainage patterns to the extent feasible by:
  - maintaining natural buffers around watercourses, wetlands and riparian zones;
  - minimizing the linear extent of roads crossing or paralleling wetlands;
  - wherever practicable, avoid diverting natural stream courses;
  - placing appropriate road culverts for waterways, and maintaining and monitoring culverts;
  - scheduling construction in potentially sensitive rare plant habitats (e.g., wetlands, riparian areas) to occur during seasonally dry or frozen ground conditions (i.e., negligible risk of ground disturbance/compaction); and
  - maintaining water flow around the work site during instream construction;
- Locate borrow pits more than 100 m away from the high-water mark of water bodies, where feasible;
- Re-establish vegetation on disturbed areas through progressive reclamation as soon as reasonably possible;
- Reduce the extent of clearing, grubbing, stripping and the removal of shrubs and herbaceous species, and retain the humus layer and vegetative root mat, where possible;
- Implement dust control measures, including dust suppressants (e.g., water) at the mine site, along the haul route and in during situations that have an increase potential to generate airborne dust;
- 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;
- Specific to plant communities in proximity to the mine site and haul route, dust deposition on plant communities arising from traffic will be reduced by measures such as using dust suppressants when conditions warrant, and ensuring that loaded iron ore product trucks are covered to prevent dust escaping during transit;
- Use of seed mixtures free of non-native and invasive species weeds and use of native species (where available) during site reclamation;
- Potential adverse effects of surface drainage from the waste stockpiles on rare plant species and uncommon plant communities will be reduced through the ongoing treatment of wastewater and surface run-off;

- Site reclamation will be designed to manage the drainage, stability and erosion effects on freshwater resources. As such, vegetative communities would be protected from negative interactions with the waste rock disposal systems during reclamation activities;
- Use seed mixtures free of invasive or noxious weeds during site reclamation;
- Implement plans to reduce access routes to and at the site, where possible. Rehabilitate access routes are no longer needed;
- Develop and implement an Emergency Spill Prevention and Response Plan (or equivalent);
- Adherence to a comprehensive equipment preventative maintenance program to maintain the vehicles, and to maximize fuel efficiency and vehicle performance, including:
  - Cleaning and inspecting construction equipment prior to transport from elsewhere so that no plant matter is attached to the machinery (e.g., use of pressure water hose to clean vehicles prior to transport); and
  - Regularly inspecting and cleaning equipment prior to, during and immediately following construction in wetland areas to limit the amount of plant matter that is transported from one construction area to another;
- As part of infrastructure maintenance, roads will be periodically graded and ditched to improve water flow, reduce erosion and/or to deter excessive vegetation growth;
- Should total avoidance of watercourses prove impractical, streams will be re-directed to maintain flow connectivity down gradient.
- Assign environmental inspectors to oversee implementation of proposed mitigation measures.
- Proposed mitigation measures have been shown to be effective for similar projects elsewhere and in the region, and the risk and severity of consequence in the event of mitigation failure is anticipated to be low.

17.6.1.3 Characterization of Residual Project Environmental Effects

Plant SAR/SOCC may be directly affected during Project Construction (primarily clearing activities) within the PDA. Ground disturbances associated with site preparation during the Construction phase may result in fewer individuals or populations of plant 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 of those habitats. Indirectly, site preparation could affect vegetation communities through habitat fragmentation, changes in topography and hydrology, increases in fugitive dust and/or through the introduction and spread of non-native and invasive species, insects and plant pathogens.

Effects of this Project component on rare species and uncommon communities will likely be lessened by the fact that it will be constructed primarily within upland areas characterized by the occurrence of extensive areas of exposed bedrock. Furthermore, indirect effects to the occurrence of rare plants or uncommon communities are not expected given previously described mitigation measures.

The PDA represents a potential "worst case scenario" for area of actual disturbance and habitat alteration or reduction. With careful Project planning and implementation, such as limiting the PDA to only those areas that need to be cleared, 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 habitat potentially altered or 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 residual effects.

Construction and Operations and Maintenance

The environmental effects of the Project, particularly during Construction and Operations and Maintenance, on rare species and their habitat are predicted to be adverse, because there is a permanent alteration and/or reduction in the amount of available habitat. For most rare plant species, a change in habitat availability and resulting displacement of individuals or populations of Plant SAR/SOCC from across the RSA is predicted to be low, based on the following:

- The estimated number of rare species occurrences of the local population potentially lost will be <5% of the available primary habitat in the RSA, once mitigation is implemented;

- As a result of mitigation measures being employed to reduce indirect effects (e.g., dust, surface run-off), the influences of the Project are expected to be restricted to within the PDA.

- Additional habitat of varying quality will be made available as a result of Project activities including clearing (e.g., may provide habitat for some species of birds), progressive rehabilitation, and site reclamation.

Disturbance-related effects are anticipated to be long term as they will be measurable for the life of the Project (and beyond) and are generally irreversible (i.e., reduction in wetland habitats.

Closure and Decommissioning

Site Closure and Decommissioning may result in changes to habitat for Plant SAR/SOCC, and though not all habitats will return to pre-Project conditions, this may result in a net increase in species occurrences once complete.

Project activities associated with Closure and Decommissioning will be neutral in direction but low in magnitude and restricted to the PDA. The effect will be long-term for some habitats and permanent (i.e., irreversible) in other areas.

17.6.2 Assessment of Change in Habitat (Bird and Wildlife SAR/SOCC)

Project activities during the Construction, Operations and Maintenance, and Closure and Decommissioning phases that may have an environmental effect on habitat for Bird and Wildlife SAR/SOCC are assessed based on the area of primary or other limiting habitat lost or altered as a result of these activities.

Habitats in the RSA were classified as primary, secondary or tertiary for Bird and Wildlife SAR/SOCC, based on a review of existing literature and locally relevant studies, where available. Primary habitat was defined as habitat that provides all of the main requirements for a species (i.e., foraging, breeding, and protection). Secondary habitat was defined as providing an abundance of one or more of the three elements (or marginal amounts of all). Tertiary habitat was considered habitat providing few or no habitat requirements, and may be used as a travel corridor or avoided. As a conservative measure, habitat types (as identified in the Project ELC) with elements of primary habitat, but not composed entirely of primary habitat, were identified as such.

17.6.2.1 Potential Environmental Effects

Construction

Project activities associated with site preparation (e.g., clearing, excavation), and the construction of the roads, causeway, rail loop, and stream crossings will result in the loss or alteration of important habitat (i.e., primary, secondary, and tertiary) for Bird and Wildlife SAR/ SOCC. This change in habitat may result in adverse environmental effects such as the loss of breeding, nesting, rearing, or other habitat (e.g., foraging).

Habitat in the Project area comprises primarily forested and non-forested uplands (e.g., spruce-moss forest and shrub lichen barrens, respectively). Clearing of upland forest can change the quality of the habitat along the edge of the Project footprint. Exposure of what was previously forest interior habitat may attract more disturbance-tolerant and edge species to the forest habitat adjacent to the Project. Indirect effects may also occur, resulting from changes in substrate composition, moisture, drainage and temperature, or as a result of increased human activity (i.e., sensory disturbance).

Wetland habitats are relatively less common in the Project area and include fens, bogs, swamps, and ponds. Wetlands are an important feature of the landscape, performing many biological, hydrological, social/cultural, and socio-economic functions. A detailed environmental effects assessment on wetlands is provided in Chapter 14: Wetlands.

Many SAR/SOCC are expected to mainly occupy suitable primary habitat (i.e., habitat that provides adequate quantities of a species' requirement for foraging, breeding, and protection). Thus, the change in habitat resulting from Project activities can be evaluated based on the amount of primary habitat lost and/or altered within the PDA relative to the availability of primary habitat of bird and wildlife SAR/SOCC in the region (i.e., the RSA). In general, the magnitude of Project effects on a change in habitat will be low, as the amount (percent) of primary habitat expected to be altered or lost as a result of Project activities, relative to the availability of primary habitat within the RSA, is <1% for all Bird and Wildlife SAR/SOCC (Table 17.13; Refer to Appendix Z for descriptions of primary habitat).

Table 17.13 Percent of Primary Habitat Altered/Lost for Bird and Wildlife SAR/SOCC Relative to the Availability of Primary Habitat in the RSA

Species	Primary		
	Total Area in PDA		% Altered/Lost
	Total Area in PDA (ha)	Total Area in RSA (ha)	
Pygmy Shrew	293.9	93,225.2	0.3
Least Weasel	373.7	115,327.4	0.3
White-winged Scoter	9.1	57,478.5	<0.1
American kestrel	373.7	115,327.4	0.3
Lesser Yellowlegs	17.7	26,896.2	0.1
Short-eared Owl	63.9	18,098.7	0.4
Common Nighthawk	116.0	43,126.7	0.3
Olive-sided Flycatcher	309.8	97,228.7	0.3
Golden-crowned Kinglet	357.9	111,323.9	0.3
Gray-cheeked Thrush	257.7	74,572.5	0.3
Nashville Warbler	273.6	78,576.0	0.3
Rusty Blackbird	257.7	74,572.5	0.3
Spring peeper	71.7	26,896.2	0.3

Notes:
Primary habitat provides all of the main habitat requirements for a species (e.g., abundance of food, protection, resting, spatial separation from predators and/or other habitat such as that used for breeding, denning or other activities). Secondary habitat provides an abundance of one or more of the three elements (or marginal amounts of all). Tertiary habitat is considered marginal habitat providing few or no habitat requirements, may be used as a corridor and/or avoided.
Habitat descriptions for key/representative species are provided in Appendix Z.

Primary habitat was not identified for little brown myotis (*Myotis lucifugus*) as this species has specific habitat requirements that cannot be determined at the scale of the habitat classification available for the RSA. Suitable foraging areas are often over water, and roosting sites are usually associated with decaying live trees or snags found in mature forest stands (Broders et al. 2006, 2012). Cabins and other man-made structures are typically used by maternity colonies. Given their specific habitat requirements, these species may be susceptible to habitat loss, however, the causative factor for their emergency listing as Endangered under COSEWIC is largely the rapid population declines due to white-nose syndrome (WNS) (Forbes 2012a, 2012b). WNS is caused by a fungal pathogen (*Geomyces destructans),* and all myotis species that hibernate in cold and damp conditions are susceptible (Forbes 2012a, 2012b). As part of the EMP, a plan to mitigate effects on bats through avoidance in the Project PDA will be implemented.

Bender et al. (1998) suggest that for edge habitat and generalist species, the loss of habitat should account for or overestimate population declines, but for interior habitat species the decline in population size will be greater than predicted by pure habitat loss. Using definitions in Bender et al. (1998) and descriptions in Whitaker and Montevecchi (1997), Gray-cheeked Thrush is considered an interior species. The amount of primary habitat that will be lost relative to its availability in the RSA is <1% and much lower than the 5% threshold for this species (Table 17.13). Furthermore, this species is more likely affected by habitat alteration during nonbreeding season (Lowther et al. 2001) and thus not present in the RSA. Little brown myotis is also considered an interior habitat species. Similarly, WNS rather than habitat loss for bats appears to be a limiting factor for this species.

The loss or alteration of important habitat for Bird and Wildlife SAR/SOCC may result in the displacement or attraction of some species. Species that are associated with natural or anthropogenic edge habitat, such as Olive-sided Flycatcher (Altman and Sallabanks 2012), may be attracted to areas of primary habitat created following clearing of the PDA. Displacement of individuals can result in a higher concentration of individuals in the remaining habitats (Schmiegelow et al. 1997; Fahrig 2003; Ewers and Didham 2006), and may result in lower quality habitats being used.

Patterns of ice formation and melting within wetlands and other waterbodies may also be altered as a result of activities during Construction (e.g., construction of roads and causeway). Many migrating waterfowl species are restricted in spring by the limited availability of *ashkui* (areas of open water) for foraging. Should fewer *ashkui* be available as a result of causeway construction, foraging habitat of species that prey upon fish [e.g., Lesser Yellowlegs on occasion (Tibbits and Moskoff 1999)] may be reduced.

Operations and Maintenance

Project effects on habitat will occur primarily during the Construction phase. Activities during the Operations and Maintenance phase that will have an adverse environmental effect on habitat for birds and wildlife are dewatering Joyce Lake, waste rock disposal on surface, and progressive rehabilitation.

Dewatering of Joyce Lake will commence after the start of pit construction and will continue throughout the life of the Project. The lake may provide forage, cover, or possibly breeding habitat for some SAR/SOCC. Species potentially affected are White-winged Scoter and Lesser Yellowlegs (confirmed in the RSA), and potentially other species.

Waste rock will be progressively infilled with material as required, and thus habitat within the footprint of the waste rock piles will be disturbed throughout operations. The total amount of habitat lost and/or altered for each SAR/SOCC is included in the calculations provided in Table 17.13.

Progressive rehabilitation will be implemented during Project operations and may include: rehabilitation of construction-related buildings and stabilization and re-vegetation of waste rock disposal areas. For most SAR/SOCC, these activities will result in a net increase in habitat, when compared to the Construction phase. SAR/SOCC such as Rusty Blackbird and Nashville Warbler may benefit from regenerating habitats, particularly regenerating conifers adjacent to wetlands, or cutovers and secondary-growth habitats, respectively (Lowther and Williams 2011; Avery 2013). An environmental monitoring program will be conducted as part of the mine development, and the resulting information will be used to evaluate the progressive rehabilitation program on an ongoing basis.

Closure and Decommissioning

Activities during site reclamation will have direct effects on potential habitat for Bird and Wildlife SAR/SOCC. As sites are reclaimed, habitat of varying quality will become available, and thus will result in a net increase in habitat, when compared to the Construction phase. As with progressive rehabilitation, some SAR/SOCC species may benefit.

A Rehabilitation and Closure Plan will be developed in accordance with the Newfoundland and Labrador Mining Act. The Rehabilitation and Closure Plan will describe the process of rehabilitation of the project up to and including closure (e.g., decommissioning, removal, and disposal of site equipment and structures, site remediation), and will define in detail the actions necessary to achieve plan objectives and requirements.

17.6.2.2 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 reduce environmental effects on SAR/SOCC. This includes the use of appropriate, accepted best practices to limit activities resulting in disturbance to habitat, to the extent practical, and compliance with the requirements of applicable permits (e.g., buffer widths and permitted activities at these locations).

Mitigation measures will be finalized by Labec Century in consultation with experts, and where appropriate, the regulatory authority. A Project-specific EMP will be developed for the Project prior to start of the construction phase and will include measures to reduce the effects of such activities as site clearing and construction activities, temporary access trails, borrow areas, clearing of the right-of-way, and working in and around waterbodies and wetlands, equipment maintenance, and work site cleanup and decommissioning. Reclamation plans will be developed in co-ordination with regulators, and implemented, where practical, to limit potential Project effects.

Standard practices and general environmental protection measures for mining projects will address most outstanding issues likely to arise during the Project. The following mitigation measures are proposed to mitigate Project-related effects related to change in habitat:

- Comply with provincial and federal legislation, permits, approvals and guidelines;
- Reduce construction footprint (i.e., PDA) to the extent feasible;
- Restrict activities associated with maintenance (e.g., vegetation management, periodic grading and ditching) to the PDA;
- Install stream crossings (e.g., bridges, culverts, ditches) in accordance with pertinent regulations and guidelines;
- Conduct progressive rehabilitation;
- Rehabilitate access routes that are no longer needed;

- Flag the boundaries of sensitive areas (e.g., wetlands) before commencing any work in the area, and avoid locations of SAR/SOCC and their habitats to the extent feasible;
- Develop and implement an Avifauna Management Plan;
- Incorporate surveys for bats into the EMP and avoid known roosting locations;
- Install bat boxes in appropriate locations/habitats, as necessary;
- Schedule Project activities and reclamation activities so that not all available habitat is disturbed simultaneously;
- Reduce disturbance and infilling within adjacent wetlands and maintain hydrological conditions to the extent feasible;
- Direct runoff from development away from wetlands;
- 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;
- Restore banks to original condition where any disturbance has occurred (e.g., causeway construction);
- Where practical, implement clearing by mulching and mechanized forestry equipment;
- Dispose of slash from clearing, as specified in permits;
- Implement erosion and sediment control;
- Conduct non-native and invasive species management;
- Restore banks to original condition where disturbance has occurred (e.g., installation of culverts, causeway construction);
- Develop and implement a dewatering plan based on hydrogeological information for Joyce Lake, in consultation with appropriate regulators and consistent relevant with legislation and guidelines; and
- Assign environmental inspectors to oversee implementation of proposed mitigation measures.
- Proposed mitigation measures have been shown to be effective for similar projects elsewhere and in the region, and the risk and severity of consequence in the event of mitigation failure is anticipated to be low.

17.6.2.3 Characterization of Residual Project Environmental Effects

Construction

The environmental effects of the Project on important habitat for Bird and Wildlife SAR/SOCC during Construction are predicted to be adverse, because there is a permanent alteration and/or reduction in the amount of available habitat.

Adverse residual environmental effects on habitat are geographically limited to the PDA. For Bird and Wildlife SAR/SOCC, the change in habitat availability and resulting displacement of individuals or populations within the RSA is predicted to be low, as <1% of the primary habitat available is anticipated to be lost or altered. This calculation is conservative and represents a "worst case scenario", as it assumes that primary habitats in PDA are at their maximum carrying capacity, which is likely not the case. Furthermore, with the exception of possibly least weasel, pygmy shrew, and spring peeper, many SAR/SOCC that are likely to occur in the RSA are highly mobile and have relatively large home ranges (e.g., birds and bats), and thus have the ability to relocate to adjacent suitable habitats. Project planning such as limiting the footprint to only those areas that need to be cleared, scheduling activities so that not all habitat is disturbed simultaneously, and progressive rehabilitation, will have the result that the actual amount of primary habitat lost at any one time is likely to be less than what is estimated. Standard mitigation measures to protect species and/or their habitats from direct disturbance will further reduce residual effects.

Adverse residual environmental effects on habitat of Bird and Wildlife SAR/SOCC are anticipated to be long-term, or in some cases, permanent. The removal of habitat from some areas of the PDA will be long-term (e.g., access roads), as these areas will be rehabilitated. However, some rehabilitated areas within the Project footprint will likely not return to pre-Project conditions, and the alteration of those habitats would be permanent (i.e., irreversible).

Operations and Maintenance

Project activities associated with Operations and Maintenance will result in adverse environmental effects on habitat within the PDA. The magnitude of adverse effects will be low, as <5% of the primary habitat available in the RSA and <1% of the available waterbodies will be lost or altered as result of Project activities. The environmental effect will occur sporadically and is anticipated to be medium-term and irreversible.

Closure and Decommissioning

Site reclamation may result in changes to habitat, but for most birds and other wildlife, this will likely result in a net increase in habitat availability once complete (i.e., net positive effect). Project activities associated reclamation will be restricted to the PDA and are anticipated to be low in magnitude, as not all primary habitat will be restored to its pre-construction condition. The residual environmental effect will be permanent.

17.6.3 Assessment of Change in Distribution and Movement (Bird and Wildlife SAR/SOCC)

Project activities during the Construction, Operations and Maintenance, and Closure and Decommissioning phases may have an environmental effect on the distribution and movement of Bird and Wildlife SAR/SOCC, and are discussed for the following measurable parameters:

- Density and distribution of species on the landscape; and
- Sensory disturbances.

17.6.3.1 Potential Environmental Effects

Construction

The distribution and movement of Bird and Wildlife SAR/SOCC on the landscape may change via several mechanisms as a result of site preparation, construction of roads, construction of causeway, construction of site buildings and associated infrastructure, construction of rail loop and associated infrastructure, construction of stream crossings, installation of water supply infrastructure, on-site vehicle/equipment operation, waste management, and transportation of personnel and goods to site. Potential mechanism for a change in distribution and movement are associated with the following:

- Habitat fragmentation;
- Barriers to movement; and
- Sensory disturbances and avoidance behaviours.

Localized movement corridors and movement patterns may be altered as a result of Project construction activities. Linear features (e.g., access roads), as well as the Project footprint in general, may result in habitat fragmentation on the landscape, hindering accessibility to preferred corridors, home ranges, and habitat connectivity. Individuals of some species, including forest songbirds (Bayne et al. 2005) and small mammal species, may choose to avoid open areas that result from the clearing of vegetation due to the increased risk of predation. Rail et al. (1997) found that territorial forest specialists such as Golden-crowned Kinglet (*Regulus satrapa*) are unlikely to cross gaps to resume territorial defense. Linear features can also act as a barrier and have an effect on movement patterns of, for example, amphibians and small mammals (e.g., Rico et al. 2007, Gravel et al. 2012). In addition, the creation of new corridors from linear features could foster the establishment of invasive species (e.g., plants), creating possible competition with endemic species on the landscape, and may affect movement patterns (Hansen and Clevenger 2005; Tanentzap et al. 2010).

The spatial extent of sensory disturbances (e.g., noise, light, human presence) resulting from Project activities may have an environmental effect on distribution and movement of SAR/SOCC. Sensory disturbances can result in avoidance behaviours, and the potential alteration of migratory routes of birds (Cameron et al. 1992; Gutzwiller et al. 1998; Drapeau et al. 2000; Noel et al. 2004; May et al. 2006; Bayne et al. 2008; Madsena and Boertmann 2008; Sawyer et al. 2009; Leblond et al. 2011; Vegvari et al. 2011; Cuiti et al. 2012; Lesmerises et al. 2012; Boulanger et al. 2012). The degree to which individuals may display avoidance behaviours (i.e., ignore or flight) to an environmental effect from sensory disturbances can vary temporally as individuals may be particularly sensitive during periods of high physiological stress such as migration, reproductive season, rearing young, and wintering conditions (Cameron et al. 1992; Regosin et al. 2003; Burger et al. 2004; Ewers and Didham 2006; Squires et al. 2008; Rittenhouse and Semlitsch 2009; Faille et al. 2010; Lycke et al. 2011; Pinard et al. 2012; Haapakoski and Ylonen 2013; Lesmerises et al. 2013). Sensory disturbances are anticipated to be more substantial within the LSA, based on proximity and propagation, but are expected to decrease with increasing distance from Project activities. Habitats within potential zones of influence of sensory disturbance may have reduced use or seasonal avoidance by SAR/SOCC but are anticipated to be recoverable following Project closure.

Operations and Maintenance

Project activities during Operations and Maintenance that may have an environmental effect on the distribution and movement of species on the landscape are: open pit mining, dewatering Joyce Lake, ore processing, waste rock disposal on surface, rail load-out and transport, on-site vehicle/equipment operation and maintenance, and progressive rehabilitation.

The dewatering of Joyce Lake may lead to the displacement of species that may be dependent on the lake, such as migrating waterfowl (Fletcher and Breeze 2000). The loss of this habitat and Project activities associated with dewatering and subsequent mining may hinder access to preferred corridors or home ranges.

Environmental effects on distribution and movement of Bird and Wildlife SAR/SOCC as a result of sensory disturbances associated with Operations and Maintenance activities are the same as during Construction (i.e., primarily through avoidance behaviours), the degree to which can vary temporally and among species.

Closure and Decommissioning

Environmental effects on distribution and movement of Bird and Wildlife SAR/SOCC as a result of sensory disturbances associated with site closure activities are the same as described during Construction and Operations and Maintenance. As Project activities cease and the landscape is rehabilitated, individuals may re-establish in the area (Simon et al. 2000; Banville and Bateman 2012).

17.6.3.2 Mitigation of Project Environmental Effects

Mitigation measures will be applied for the duration of the Project to avoid or reduce the potential environmental effects of Project activities on the distribution and movement of birds and wildlife. The mitigation measures will be detailed in the EMP and will include the use of the appropriate and accepted best practices with respect to reducing the potential environmental effects on the distribution and movement of birds and wildlife. Some examples include, but are not limited to:

- Comply with provincial and federal legislation, permits, approvals and guidelines;

- Reduce construction footprint (i.e., PDA) to the extent feasible;
- Avoid SAR/SOCC and their habitats to the extent feasible;
- Allow all wildlife to pass through construction sites without harassment;
- Restrict clearing activities to outside of the bird breeding season, whenever feasible, and implement an Avifauna Management Plan;
- Install bat boxes in appropriate locations/habitats;
- Flag the boundaries of sensitive areas before commencing any work in the area, and avoid locations of SAR/SOCC to the extent feasible;
- Do not feed wildlife;
- Limit noise through the use of mufflers on equipment, enclosed motors and other equipment to attenuate sound propagation, and regular maintenance on vehicles and other equipment to reduce air and sound emissions;
- Limit lighting to that required for safe operation, use motion sensors for security lighting, and/or shield exterior lights from above;
- Restore banks to original condition where any disturbance has occurred (e.g., causeway construction);
- Develop and implement a dewatering plan for Joyce Lake based on hydro-geographical information;
- Maintain hydrology at stream crossings through approved methods to install culverts;
- Grade or engineer slopes along roads at locations of potential crossing points for caribou;
- Dispose of wastes in an approved waste disposal site;
- Ensure all discharges (e.g., effluents, site run-off) comply with regulatory standards;
- Implement various erosion, sediment and dust control measures;
- Conduct non-native and invasive species management;
- Implement progressive rehabilitation;
- Assign environmental inspectors to oversee implementation of proposed mitigation measures.

Proposed mitigation measures have been shown to be effective for similar projects elsewhere and in the region, and the risk and severity of consequence in the event of mitigation failure is anticipated to be low.

17.6.3.3 Characterization of Residual Project Environmental Effects

Construction

Project activities associated with Construction will result in adverse residual environmental effects on distribution and movement of individuals and species within the LSA, primarily through sensory disturbances and the potential alteration of traditional migratory corridors. The magnitude of these effects is anticipated to be low, based on the overall small percentage of Bird and Wildlife SAR/SOCC populations likely present in the PDA (by virtue of occurring in or adjacent to the LSA), and the low number of individuals expected to be affected. Residual environmental effects will be frequent (e.g., sensory disturbances), and are anticipated to be medium-term and reversible.

Operations and Maintenance

Project activities associated with Operations and Maintenance will result in adverse residual environmental effects on distribution and movement of individuals and species within the LSA, primarily through sensory disturbance and/or continued alteration of migratory corridors. The magnitude of adverse effects will be low, similarly based on the low number of individuals anticipated to be affected, as well as their expected previous displacement from the LSA as a result of habitat loss and sensory disturbances during Construction. The residual environmental effects will be frequent, and are anticipated to be medium-term (i.e., lasting throughout operations) and reversible.

Closure and Decommissioning

Activities during Closure and Decommissioning may result in changes to distribution and movement of Bird and Wildlife SAR/SOCC within the LSA, primarily though ongoing sensory disturbances associated with these activities. The magnitude of residual environmental effects will also be low, given the low numbers of individuals likely to be present in the LSA and thus affected by Project activities. The environmental effects will be frequent, and are anticipated to be short-term and reversible.

17.6.4 Assessment of Change in Mortality Risk (Bird and Wildlife SAR/SOCC)

Project activities during the Construction, Operations and Maintenance, and Closure and Decommissioning phases that may have a residual environmental effect on mortality risk are discussed in relation to:

- Number of mortalities or mortality rate, based on existing literature and the amount of primary habitat affected; and
- Amount of new access.

17.6.4.1 Potential Environmental Effects

Construction

Project activities associated with site preparation, and the construction of roads, causeway, and rail loop and associated infrastructure, as well as on-site vehicle/equipment operation, and transportation of personnel and goods to site, will have an adverse environmental effect on mortality risk of SAR/SOCC, through the direct loss of individuals and/or indirectly through the loss or alteration of habitat.

Direct mortality is likely to occur to terrestrial species (e.g., spring peeper and pygmy shrew), and the eggs or flightless young of birds, particularly during clearing activities or as a result of vehicle collisions. Some birds and wildlife species are attracted to open disturbed sites (e.g., Common Nighthawk and Short-eared Owl) created by clearing and grubbing, that use such habitats 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.

Vehicle collisions may also have a direct environmental effect on mortality, especially during Construction when traffic volumes are expected to be greatest. The extent of this effect will vary depending on species and location. For example, small mammals may avoid crossing roads (Fuentes-Montemayor et al. 2009; McGregor et al. 2008) and thus direct mortality from collisions is expected to be relatively uncommon for Pygmy Shrew, if present. Erickson et al. (2005) estimated that bird fatalities as a result of collisions amounted for <0.2% of the adjacent breeding populations investigated, with some variation depending on location and species (passerines were identified as the most common fatalities, followed by waterfowl and raptors). Mortality as a result of vehicle collisions with birds or their nests (including ATVs) has been documented for several Common Nighthawk populations in North America, and is considered a potential limiting factor for this species (COSEWIC 2007). In general, while traffic will increase as a result of the Project, the volume will be overall relatively low, given the remoteness and scale of the Project, and similarly the speed of construction vehicles will also be low. Furthermore, the noise and/or visual stimulus would likely alert most mobile species to move away. Thus, increased mortality risk as a result of collisions would be low to negligible. Based on a review of the literature surrounding road kills, Spellerberg (1998) concludes that "road kills do not seem to have detrimental effects on animal populations except in those cases of species with small or diminishing populations."

Indirect mortality as a result of construction activities can include increased poaching, hunting and/or predation that may occur as a result of increased access provided by the creation of roads and other corridors (e.g., railway, temporary trails). The Project will result in the construction of a number of additional access roads and haulage roads in the PDA, including:

- Access roads between the crushing and screening plant, waste and overburden stockpiles, and the explosives storage;
- Rock causeway road across Iron Arm;
- Haulage roads from the causeway to the crushing and screening plant;
- Access road from the haulage road to the existing road; and
- Haulage road from the rock causeway to train loading.

Current access to Iron Arm, where there are numerous cabins, is via an existing road from Schefferville. The development of access roads, the haulage road to the existing rail line (near Astray Lake) and a road connecting the haulage road to an existing, will add additional year-round access to interior habitats (approximately 54 linear km). White-winged Scoter has traditionally been vulnerable to hunting activities (Brown and Fredrickson 1997), and is currently permissible to be hunted in Labrador [regulated under the *Migratory Birds Hunting Regulations, 2013–2014* (Environment Canada 2013)]. Weasel was also traditionally trapped in Labrador, although records are most likely of *Mustela vison*, which is likely more common in the RSA (GENIVAR 2013b).

Indirect mortality may also result when predation is increased in forest edges created during Construction clearing activities. Species such as fox (*Vulpes sp.*) and Common Raven (*Corvus corvax*) that are often attracted to human presence and developments are known predators of bird nests.

Operations and Maintenance

Project activities that will have an adverse environmental effect on mortality risk of Bird and Wildlife SAR/SOCC during Operations and Maintenance are: rail load-out and transport, on-site vehicle/equipment operation and maintenance, transportation of personnel and goods to site, and fuel transport. These activities have the potential to result in direct effects on mortality as a result of collisions (discussed above under Construction).

Project site lighting can lead to mortality of migrating birds, as these lights may be a source of attraction (Cochran and Graber 1958). Birds may collide with the light or structures near the light (e.g., Jones and Francis 2003), or expend large amounts of their energy reserves (Poot et al. 2008). Factors that affect the level of attraction to lights include colouration, intensity, spectral characteristics, and also the pattern of lights in the environment. In general, intense lights are more attractive to birds (Jones and Francis 2003), and white and red light are more attractive than green or blue light (Poot et al. 2008). Lights that are shielded from above are generally less attractive than those visible from above. Strobe lighting is less attractive to birds than continuous lighting (Jones and Francis 2003). Light-associated collisions during migration have been identified as a mortality risk for Gray-cheeked Thrush (Payne 1961; Lowther et al. 2001).

Closure and Decommissioning

A Rehabilitation and Closure Plan will be developed in accordance with the Newfoundland and Labrador *Mining Act*. The Rehabilitation and Closure Plan will describe the process of rehabilitation of the project up to and including closure (e.g., decommissioning, removal, and disposal of site equipment and structures, site remediation), and will define in detail the actions necessary to achieve plan objectives and requirements. Potential environmental effects of decommissioning activities will also be managed following the Project-specific EMP.

Increased transportation activities and sensory disturbances (discussed above) associated with vehicle and equipment operations during decommissioning may increase the risk of mortality. Progressive rehabilitation and site remediation activities that reduce the amount of access to primary habitats of species targeted by hunters or by certain predators may result in a small reduction in mortality.

17.6.4.2 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 reduce environmental effects. This includes the use of appropriate, accepted best practices to limit activities resulting in mortality, to the extent practical, and compliance with the requirements of applicable permits (e.g., permitted activities at these locations). Mitigation measures to reduce the risk of mortality will be finalized by Labec Century in consultation with experts, and where appropriate, the regulatory authority in the Project-specific EMP. Specific mitigation will be developed in the EMP for caribou, should any individuals come within a specified distance from Project activities (to be determined in consultation with regulators). Reclamation plans will be developed in co-ordination with regulators, and implemented, where practical, to limit potential Project effects.

Mortality related to improved access, though likely a low risk, will be offset through measures such as employee education, a policy of no harvesting for all on-site Project personnel and rehabilitation of temporary access roads when they are no longer required. Additionally, work areas and access roads will be off limits to unescorted non-Project personnel.

Standard practices and general environmental protection measures for mining projects will address most outstanding issues likely to arise during the Project. Mitigation measures proposed to mitigate Project-related effects related to change in mortality risk include (but are not limited to) the following:

- Comply with provincial and federal legislation, permits, approvals and guidelines;
- Reduce construction footprint (i.e., the PDA) to the extent feasible and restrict construction activities to the PDA;
- Avoid SAR/SOCC and their habitats to the extent feasible;
- Use fences and passageways as a means to intercept dispersing amphibians;
- Prohibit hunting or harassment of wildlife on Project site;
- Survey for any Bird or Wildlife SAR/SOCC, or their nests or eggs, before disposing of any materials on the surface (e.g., stockpiling), using an experienced biologist;
- In consultation with regulators, identify sites requiring additional surveys for SAR/SOCC species prior to disturbance;
- Record the location and condition/status of new access roads, observations of hunting activities, and results of any monitoring programs conducted by Labec Century related to SAR/SOCC in the area, and provide this information to relevant governing departments;
- Implement Avifauna Management Plan to address incidental take;
- Post maximum speed limits on site roads to reduce the potential for vehicle-wildlife collisions;

- Conduct wildlife awareness training for staff and contractors;
- Limit lighting to that required for safe operation; use motion sensors for security lighting and/or shield exterior lights from above;
- Develop and implement a site-specific Emergency Spill Prevention and Response Plan;
- Allow fuel trucks to travel on approved access roads only;
- Use best practices for fuels and other hazardous materials (e.g., herbicides);
- Ensure equipment arrives on site free from fluid leaks;
- Establish a site for equipment maintenance, repair and cleaning that is at least 100 m from any lake, river, stream or wetland; and
- Assign environmental inspectors to oversee implementation of proposed mitigation measures.

Proposed mitigation measures have been shown to be effective for similar projects elsewhere and in the region, and the risk and severity of consequence in the event of mitigation failure is anticipated to be low.

17.6.4.3 Characterization of Residual Project Environmental Effects

Construction

Project activities associated with Construction may result in adverse residual environmental effects on mortality risk for Bird and Wildlife SAR/SOCC in the PDA. The magnitude of residual effects will be low following mitigation, as only a small percentage of SAR/SOCC populations are likely occur within or adjacent to the PDA (given overall low numbers and limited availability of primary habitat in the PDA) and thus potentially vulnerable, as well most individuals are expected to have been already displaced as a result of construction activities (sensory disturbance and habitat loss). Residual environmental effects on birds and wildlife during the Construction phase are anticipated to be short-term, occur sporadically (e.g., potential collisions), and will be reversible.

Operations and Maintenance

Project activities associated with Operations and Maintenance will result in adverse environmental effects on mortality risk for Bird and Wildlife SAR/SOCC in the PDA, primarily through vehicle or other collisions. The magnitude of adverse effects will be low, as many individuals are expected to have been previously displaced as a result of Project activities during Construction and thus low number likely vulnerable. Residual effects will continue throughout operations (i.e., are medium-term), occur sporadically, and are anticipated to be reversible.

Closure and Decommissioning

Project activities associated with Closure and Decommissioning will result in adverse residual environmental effects on mortality risk for Bird and Wildlife SAR/SOCC in the PDA, through the potential for vehicle or other collisions. Site reclamation activities that reduce the amount of access to primary habitats of some species targeted by hunters may result in a net positive residual effect. The magnitude of residual effects is anticipated to be low, as many individuals are expected to have been already displaced from the area, and thus overall low numbers are likely to be vulnerable, following implementation of mitigation. Residual environmental effects are anticipated to be short-term, occur sporadically, and will be reversible in terms of increased risk of mortality associated with collisions, but permanent in areas where access routes are rehabilitated (and hunting reduced).

17.6.5 Assessment of Change in Health (Bird and Wildlife SAR/SOCC)

Project activities during the Construction, Operations and Maintenance, and Closure and Decommissioning phases may have an environmental effect on change in health of species, and are discussed in terms of potential environmental effects on reproductive success for key or representative species. Changes in health may occur indirectly through stress (e.g., from sensory disturbances and avoidance behaviours), and the reproductive success of some species may also be affected when auditory signals (e.g., mating calls, prey sounds) are masked due to noise.

17.6.5.1 Potential Environmental Effects

Construction

Project activities during the Construction phase that may have an environmental effect on the health of SAR/SOCC are: site preparation, construction of roads, construction of causeway, construction of site buildings and associated infrastructure, construction of rail loop and associated infrastructure, construction of stream crossings, and installation of water supply infrastructure.

Displacement of individuals has the potential to result in higher concentrations of individuals in adjacent habitats, and/or the use of lower quality habitats, with potential effects on individual fitness (e.g., Schmiegelow et al. 1997, Fahrig 2003, Laliberte and Ripple 2004, Ewers and Didham 2006, Potvin and Courtois 2006, Fortin et al. 2013). Flaspohler et al. (2001) found that nest success was negatively correlated with the creation of openings in forested landscapes for ground nesting species, and that this negative relationship may extend up to 300 m into the forest.

Sensory disturbance (such as noise, light, and human presence) resulting from activities associated with Project construction (and other phases) may have an environmental effect on reproductive success. Physiological responses may result from increased sensory disturbance associated with various activities such as blasting, excavating, grading, installation and construction of infrastructure, and other activities. Prolonged human presence may elicit anti-predator responses and increase the risk of exposure to broods or young, as reported for brood-rearing Lesser Yellowlegs (Tibbits and Moskoff 1999). Noise levels associated with some of the Project's construction activities may mask important environmental cues (e.g., mating calls, warning sounds) used by bird and wildlife SAR/SOCC, thereby reducing individual survival and recruitment (Laiolo 2010). If sensory disturbances occur in areas near breeding grounds, individuals may display avoidance behaviours that could lower reproductive success (Cameron et al. 1992; Regosin et al. 2003; Burger et al. 2004; Squires et al. 2008; Faille et al. 2010; Pinard et al. 2012; Haapakoski and Ylonen 2013). The noise level threshold for behavioural responses by waterfowl generally occurs at 80 to 85 dBA (Bowles et al. 1991; Goudie and Jones 2004). Noise levels associated with Project Construction, at the nearest seasonal dwellings, will likely be higher than levels predicted for Operations and Maintenance (< 75 dBA), but will be temporary in nature, and likely to fall below the Health Canada recommended levels for day-night sound levels (Ldn), percent highly annoyed (percent HA), or the maximum sound level of 75 dBA.

Operations and Maintenance

Project activities that may result in a change in health of Bird and Wildlife SAR/SOCC during Operations and Maintenance are: open pit mining, dewatering of Joyce Lake, ore processing, waste rock disposal on surface, rail load-out and transport, and progressive rehabilitation. The mechanisms for effects on health (i.e., stress, sensory disturbance and displacement) are the same as those described for Project construction.

Closure and Decommissioning

Site decommissioning and reclamation activities during the Closure and Decommissioning phase may have an environmental effect on the health of Bird and Wildlife SAR/SOCC. Physiological stress and sensory disturbances are the same as those described during Construction.

17.6.5.2 Mitigation of Project Environmental Effects

Mitigation measures will be applied to avoid or reduce potential environmental effects on a change in health of Bird and Wildlife SAR/SOCC. The mitigation measures will be detailed in the EMP and will include the use of the appropriate and accepted best practices with respect to reducing potential environmental effects. Some examples include, but are not limited to:

- Comply with all provincial and federal legislation, permits, approvals and guidelines;
- Dispose of wastes in an approved waste disposal site;
- Use best practices for fuels and other hazardous materials (e.g., herbicides);
- Do not bury waste during progressive rehabilitation activities;
- Develop and implement a site-specific Emergency Spill Prevention and Response Plan;
- Allow fuel trucks to travel only on approved access roads;
- Ensure equipment arrives on site free from fluid leaks, and 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;

- Flag the boundaries of sensitive areas before commencing any work in the area, and avoid locations of SAR/SOCC to the extent feasible;
- Limit noise through the use of mufflers on equipment, enclosed motors and other equipment to attenuate sound propagation, and regular maintenance on vehicles and other equipment to reduce air and sound emissions;
- Limit lighting to that required for safe operation, use motion sensors for security lighting and/or shield exterior lights from above; and
- Assign environmental inspectors to oversee implementation of proposed mitigation measures.

Proposed mitigation measures have been shown to be effective for similar projects elsewhere and in the region, and the risk and severity of consequence in the event of mitigation failure is anticipated to be low.

17.6.5.3 Characterization of Residual Project Environmental Effects

Construction

Project activities during Construction are predicted to have an adverse residual environmental effect on the health of Bird and Wildlife SAR/SOCC in the LSA, primarily through sensory disturbances and potential avoidance behaviours. The magnitude of adverse effects will be low, as few Bird and Wildlife SAR/SOCC are likely to be exposed to sources of contamination, and the overall low proportion of SAR/SOCC likely affected given the low amount of suitable habitat for Bird and Wildlife SAR/SOCC in the PDA. Environmental effects during Construction are anticipated to be short-term, occur frequently, and are anticipated to be reversible.

Operations and Maintenance

Project activities during Operations and Maintenance are predicted to have an adverse environmental effect on the health of Bird and Wildlife SAR/SOCC in the LSA. The magnitude of adverse effects will be low as few individuals would likely be exposed to sources of contamination and the expected previous displacement of many individuals as a result of habitat loss and sensory disturbances during Construction. Environmental effects during Operations and Maintenance are anticipated to be medium-term (i.e., throughout operations), occur frequently, and are anticipated to be reversible.

Closure and Decommissioning

Project activities during Closure and Decommissioning are predicted to have an adverse environmental effect on the health of Bird and Wildlife SAR/SOCC in the LSA. The magnitude of adverse effects will be low, similarly based on the low number of individuals likely to be affected, given their expected previous displacement as a result of Construction activities. Environmental effects during Closure and Decommissioning are anticipated to be short-term, frequent, and reversible.

17.6.6 Summary of Residual Adverse Environmental Effects on SAR/SOCC

A summary of residual adverse environmental effects on SAR/SOCC (flora and fauna) is provided in Table 17.14.

17.7 Assessment of Cumulative Environmental Effects

In accordance with the EIS Guidelines, other projects and activities that have the potential to overlap in space and time with the Project are considered in assessing cumulative effects to VCs. Ongoing and reasonably foreseeable future projects with environmental effects considered in the cumulative effects assessment include the following:

- Champion Iron Ltd. Kami Iron Ore Project;
- Champion Iron Ltd. Fire Lake North Iron Ore Project;
- IOC Carol Mining Project;
- Tacora Resources Inc. Scully Mine;
- Arcelor-Mittal Mont Wright Mine;
- Champion Iron Ltd. Bloom Lake Mine and Rail Spur;
- Labrador Iron Mines Houston 1&2;
- Tata Steel Minerals Canada DSO Iron Ore Project;
- Lower Churchill Hydroelectric Generation Project; and
- Maritime Link Project.

Residual environmental effects on SAR/SOCC associated with the Joyce Lake Direct Shipping Iron Ore Project are primarily associated with the Construction phase and the loss or alteration of habitat that occurs as a result of site preparation. Residual environmental effects specific to Bird and Wildlife SAR/SOCC also include a potential change in distribution and movement of some individuals (through ongoing sensory disturbances and avoidance behaviours), increased risk of mortality (potential collisions), and changes in individual health (through sensory disturbances and increased stress and/or masking of auditory signals).

Cumulative environmental effects on SAR/SOCC may occur as a result of residual environmental effects from Project activities in combination with those of other projects or activities. Table 17.15 rates each potential interaction with other projects as 0, 1, or 2 with respect to the nature and degree to which environmental effects overlap with those of other projects and activities. The presence of SAR and SOCC has important ecological, social and regulatory implications.

Table 17.14 Summary of Residual Environmental Effects – Species at Risk and Species of Conservation Concern

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 Rare Species and Uncommon Communities											
Construction	See Section 17.6.1	A	M	S	LT	O	I	U/D	N	H	Labec Century on-site environmental personnel will be advised regarding all known rare plant occurrences associated with the mine site and mine infrastructure, and along the haul route. Future rare plant surveys may be required in those areas of proposed disturbance not yet surveyed. Monitor for compliance with mitigation measures
Operation and maintenance		A	L	S	LT	O	I	U/D	N	H	
Closure and Decommissioning		A	L	S	LT	O	I	D	N	H	
Change in Habitat (Bird and Wildlife SAR/SOCC)											
Construction	See Section 17.6.2	A	L	S	LT/P	O	R/I	U	N	M	Monitor for compliance of mitigation measures.
Operations and Maintenance		A	L	S	MT	S	R	D	N	M	
Closure and Decommissioning		P	L	S	P	O	R	D	N	M	

Table 17.14 Summary of Residual Environmental Effects – Species at Risk and Species of Conservation Concern

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 Distribution and Movement (Bird and Wildlife SAR/SOCC)											
Construction	See Section 17.6.3	A	L	L	MT	R	R	U	N	M	Monitor for compliance of mitigation measures.
Operations and Maintenance		A	L	L	MT	R	R	D	N	M	
Closure and Decommissioning		A	L	L	ST	F	R	D	N	M	
Change in Mortality Risk – Fauna											
Construction	See Section 17.6.4	A	L	S	ST	S	R	U	N	M	Monitor for compliance with mitigation measures
Operations and Maintenance		A	L	S	MT	S	R	D	N	M	
Closure and Decommissioning		A/P	L	S	ST/P	S	R	D	N	M	
Change in Health (Bird and Wildlife SAR/SOCC)											
Construction	See Section 17.6.5	A	L	L	ST	F	R	U	N	M	Monitor for compliance with mitigation measures
Operations and Maintenance		A	L	L	MT	F	R	D	N	M	
Closure and Decommissioning		A	L	L	ST	F	R	D	N	M	

Table 17.14 Summary of Residual Environmental Effects – Species at Risk and Species of Conservation Concern

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,
M Moderate,
H High

Geographic Extent:
S Site-specific: environmental effect confined to the PDA.
L Local: environmental effect extends into the LSA.
R Regional: environmental effect extends into the RSA, where indirect or cumulative environmental effects may occur.

Duration:
ST Short-term: residual environmental effect occurs during the Construction phase (i.e., one year)
MT Medium-term: residual environmental effect extends through the Operations and Maintenance phase (i.e., up to seven years)
LT Long-term: residual environmental effect is greater than seven years
P Permanent: measurable parameter unlikely to recover to baseline

Frequency:
Quantitative measure; or
O Once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.
U Unlikely to occur

Reversibility:
R Reversible: effect is reversible following closure and reclamation
I Irreversible: residual environmental effect 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 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.

Table 17.15 Potential Cumulative Environmental Effects

Other Projects and Activities with the Potential for Cumulative Environmental Effects	Potential Cumulative Environmental Effects				
	Change in Rare Plant Species and Uncommon Plant Communities	Change in Habitat (Bird and Wildlife SAR/SOCC)	Change in Distribution and Movement (Bird and Wildlife SAR/SOCC)	Change in Mortality Risk (Bird and Wildlife SAR/SOCC)	Change in Health (Bird and Wildlife SAR/SOCC)
Champion Iron Ltd. Kami Iron Ore	0	0	0	0	0
Arcelor-Mittal Mont Wright Mine	0	0	0	0	0
Champion Iron Ltd. Fire Lake North Iron Ore Project	0	0	0	0	0
Tacora Resources Inc. Scully Mine	0	0	0	0	0
Champion Iron Ltd. Bloom Lake Mine and Rail Spur	0	0	0	0	0
IOC Labrador Operation	0	0	0	0	0
Labrador Iron Mines Houston 1&2	1	1	2	2	2
Tata Steel Minerals Canada - DSO Iron Ore Project	1	1	2	2	2
Nalcor Energy - Lower Churchill Hydroelectric Generation Project	0	0	0	0	0
Maritime Transmission Link Project	0	0	0	0	0

Key:
0 No interaction (i.e., no potential for activity to result in the effect).
1 Interaction may occur; however, based on past experience and professional judgment, the resulting effect is well understood and can be managed to negligible or acceptable levels through standard operating procedures or through the application of management or codified practices. No further assessment is warranted.
2 Interaction may occur and the resulting effect may exceed negligible or acceptable levels without implementation of project-specific mitigation. Further assessment is warranted.

17.7.1 Interactions Rated as 0

A number of potential interactions are not expected to occur (rated “0”) or might occur, but do not warrant further assessment because Project environmental effects do not act cumulatively with those of other projects and activities (Table 17.15).

17.7.2 Interactions Rated as 1

Other projects and activities rated as 1 may have cumulative environmental effects on SAR/SOCC (Table 17.15); however, standard environmental protection practices are available and will be implemented to effectively mitigate these effects. Environmental protection measures designed to manage effects associated with the Project will be detailed in a separate EMP. To promote effectiveness of the EMP, Labec Century will have a full-time on-site environmental inspector, who will inspect worksites and activities for conformance with the EMP, and compliance with government regulations and permits.

17.7.2.1 Rare Plant Species and Uncommon Plant Communities

Effects on Rare Plant Species and Uncommon Plant Communities are rated 1 for Houston 1 & 2 (Labrador Iron Mines) and DSO Iron Ore Project (Tata Steel Minerals Canada).

There are no existing or planned projects or activities that overlap spatially with the PDA. The effects of existing projects and towns located within the RSA are reflected in baseline conditions. Presently, there is insufficient information available regarding the existence of rare plants or uncommon communities in the locations of the existing projects prior to their development, and as such the development of these projects may have resulted in the loss of individuals and/or habitat for SAR and SOCC.

Although historical mining activities in the region have resulted in disturbance to vegetation (i.e., along the existing access road to Iron Arm and throughout the area occupied by the existing seasonal properties), the effects of these activities on rare plant species and uncommon communities are unknown. The current initiative is unlikely to interact with past disturbances to cause important adverse effects on Rare Plant Species and Uncommon Plant Communities. In particular, none of the plant SOCC[1] which are likely to be disturbed by Joyce Lake Project activities are known to inhabit anthropogenically disturbed habitats. There is potential for both past and present developments, both on the Joyce Lake Peninsula and within the larger RSA, to have contributed to the amount of potentially available habitat for these species. Additionally, no uncommon plant communities are recognized on the Joyce Lake Peninsula or in association with other Project infrastructure (i.e., haul road, rail loop), thereby negating the potential for the Project to interact with other developments to adversely influence this biodiversity value.

Project effects (including loss of individuals or habitats in the PDA) are predicted to not act cumulatively with other past, present, or future projects or activities that would result in the degradation, alteration, or loss of important habitat, in quality or extent, in such a way as to cause a change or decline in distribution or abundance such that the likelihood of the long-term viability or survival of for rare plant species and uncommon communities within the RSA is substantially reduced as a result.

With implementation of mitigation measures described (refer to Section 17.6.1), the Project's effects are predicted to be not significant. There is a high level of confidence in the assessment of environmental effects and significance prediction because of the nature of mitigation outlined in this assessment and the collective professional judgment of the Study Team which has local knowledge based on involvement with other projects within the RSA and wider region (i.e., western Labrador).

[1] there are presently no known occurrences of listed plant SAR in the region

17.7.2.2 Bird and Wildlife SAR/SOCC

Cumulative environmental effects rated as 1 are limited to a potential change in habitat of Bird and Wildlife SAR/SOCC. Effects on habitat are rated 1 for those activities closest to the Project and include the Schefferville Iron Ore Mine and Houston 1&2 project (approximately 25 km away) and the Tata DSO Iron Project (approximately 35 km away). For individuals with ranges that overlap the project footprint of these two other developments (e.g., migratory species), potential habitat availability may be reduced. However, given the high mobility of potentially affected individuals, and the general availability of primary habitat in the RSA and adjacent areas, it is anticipated that few individuals would be adversely affected following the implementation of standard mitigation measures and BMP.

17.7.3 Interactions Rated as 2

An assessment of Project environmental effects was completed for Project activities that have the potential to act cumulatively with those of other projects and activities that have the potential to result in significant adverse environmental effects without implementation of project-specific or regional mitigation. In the case of this assessment, this applies only to Bird and Wildlife SAR/SOCC. Specifically, projects within and immediately adjacent to the RSA were included in this analysis: Houston 1&2 project and the DSO Iron Ore Project.

17.7.4 Assessment of Cumulative Environmental Effects

Environmental effects that have the potential to interact cumulatively with other projects and activities and rated as “2” (Table 17.15) are a change in distribution and movement, change in mortality risk, and change in health.

17.7.4.1 Potential Environmental Effects

Change in Distribution and Movement (Bird and Wildlife SAR/SOCC)

Existing projects have the potential to affect the distribution and movement of birds and wildlife via activities that result in habitat fragmentation and the creation of sensory disturbance (lighting, noise, human presence). Potential interactions with the Joyce Lake Direct Shipping Iron Ore Project may occur, particularly for SAR/SOCC during seasonal/annual migrations.

Given the distance between projects, following implementation of standard mitigation measures (including reducing site lighting and noise levels, and restricting all activities to the PDA or respective footprints of other projects), a relatively small proportion of populations is likely vulnerable to these effects.

Change in Mortality Risk (Bird and Wildlife SAR/SOCC)

Existing projects near the Project have an environmental effect on mortality through vehicle collisions, collisions associated with light attraction, and direct mortality associated with clearing activities. Cumulative environmental effects may occur for species with home ranges that have the potential to overlap nearby projects and are likely to occur in the RSA (e.g., migratory SAR such as Gray-cheeked Thrush).

Change in Health (Bird and Wildlife SAR/SOCC)

Existing projects in and adjacent to the RSA may have an environmental effect on health via displacement and resultant stress associated with potential increases in competition, predation, and search times to find suitable habitat and/or having to settle in lower quality habitats. Light exposure and noise may also increase stress. Potential interactions are greatest for migratory SAR/SOCC (e.g., birds, bats).

17.7.4.2 Mitigation of Cumulative Environmental Effects

Labec Century will comply with all provincial and federal legislation, permits, policies, and guideline, and current and future projects are and will also be subject to such regulations aimed at protecting SAR and SOCC. Mitigation measures that will be untaken for the Project are identified in Sections 17.6.1 to 17.6.5. These same mitigation measures apply to address cumulative environmental effects on a change in rare or uncommon plant communities, and/or a change in habitat, distribution and movement, mortality risk, or health of birds and wildlife. Additional mitigation includes supporting collaborative initiatives with proponents of other projects and activities, government agencies and other third parties. An example of such initiatives may include the participation in research and recovery planning for SAR and SOCC.

17.7.4.3 Characterization of Residual Cumulative Environmental Effects

Residual cumulative environmental effects are anticipated to be adverse and low in magnitude, following implementation of standard and proven mitigation measures and BMP. Environmental effects are likely to be sporadic (e.g., mortality as a result of collisions), medium- to long-term in duration, and reversible.

17.8 Accidents and Malfunctions

Reasonable worst-case scenarios for accidents and malfunctions that may result from the Project and may have an environmental effect on SAR and SOCC include:

- Hydrocarbon Spill;
- Train Derailment;
- Forest Fire;
- Settling/Sedimentation Pond Overflow; and
- Premature or Permanent Shutdown.

17.8.1 Hydrocarbon Spill

Fuel storage on the site will include diesel and fuel oil tanks located at the rail unloading area, near the diesel generators at the mine site, and the process plant area. The maximum total storage capacity for diesel fuel will be 250,000 L. The fuel storage tanks will be located in secondary containment to control spills and will comply with requirements of the applicable provincial and federal acts and regulations, as well as the conditions of the permit and authorizations. The control measures will be able to contain the maximum capacity of all tanks in a storage area.

17.8.1.1 Emergency Response/Mitigation of Environmental Effects

The main mitigation measures for a hydrocarbon spill relate to prevention and rapid and effective cleanup. As part of the Emergency Response and Spill Response Plan, spill prevention and response protocols will include the inspection of vehicles and hydraulics on a daily basis for leaks or damage that could cause minor spills and rapid spill response. Vehicles and equipment will be stored in controlled areas where secondary containment of spills can be provided. Staff will be trained in the handling of emergency response and spill scenarios. Response equipment stored on site will include containment and absorbent booms, pads, barriers, sand bags, and skimmers, as well as natural and synthetic sorbent materials.

17.8.1.2 Characterization of Residual Environmental Effects

SAR/SOCC may be adversely affected by a fuel tank failure and the consequent releases of petroleum hydrocarbons. A major fuel spill could result in the movement of free phase petroleum hydrocarbons across the surface towards receiving waters and drainage features, as well as movement of free petroleum hydrocarbon product into subsurface soils, thereby affecting habitat (terrestrial, wetland, and/or aquatic) for SAR/SOCC. Such spills are usually highly localized and can be effectively cleaned up by on-site crews using standard equipment and spill response materials.

The environmental effects of a fuel spill on SAR/SOCC are predicted to be adverse, but localized and temporary. The magnitude and duration of any environmental effect depends on a number of factors including the nature of material spilled, the quantity spilled, the location of the spill, and the time of year in which the incident occurs. Large fuel spills are unlikely to occur. With appropriate mitigation, the magnitude of the environmental effects is likely to be low; under potentially worst case scenarios magnitude could be moderate. Spill prevention and response protocols included in the Emergency Response and Spill Response Plan will further reduce the likelihood of a fuel spill. Reversibility of the environmental effects will depend on the specific habitat involved, the proportion of habitat affected, and the potential for those habitats to be used by species, but would be anticipated to occur naturally over a number of years. Significant effects on SAR and SOCC (e.g., population level effects) are not anticipated; this prediction is made with a high level of confidence.

17.8.2 Train Derailment

Iron ore product will be transported by truck from the Project site to the Astray rail loop which connects directly to the Tshiuetin/QNS&L railway for transport to Sept-Îles. Diesel fuel will be transported by rail to Schefferville and then by contracted trucker to site. On average, iron ore will be transported on approximately four trains each week during summer months between the Astray rail loop and the Sept-Îles port. Each train set will carry approximately 24,000 tonnes of ore in 240 gondola cars. Based on the speed the train will be travelling in the rail loop (5 miles per hour or 8 km/h), the reasonable worst case is the derailment of a maximum of four to five cars. This could result in the iron ore being spilled onto the ground or at stream crossings. Such an event is highly unlikely.

It is estimated that diesel fuel transport frequency will be a maximum of six 96,000 L tank cars per week for all site purposes.

Fuel tank car numbers are based on shipment in standard 96,000 L tank cars similar to those already in fuel haulage service between Sept-Îles and Labrador City. In a reasonable worst case scenario (i.e., where six tanks of diesel fuel are de-railed), approximately 576,000 L (127,000 Imperial gallons) of diesel fuel could be released.

17.8.2.1 Emergency Response/Mitigation of Environmental Effects

The trains will be operated under current Tshiuetin/QNS&L environmental and safety procedures. A detailed Emergency Response and Spill Response Plan will also be developed by Labec Century. This plan will include measures such as:

- Immediate response through the use of absorbent booms and pads;
- Liquid clean up using a vacuum truck (both fuel and groundwater);
- Reclamation of contaminated soils, removal of contaminated soils and replacement with clean soil.

Additional mitigation measures to be implemented to limit the potential for a train derailment include:

- Manual inspection of rolling stock to confirm there are no problems with the wheels, couplers, carbody or brakes;
- Track inspections in accordance with Transport Canada regulations;
- Properly maintained equipment; and
- Fuel transport amounts will be limited to the amounts required by the Project.

To reduce the likelihood of such an event, emphasis will be placed on safety and accident prevention. Effective and rapid response procedures will be in place, in the unlikely event of a Train Derailment.

17.8.2.2 Characterization of Residual Environmental Effects

A train derailment may occur resulting in the deposition of hazardous materials and/or crushed and screened iron ore products 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. 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 SAR/SOCC, in particular where those lands provide habitat for these species (e.g., wetlands). The magnitude and duration of any environmental effect depends on a number of factors including 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 and Spill Response Plan will address emergency preparedness measures necessary to provide effective response in the unlikely event of a spill. 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. With appropriate mitigation, the magnitude of the environmental effects attributable to these infrequent and unlikely accidents and malfunctions is likely to be low; under potentially worse case scenarios magnitude could be moderate. 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 used by species, but would be anticipated to occur naturally over a number of years. Significant effects on SAR and SOCC (e.g., population level effects) are not anticipated; this prediction is made with a high level of confidence.

17.8.3 Forest Fire

Although unlikely, Project activities involving the use of heat or flame could result in a fire. Fires can alter habitat, consume vegetation and lead to direct mortality of SAR/SOCC species. The extent and duration of a fire would be dependent on response efforts and meteorological conditions.

17.8.3.1 Emergency Response/Mitigation of Environmental Effects

Fire suppression water systems will be maintained on site. The fire suppression water supply at the mine and processing site will be extracted from wells and stored in a 200,000 L fire water tank prior to use. The fire suppression water at the Astray rail loop will be extracted from Astray Lake. 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 Spill Response Plan.

The nearest district forest management unit office in Labrador is in Wabush, which has staff and equipment to provide initial suppression activities. The Town of Schefferville also provides fire control services. Labec Century is discussing a reciprocal response arrangement with the Town of Schefferville, approximately 20 km away from the site. In the event of a fire, the on-site response and proximity of fire suppression services in Schefferville will limit the size of any burn.

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 in Labrador is in Wabush, which has staff and equipment to provide initial suppression activities.

17.8.3.2 Characterization of Residual Environmental Effects

A fire in the Project area could alter the distribution of SAR or SOCC, with the potential for a short to medium term loss of important habitat. The effects of a forest fire on important habitat are predicted to be adverse, because it would reduce availability of habitat for most SAR or SOCC (particularly vascular plants), The magnitude and geographic extent of the environmental effect is largely dependent on the scale and intensity of the forest fire; extensive fires may result in significant adverse residual environmental effects, if uncontrolled. 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. Reversibility of the physical effects of a fire is high, but would be anticipated to occur over a number of years. The restoration of important habitats would rely upon the re-establishment of vegetation communities through succession and the maintenance of those ecological conditions that existed prior to disturbance, and thus environmental effects on habitat may be of short to long duration. The likelihood of a forest fire occurring naturally is low; fire cycles in Labrador can exceed 400 to 500 years (Elson 2009). The prediction of significant effects (e.g., potentially affecting SAR/SOCC species at a population level) in the unlikely event of a very large fire is made with a moderate level of confidence.

17.8.4 Settling/Sedimentation Pond Overflow

Settling/sedimentation ponds will be established at waste rock, overburden, run-of-mine stockpile areas, at the crushing and screening plant area, at the accommodation camp area, and at the rail loop. Run-off from the stockpiles and site run-off will be directed to the settling/sedimentation ponds prior to discharge to the receiving environment. The likelihood of an overflow is low because the ponds will be designed to contain run-off associated with a 1:100 year precipitation event. In such an event, settling/sedimentation ponds could overflow, releasing untreated water. Untreated water could have elevated levels of total suspended solids. No other contaminants are anticipated.

In the unlikely event of an overflow, contingency plans will be in place as part of the Emergency Response and Spill Response Plan to mitigate environmental effects to the receiving environment. Water sampling of TSS and other MDMER parameters will be conducted in downstream water bodies. Applicable stakeholders, including regulatory agencies, First Nations and communities, will be consulted to discuss such events and mitigation measures to be implemented.

17.8.4.1 Emergency Response/Mitigation of Environmental Effects

In the unlikely event of an overflow event, contingency plans will be in place as part of the Emergency Response and Spill Response Plan to mitigate environmental effects to the receiving environment. Water sampling of TSS and pH levels will be conducted in downstream waterbodies.

17.8.4.2 Characterization of Residual Environmental Effects

Settling/sedimentation pond overflow could result in the release of sediment and/or debris downstream. In the case where a large, sudden breach occurred, failure of the settling/sedimentation ponds could temporarily degrade habitat down gradient of the pond, and in adjacent wetlands. Loss of habitat could potentially influence the loss, or sustained presence of SAR/SOCC (particularly vascular plants) in the area of the release. SOCC have been recorded in association with a number of the wetlands and riparian areas surveyed within the PDA; however, these wetland habitats do not represent high quality or limiting wildlife habitat in consideration of the available riparian and wetland habitat in the RSA.

The Emergency Response and Spill Response Plan will address emergency preparedness measures necessary to provide effective response in the unlikely event of a settling/sedimentation pond overflow. The magnitude of adverse residual environmental effects of a settling/sedimentation pond overflow is largely dependent on the volume released, but anticipated to be low following implementation of mitigation and emergency response measures. In the unlikely event of an overflow, environmental effects are anticipated to be short- to long-term in duration and reversible over a number of years. Significant effects on SAR and SOCC (e.g., population level effects) are not anticipated; this prediction is made with a high level of confidence.

17.8.5 Premature or Permanent Shutdown

As currently planned, the mine will have an operational production period of seven years, (following one year of construction) at which time decommissioning and rehabilitation will commence. However, should factors arise that result in the premature shutdown of the mine, regulatory requirements include provision for financial assurance from Labec Century

17.8.5.1 Emergency Response/Mitigation of Environmental Effects

Rehabilitative measures may be implemented by the NLDIET, in which case costs incurred by the Crown in implementing these measures may be recovered by drawing on the financial assurance provided by the proponent. Any required cost expenditures over and above the financial assurance provided would be considered debt by Labec Century to the Crown.

17.8.5.2 Characterization of Residual Environmental Effects

In the event of a premature or permanent shutdown, it is anticipated that adverse environmental effects would be low, under the assumption that rehabilitative measures would be realized following implementation by the Crown. Residual environmental effects would be site-specific, and short to long term duration for some habitats following site rehabilitation, or permanent for other habitats that may not return to pre-Project conditions (e.g., open pit). Significant effects on SAR and SOCC (e.g., population level effects) are not anticipated; this prediction is made with a high level of confidence.

17.8.6 Summary of Residual Effects Resulting from Accidents and Malfunctions

A summary of residual environmental effects resulting from accidents and malfunctions is summarized in Table 17.16.

17.9 Determination of Significance of Residual Adverse Environmental Effects

In the approach to the assessment, effect pathways for Project and cumulative effects for SAR/SOCC were change in rare plant species and uncommon plant communities, and change in habitat, distribution and movement, mortality risk, and health for bird and wildlife SAR/SOCC. Within the EIS, effect pathways are first considered separately for each phase of the Project and associated activities, to demonstrate that the full range of potential effects of the Project has been assessed and characterized. The determination of the significance of residual effects of the Project considers the combined effects of all identified pathways and provides an overall prediction of the potential risk posed by the Project.

17.9.1 Project Residual Environmental Effects

The EIS considers the effect of Project Construction, Operations and Maintenance, and Closure and Decommissioning on SAR and SOCC. The Project is being designed, and will be constructed and operated to reduce potential environmental effects on SAR and SOCC that could result during the normal course of the Project as well as those that could result from accidents and malfunctions. Specific mitigation measures that will be implemented to reduce potential environmental effects associated with the Project are summarized in Sections 17.6.1 through 17.6.5. Details related to these measures will be provided in the EMP and the Emergency Response and Spill Response Plan for the Project.

During Construction, the Project will result in direct disturbance and/or removal of vegetation and vegetation communities, and thus a number of habitat types within the PDA will be altered or lost, with potential changes in the distribution and abundance of SAR[2] and SOCC. Although the Project will alter habitat for SAR and SOCC, the populations of these species are predicted to remain in the adjoining LSA on Closure and Decommissioning of the Project. Progressive rehabilitation will be conducted throughout the life of the Project, further mitigating effects on SAR and SOCC.

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[2] No plant species listed under SARA or under the NLESA were found to occur within the PDA. Interaction between the Project and those species deemed to be of conservation concern to the Province (i.e., SOCC).

Table 17.16 Summary of Residual Environmental Effects – Accidents and Malfunctions

Project Phase	Emergency Response/Contingency Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental/Socio-economic Context			
Operations and Maintenance											
Fuel Spill	• Develop and Implement an Emergency Response and Spill Response Plan.	A	L/M	S	ST/MT	U	R	U	N	H	Monitor for success of response measures.
Train Derailment	• Develop and Implement an Emergency Response and Spill Response Plan	A	L/M	S	ST/MT	U	R	U	N	H	Monitor for success of response measures.
Forest Fire	• Develop and Implement an Emergency Response and Spill Response Plan	A	H	S/R	ST	U	R	U	S	M	Monitor for success of response measures.
Settling/ Sedimentation Pond Overflow	• Develop and Implement an Emergency Response and Spill Response Plan	A	L/M	S	ST/LT	U	R	U	N	H	Monitor success of response measures.
Premature or Permanent Shutdown	• Work with NLDIET to implement rehabilitative measures.	A	L	S	ST/P	U	R/I	U	N	H	Monitor success of response measures.

Table 17.16 Summary of Residual Environmental Effects – Accidents and Malfunctions

Project Phase	Emergency Response/Contingency Measures	Direction	Residual Environmental Characteristics						Significance	Prediction Confidence	Recommended Follow-up and Monitoring
			Magnitude	Geographic Extent	Duration	Frequency	Reversibility	Environmental/Socio-economic Context			

Key:

Direction:
P Positive,
A Adverse,
N Neutral

Magnitude:
L Low,
M Moderate,
H High

Geographic Extent:
S Site-specific: environmental effect confined to the PDA.
L Local: environmental effect extends into the LSA.
R Regional: environmental effect extends into the RSA, where indirect or cumulative environmental effects may occur.

Duration:
ST Short-term: residual environmental effect occurs during the Construction phase (i.e., one year)
MT Medium-term: residual environmental effect extends through the Operations and Maintenance phase (i.e., up to seven years)
LT Long-term: residual environmental effect is greater than seven years
P Permanent: measurable parameter unlikely to recover to baseline

Frequency:
Quantitative measure; or
O Once per month or less.
S Occurs sporadically at irregular intervals.
R Occurs on a regular basis and at regular intervals.
C Continuous.
U Unlikely to occur

Reversibility:
R Reversible: effect is reversible following closure and reclamation
I Irreversible: residual environmental effect 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 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.

In cases where occurrences of plant SOCC cannot be avoided, mitigation (e.g., transplantation to alternate suitable habitat) will be investigated. Additional residual adverse effects on plants and plant communities are not expected during Operations and Maintenance or Closure and Decommissioning because adverse residual effects will occur primarily, if not exclusively, as a result of first-time ground disturbance (i.e., site preparation) during Construction and in compliance with proposed mitigation and environmental protection measures.

Residual environmental effects on Bird and Wildlife SAR/SOCC are associated primarily the loss or alteration of habitat associated with Project Construction. Additional residual environmental effects include potential changes in distribution and movement of individuals of some species, increased risk of mortality, and changes in individual health associated with collisions, increased access, ongoing sensory disturbances and avoidance behaviours.

Although the Project is expected to have an adverse environmental effect on SAR and SOCC, the Project will not result in a change or decline in the distribution or abundance of species such that the likelihood of their long-term survival within the LSA is substantially reduced as a result. Therefore, with the proposed mitigation and environmental protection measures, the environmental effect of the Project on SAR and SOCC is predicted to be not significant. The level of confidence that the effect will not be greater than predicted is moderate for Bird and Wildlife SAR/SOCC and high for plant SOCC. The following principles were used to provide confidence to the effects predictions:

- Baseline data for Bird and Wildlife SAR/SOCC in the Project PDA incorporated field studies and a review of relevant literature. The abundance of some SAR/SOCC in the PDA and RSA remains uncertain; however, biological processes (e.g., behavioural responses to stimuli) are well understood;

- ELC habitat data used to assess Project environmental effects were based on the most accurate and appropriately scaled data sources available;

- Habitats used to assess Project-related environmental were ranked so that the loss of such habitats would be over- versus under-estimated. As a conservative measure, <5% loss of habitat was used to represent a low effect, 5% to 25% loss of habitat was used to represent a moderate effect, and >25% was used to indicate a high environmental effect;

- If sufficient information is available on the habitat requirements of potentially occurring rare plant species (substrate, plant community, etc.), and the site in question is believed to be unsuitable for those species, a field visit may still be recommended to document and validate the assumptions for believing the species to be absent.

- Conclusions are conservatively made and assumed that an effect was more rather than less adverse;

- Mitigation measures proposed have been proven successful and will be followed by monitoring to assess effectiveness; and

- Mechanisms to evaluate monitoring results and provide for subsequent/additional mitigation or project modification will be implemented, as necessary.

17.9.2 Cumulative Environmental Effects

This Project-specific cumulative environmental effects assessment considered the identified potential residual environmental effects of the Project on SAR/SOCC in combination with similar residual effects resulting from past, present and future effects of existing and reasonably foreseeable projects and activities.

The contribution of the Project to potential cumulative environmental effects is anticipated to be negligible to low when considered in the context of the RSA. The Project will not result in a change or decline in the distribution or abundance of SAR and SOCC or their habitats, such that the likelihood of its long-term viability within the RSA is substantially reduced as a result. It is assumed that other projects (current and future) are or will be subject to federal and provincial policies that SAR/SOCC and their habitat, and will be required to implement similar well-established and proven mitigation measures to reduce the cumulative effects to a level which is not significant at the level of regional populations. Therefore, residual cumulative environmental effects on SAR and SOCC are predicted to be not significant. This determination has been made with a high level of confidence, given the limited temporal and spatial nature of the potential residual cumulative environmental effects, the professional knowledge and experience of the Study Team, as well as the associated mitigation.

17.9.3 Accidents and Malfunctions

The residual adverse environmental effects on SAR/SOCC resulting from accidents and malfunctions are predicted to be not significant, as design features and engineering techniques will be incorporated to reduce potential effects, with the exception of forest fires that may result in significant effects depending on scale and intensity. In the unlikely event of an accident or malfunction, an Emergency Response and Spill Response Plan will be implemented to further reduce adverse environmental effects.

17.10 Follow-up and Monitoring

Monitoring is a necessary component and will inform future mitigation strategies. In the unlikely event it is found that mitigation measures are not effective, adaptive management measures will be developed to address potential issues and government departments responsible for the species in question would be engaged in reviewing the proposed measures.

In consultation with the appropriate regulatory authorities, Labec Century will evaluate the need for monitoring plans to verify predicted effects and to confirm Labec Century's intended objective for SAR and SOCC which includes the protection of species at risk, important wildlife habitat, and the biodiversity and ecological integrity of their habitats. Pre-construction surveys for SAR and SOCC have already been completed (as part of the baseline investigations) and additional monitoring, including compliance monitoring, will be conducted during Construction, Operations and Maintenance, and at Closure and Decommissioning, as appropriate.

Final details of the monitoring requirements and adaptive management strategies required to achieve intended goals will be included in the detailed EMP to be developed in consultation with the appropriate regulatory agencies and stakeholder groups.

Monitoring plans are conceptual at this time and will be developed upon release of the Project from the EIS process. The following monitoring plans (or documentation of information) are recommended for the Project:

- Monitoring of all Project-related activities, particularly during Construction, to document whether mitigation has been implemented and effective (i.e., whether SAR and SOCC are protected);
- Monitoring of all construction activities to document whether vegetation is cleared only from designated area;
- Periodic monitoring of the known occurrences of rare plant species defined as the habitat or microhabitat areas where species have been positively identified by professional botanists through surveys or observation and mapped with reasonable accuracy as to permit their protection;
- Documentation of the mortalities related to road kills or associated with site lighting or other activities;
- Documentation of SAR/SOCC observed in relation to the Project or any Project-SAR/SOCC interactions;
- In the year following Construction, monitoring following spring run-off may be considered to review the effectiveness of the bank and slope re-vegetation, to check bank and slope stability, to determine the effectiveness of surface drainage and that habitat protection measures (e.g., silt fencing) remain functional. Appropriate remedial measures will be completed as necessary and additional follow-up monitoring conducted as appropriate; and
- Monitoring and remediation following the unlikely event of contamination from an accidental spill or malfunction.

In addition, monitoring will be necessary following the unlikely event of contamination from an accidental spill or malfunction. Required monitoring will be detailed in the Emergency Response and Spill Response Plan.

17.11 Summary

All phases of the Project (Construction, Operations and Maintenance, Closure and Decommissioning) are likely to have an adverse effect on SAR and SOCC. With the proposed mitigation and environmental protection measures, adverse residual environmental effects on SAR and SOCC are anticipated to be not significant. That is, adverse residual environmental effects will not be seen on the sustainability of populations in the RSA as a whole.

Standard and proven mitigation measures and BMP designed to limit the area disturbed by the Project and to manage sensory disturbances, emissions and discharges, will be applied to mitigate environmental effects of the Project on SAR/SOCC. Site-specific procedures will be outlined in the EMP and the Emergency Response and Spill Response Plan, including mitigation to protect SAR/SOCC (e.g., Avifauna Management Plan, transplantation of plant SOCC), sensitive habitats, and the biodiversity and ecological integrity in proximity to the Project.

The characterization of the potential cumulative environmental effects and associated mechanisms, combined with the proposed mitigation measures proposed in Section 17.7 indicate that the residual cumulative environmental effects as a result of past, present, and reasonably foreseeable projects and activities that have been or will be carried out, in combination with the environmental effects of the Project during all phases, on SAR and SOCC is rated not significant.

17.12 References

17.12.1 Personal Communications

Claudia Hanel. Personal Communication 2013. Ecosystem Management Ecologist, Botanist. 16 June 2013.

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