
Appendix A

Health, Safety, Environment and Quality Policy & Water Management Plan

Policy on

HEALTH, SAFETY, ENVIRONMENT AND COMMUNITIES

RioTinto



Iron Ore Company of Canada and its subsidiary QNS&L Railway recognise that the pursuit of excellence with regard to health, safety, the environment and communities (HSEC) is vital to a company's success and sustainability. We also recognise that this level of excellence can be achieved or maintained only through teamwork, respect and integrity.

OUR SUCCESS FACTORS



Each person
RETURNS HOME SAFE AND HEALTHY
at the end of the shift.



Our environmental footprint is
REDUCED TO A MINIMUM.



We are seen as an
OUTSTANDING CORPORATE CITIZEN.



Our sales products meet our
CUSTOMER'S EXPECTATIONS.

To achieve our four key success factors, we are actively working to reduce HSEC risks to the lowest possible level and optimise our supply chain.

We are making sure to carry out our activities in accordance with the laws, regulations and other applicable requirements, including those of Rio Tinto and our customers.

We are using the continuous improvement process and establishing measurable annual objectives and targets to evaluate our performance against our success factors.

To focus on achieving these objectives, **OUR COMMITMENTS** are :

HEALTH

- Protect and enhance the health of employees, promoting workplace wellness through health promotion and prevention, medical surveillance and injury / illness management.
- Mitigate occupational disease by identifying and controlling our material health risks.

SAFETY

- Provide the material, financial and professional resources needed to effectively manage risks.
- Promote a sound and consistent culture of safety built into all hierarchical levels in all areas.
- Work to minimise employees' and contractors' risk tolerance threshold.
- Maintain a rail safety management system compliant to Transport Canada's requirements.

ENVIRONMENT

- Adopt best practices to prevent pollution, reduce waste, greenhouse gases, water consumption, energy and protect biodiversity.
- Produce quality products that give us a competitive advantage, according to a sustainable development approach.
- Ensure the safe management of tailing facilities throughout their life cycle.

COMMUNITIES

- Foster the collaboration and trust of employees, contractors, communities and government authorities through frank and proactive communication.
- Mitigate the impact of our operations in order to maintain viable relationships with our stakeholders.
- Recognise and respect the interests and the rights of Indigenous peoples, and promote mutually beneficial collaboration.

Mike McCann
IOC Chairman & CEO

Chantal Lavoie
Chief Operating Officer



Our commitment to health, safety, environment and communities is fundamental to how we do business at Rio Tinto. It applies wherever and whenever we operate, from exploration, to closure.

<p>Safety Caring for human life and wellbeing above everything else</p>	<p>Teamwork Collaborating for success</p>	<p>Respect Fostering inclusion and embracing diversity</p>	<p>Integrity Having the courage and commitment to do the right thing</p>	<p>Excellence Being the best we can be for superior performance</p>
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Delivering world class health, safety, environment and communities performance is essential to our business success. Meeting our commitments in these areas contributes to sustainable development and underpins our continued access to resources, capital and engaged people. Our focus on continuous improvement ensures regular renewal and relevance of our policies, procedures and activities.

We make the safety and wellbeing of our employees, contractors and communities our number one goal. Always. Where everyone goes home safe and healthy every day.

Equally critical, is maintaining stakeholder confidence through accountable and effective management of our risks and our impacts. Safely looking after the environment is an essential part of our care for future generations.

We approach each social, environmental or economic challenge as an opportunity to create safer, more valuable and more responsible ways to run our business. Wherever possible we prevent, or otherwise minimise, mitigate and remediate

the effects of our business' operations. We assess the impact of our activities and products in advance, and we work with local communities and agencies to manage and monitor these impacts.

Our approach starts with compliance with relevant laws and regulations. We have the courage and commitment to doing what is right, not what is easiest. We maintain our focus on ethics, transparency and building mutual trust. We support and encourage further action by helping to identify, develop and implement world class practices through the application of our Group wide standards.

We make the safety and wellbeing of our employees, contractors and communities our number one goal.



We actively monitor and ensure the security and resilience of our operations and collaborate when confronted with unwanted events or interruptions to minimise the impact on our people, communities, stakeholders and operations.

We work together with colleagues, partners and communities globally to deliver the products our customers need. We learn from each other to improve our performance and achieve success. We promote active partnerships at international, national, regional, and local levels, based on mutual commitment and trust. We engage with our joint venture partners to share our practices and insights. We recognise and respect diverse cultures, communities and points of view.

We acknowledge and respect Indigenous and local communities' connections to lands, waters and the environment and seek to develop mutually beneficial agreements with land connected peoples. We prioritise local economic participation through employment and business development. We respect human rights and work with communities to create mutual value throughout and beyond the life of our operations.

Importantly, it is a shared responsibility, requiring the active commitment and participation of all our leaders, employees and contractors. Our business standards, systems and processes, support responsible operations, as well as contributions and innovations that make a positive and sustainable difference in every region we are part of.



Construction and Development

WATER MANAGEMENT PLAN

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[Sponsor's approval is required for this document](#)

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Approved by :	Tina Cassell		September 12, 2018
	Name	Signature	Date

Revision Record				
Revision	Description of change	Prepared by	Approved by	Date
01	Review to update procedures if applicable	Tina Cassell	<i>Tina Cassell</i>	February 21, 2023

References

N°	Reference	Title
1	CR-E-E-FRM	Effluent Management Plan – Mining Operations
2	CR-E-E-PRO	Dewatering Pits and Lakes
3	CR-E-E-PRO	Internal Water Sampling
4	CR-E-E-PRO	MDMER Final Discharge Point Monitoring
5		Mine Site Water Management Plan
6		Water Management SOP
7	EPP	Environmental Protection Plan
8	CR-E-E-PRO	Land Management and Disturbances Procedure
9	CR-E-E FRM	Land Management and Disturbances Permit Request

INTRODUCTION

PURPOSE

The purpose of the Water Management Plan is to fulfil the Iron Ore Company of Canada's (IOC) commitment to the Government of Newfoundland and Labrador as stated in the Environment Assessment Registration (EA) to provide a Water Management Plan (WMP) for expansion and development.

This WMP will be incorporated into IOC's existing Mine Site Water Management Plan.

The purpose of the WMP is to provide a description of the management, design, and proper operating procedures for the dewatering systems in the IOC mine site. This document describes the existing environment, the proposed dewatering systems for the mine and future water management. This is a living document and will be reviewed on an annual basis, in case of significant environmental non-compliance or when more design information is made available and changed as necessary.

WATER MANAGEMENT OBJECTIVES

The key objectives of IOC's WMP are as follows:

- Ensuring compliance with discharge and monitoring requirements as specified in Government Legislation, approvals, and Regulations.
- Ensuring conformance with Rio Tinto's Water quality protection and water management E11.
- Anticipating and proactively managing in-pit water issues; and,
- Effectively managing site runoff to reduce soil erosion and sediment transport to receiving waters.

OVERVIEW

The IOC site can be separated into two working areas: the mine area and the processing plants. This document specifically covers construction, expansion and development in the mining area. Upon handover of Projects and integration into IOC's existing operations this document will be incorporated into the WMP for the entire mine site which covers the water management systems for the mining area. This Plan does not include the processing plants.

WATER MANAGEMENT RESPONSIBILITIES

IOC departments that have water management responsibilities in the mining area include but are not limited to the following:

- Mine Operations.
- Mine Maintenance.
- Health, Safety, and Environment Group (HSE); and,
- Mine Operations Technical Services.

For the purposes of construction activities for future expansion and development, contractors working in the project area also have water management responsibilities.

PIT INFLOW MANAGEMENT

The principal objectives of managing pit inflows are to create and maintain a dry environment for drilling, blasting and excavating material, and to reduce adverse effects of groundwater on the development of sinking cuts. These objectives are accomplished by developing and maintaining a dewatering system that includes the following aspects:

- Diverting surface flows around the pit area with diversions and ditches.
- Collecting groundwater seepage and surface runoff from the mining area and directing it into designated sumps within the pit.
- Preventing surface ponding on the pit floor by directing flows into sumps with the use of ditches.
- Extracting groundwater with dewatering wells, to draw the water table below the operating level in the pit; and,
- Maintaining drawdown conditions in sumps by pumping water out of the pit to designated discharge points.

SURFACE RUNOFF AND ROAD MAINTENANCE

Run-off from haul roads, waste rock dumps and overburden stockpiles during spring freshet and summer storms contributes to sedimentation and risk of elevated total suspended solids (TSS) in receiving waters. This section of the Water Management Plan describes the standards under which design, construction, and maintenance are undertaken to minimize the environmental and operational impacts of an uncontrolled release of run-off to sediment collection area and water bodies. Specific objectives include:

- Proper geometric and geotechnical engineering of roads, ramps and ditches that incorporates safety, economics, efficiency, and environmental diligence.
- Construction and maintenance of settling ponds.
- Planned and scheduled construction activities.
- A regime of inspections and planned maintenance of roads and ditches as specified in Standard Operating Procedures.
- A process for periodic monitoring and auditing of results achieved toward the primary objective.

In addition to the above objectives, proper road maintenance will help to reduce the amount of inflow to the pit resulting from surface runoff. This is accomplished by:

- Developing and maintaining adequate ditches along haul roads.
- Maintaining proper grade on haul roads.
- Maintaining berms to prevent runoff flowing over pit walls.
- Developing and maintaining proper diversions for natural waterways away from the pit.

Haulage roads will be maintained by an IOC road maintenance crew and activities will include grading, dust suppression and resurfacing. Snow clearing and traction control (gravel spreading) will also be carried out as required. Surface runoff diversion ditching will require occasional maintenance, cleanout and grading. Diverted water will be pumped to an effluent treatment system (sedimentation pond), if needed, prior to release.

WATER FLOW DESCRIPTION

Runoff is the component of rain or snow melt that flows overland to a receiving water body. Rainfall runoff has to be dealt with on an ambient basis, whereas snow accumulates in a snow pack that will not be a concern until it melts during the spring freshet. This additional water, when it is in-pit is directed to the sumps and is ultimately pumped out and discharged to the designated discharge location.

The precipitation that falls on the exterior to the pit, will be collected and conveyed through a series of ditches. The water will be directed to sedimentation ponds that will collect water and allow for settling of solids in the water before it is released into the environment. Since this water has not come in contact with the mining operation, it is assumed that it does not have to undergo any further treatment other than settling out TSS before being released to the environment.

FINAL DISCHARGE POINTS

Final Discharge Points (FDP) will be established in locations where impacted water (effluent) is discharged into a receiving body of water. These discharge points will be registered with both the federal and provincial governments. All the discharges have sampling schedules as mandated under MDMER and the provincial government under the Certificate of Approval (CofA). Any FDP site will be held to the same MDMER sampling point regulations. The discharge of deleterious substances is closely monitored to ensure that there are no exceedances.

CONTROL AND MONITORING

Road conditions are inspected on a regular basis and recorded in the shift logbook. Information recorded will include the general conditions of the road, camber of the road surface, berm conditions, intersections, and drainage of the road. Any minor maintenance will be done during that shift as directed by the supervisor. Other work that would require designs and planning would be reported to the Mine Planning team in Technical Services.

Seasonal Considerations

Mining in Labrador is a cold weather operation, ensconced in snow and ice from November to late March. Water run off due to mild spells or winter rains are rare events. Slippery snow roads are treated primarily with crushed stone as a traction medium. Late winter snow removal from sides of haul roads will help to minimize the effects of spring melts. Snow removed from haul roads and active pits is placed in designated snow dumps, in areas that are out of the way and will not create further issues when the snow starts to melt.

Spring freshets cause higher than normal surface water flows from surrounding hills, waste dumps, roads, and other areas. Road ditches will collect the runoff water and direct it to sumps, settling ponds or vegetation before it is released into the receiving waterbody. Roads typically become muddy as fines are collected in running water and carried to ditches. This continuous operation of heavy haulage equipment causes road surface erosion and suspended solids in surface water.

Summer in Labrador West typically brings frequent rainfalls that deliver a monthly average of approximately 100mm of precipitation. Ditches and settling ponds will require regular inspection and occasional maintenance, cleanout, and grading to maintain water flow. Haul road surface geometry and surface materials require constant monitoring and remediation due to the heavy traffic and constant grader operations.

Since work to control run-off water in spring months is reactionary, considerable planning and preparation is required before the snow arrives. Fall work therefore consists of the following:

- A survey of road surfaces to identify areas where grades need to be re-established.
- Clearing of ditches, culverts, and perimeter settling ponds.
- Grading haul roads to define crowns and cross-falls.
- Redefining diversion ditches to direct surface flow into ditches on the perimeter of the pit to settling ponds.
- Completion of construction and reconstruction project work on roads, ditches and settlement areas.

Road Runoff Maintenance Plan

Road maintenance is completed by a dedicated IOC road crew. Runoff along haul roads is managed by crowning the road surface slightly and directing runoff water to the edge of the road at regular intervals through the berms. It is then collected in ditches and directed to sumps, settling ponds or vegetation before it is released into the receiving waterbody.

Contingency

When there is ingress of surface water from a haul road to an open pit, the required actions are as follows:

- determine the location of ingress and assess the area.
- build or repair a berm if appropriate.
- construct ditches to channel the water away from the pit.
- maintain ditches and culverts so water can be conveyed freely; and,
- re-grade the road to prevent ponding.

In the case of runoff being caused by extreme weather (i.e., heavy rainfall event) the applicable BRRP protocol must be followed. For extreme weather rain events, the guidelines to activate emergency response are as follows, in an event of:

- I. 100mm of rain within 24 hours or less; or,
- II. 50mm of rain forecasted for three consecutive days.

If 100mm of rain falls within 24 hours (approximately 1:1000-year event) vulnerable operations must stop and equipment must be removed from the area. If there is 50mm or more rain for three consecutive days, vulnerable operations must stop, and equipment must be removed from the area.

SOIL EROSION AND SEDIMENT CONTROL

The sediment control strategy at the IOC Labrador City Operations currently involves the collection of runoff and conveyance to sediment detention structures. Within each pit watershed, runoff water naturally concentrates on ramps and flows to the sumps in active pits, or into the lakes in the dormant pits. Outside of the pit surface catchments, runoff either follows natural overland flow paths, or is intercepted by roads. Storm water, snowmelt, and runoff flows that are intercepted by roads are conveyed in ditches to sumps, settling ponds or vegetation. Rather, runoff collected by the roads is either directed down into pit sumps along haul road ditches or is shed from the road surface at regular intervals. In the latter instance, runoff is allowed to flow either overland or along natural drainage courses to the receiving lakes.

Overland Flow

Overland flow management is implemented along the haul roads by cutting slots in the safety berms at 50 to 100m intervals and grading the roads to shed the water to these points. This practice will most likely be applied to the longer stretches of haul roads that are already constructed to development areas. Where applicable; future haul roads may have runoff collection ditches which will direct water to the appropriate sedimentation pond or sump.

Waste Dumps

Waste dumps do not typically generate a lot of fine sediment in runoff at IOC, but the quality of rock placed in the dumps will vary and erodible fines, like limonite, may be present within some zones in the dump. Waste dumps are monitored on a weekly basis by the Geotechnical personnel in the Mine Technical Services group, for stability, material type, water pooling and other factors which may cause the waste dump to be unsafe. Measures for managing runoff from waste dumps are like those adopted for haul roads which are:

- On operating waste dumps, maintain discharge points at regular intervals (60m) along the crest of the dump platform, where surface drainage will be directed to decant down the face of the dump into a settling pond. This will prevent larger cumulative flows from causing erosion of the dump face.
- In areas of potential dump instability, reclaim dump surfaces and grade surfaces to promote runoff. Grading should be done to shed water back towards natural ground or into a diversion channel constructed around the margins of the waste dump. If the diversion channel is conveying clean water, it can extend to the environment. If it is conveying turbid water, it should be directed to the nearest settling pond.
- Site new dumps ideally leave a 100m buffer of naturally vegetated ground between the ultimate dump toe and the nearest body of water. If this is not possible, leave a 50m buffer and implement appropriate sediment source control measures.

Operational Monitoring

The mine site has monitoring programs that identify areas where sediment is entering the natural drainage system and an investigation of the sources of the sediment can be conducted. Measures to remove or control the source could then be identified and implemented. Measures could vary from construction of new diversion structures or the implementation of localized sediment source control practices.

WATER MONITORING PLAN

Water quality monitoring at IOC is governed by the requirements of the MDMER promulgated under the federal Fisheries Act and the Certificate of Approval (CofA) for the mines issued by the provincial Department of Environment and Conservation.

Additional testing may be required from other locations throughout construction and development of the general water chemistry analysis program through the CofA. More details and the requirements will be determined once discharge sites have been registered and approved by the government agencies.

DEWATERING PITS AND LAKES

To ensure that the environmental risks associated with pit and lake dewatering operations are properly managed, procedures are governed and adhered to through external permits those such as, Water Use License (WUL), Permit to Alter a Body of Water (PABW), Dewatering Wells, Ground Monitoring Wells etc., and Environment Assessment (EA) conditions listed upon Ministers Approval.

Dewatering Strategy Design

A Pit Dewatering Permit Request will be completed and submitted to the IOC Environment Department and de-watering strategies shall be designed to ensure that the impact to the environment is minimised.

The IOC Environment Department shall be initially consulted to identify the following issues that will influence the de-watering design:

- Compliance levels that must be achieved,
- Regulatory approvals that must be obtained, and
- Environmental protection plans that may be required.

De-watering design shall consider the placement of de-watering discharge sites to:

- Allow discharged water to follow natural surface drainage patterns to minimize erosion, and
- To discharge to vegetated work areas to reducing impact on turbidity levels in natural water bodies.

Note: This will not affect compliance levels, which are taken at “end of pipe”.

Further environmental protection measures shall be developed and implemented as defined by the IOC Environment Department.

De-Watering Operations

Once a de-watering design has been implemented, there shall be no changes to the de-watering discharge points without prior liaison with the IOC Environment Department.

Extraction at the de-watering sumps shall be managed so the placement of the de-watering pump intake shall be above the lake/sump bottom to reduce silt intake and minimize the discharge turbidity.

All operating de-watering sumps and discharge points shall be inspected to insure:

- The de-watering pump intake is above the lake/sump bottom,
- Excessive erosion or sedimentation is not occurring at discharge points.

The typical discharge design is pumping water to an area of undisturbed forest, which will act as a vegetative filter. Boulders or a small rock lined pool will be placed at the point of discharge to prevent localized erosion.. If compliance levels are considered difficult to meet at the compliance point, reductions may be achieved by using either one or a combination of the following methods:

- Filtration,
- Settling Ponds,
- Silt fences,
- Dykes.

Dewatering Monitoring

All de-watering discharge sites shall be sampled and tested in a manner as determined by the IOC Environment Department in consideration of legal requirements.

De-watering monitoring results shall be kept by the IOC Environment Department.

If monitoring results demonstrate that legal requirements are not being met, the de-watering design and operation shall be investigated to determine the root cause and action for improvements.

ENVIRONMENTAL MANAGEMENT SYSTEM

An environmental management plan is in effect at the mine site. When any construction and development begin, it will be incorporated into this plan. The management plan includes an Environmental Aspects Register, in which all activities in the mine are listed, and associated risks are identified and quantified. Procedures to manage the risks are identified along with the government regulations that are applicable to each of the activities.

Appendix B

Site-Wide Environmental Protection Plan



Environment Protection Plan

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1 Section 1 Introduction

1.1 Introduction and objective of plan

The Environmental Protection Plan (EPP) outlines the required regulatory requirements and environmental protection procedures for the Operational and Development Sites at Carol Lake Project in Labrador City, owned by Iron Ore Company of Canada (IOC). The EPP satisfies Fisheries and Oceans Canada (DFO) expectations prior to issuance of a Section 35(2) Authorization under the *Fisheries Act*, and as a condition of release of the assessment requirements under the Newfoundland *Environmental Protection Act*, specifically under the Environmental Assessment Regulations.

Note: When required, project specific information will be annexed to this document.

1.1.1 Objective

The EPP outlines practical procedures required for all project personnel (i.e., IOC employees, contractors, and suppliers) to reduce or eliminate the potential environmental effects associated with the operations and decommissioning phases. The EPP also:

- describes how IOC commitment to reduce environmental effects will be met;
- reviews potential environmental concerns and appropriate protection measures;
- provides a reference document for personnel when planning and/or conducting specific activities;
- provides direction for developing contingency plans for accidental events;
- communicates changes in the CR project through the revision process;
- provides a reference to and instructions to understand applicable legal and other requirements;
- includes a quick reference for both project personnel and regulators to monitor compliance and recommended improvements;
- provides direction at the corporate level for ensuring commitments made in policy statements are implemented and monitored.

1.1.2 Environmental Protection Plan Organization

This EPP has been developed for specific activities to be conducted in support of the Operational and Development Sites. It provides instructions for addressing both planned and unplanned activities/events associated with the project. The EPP contains the following sections:

Section 1 introduces the EPP. It outlines the EPP purpose and organization, roles and responsibilities and environmental orientation.

Section 2 provides an overview of the CR Project

Section 3 lists the permits, approvals and authorizations required for the undertaking, and provides an overview of compliance monitoring.

Section 4 describes environmental concerns and environmental protection procedures for planned project activities.

Section 5 outlines the contingency plans for potential unplanned and accidental events.

Section 6 describes procedures for revising the EPP.

Section 7 contains a list of key projects and regulatory contacts.

Section 8 lists references cited in the EPP, as well as several sources of further information.

1.2 Roles and Responsibilities

1.2.1 IOC

- provide final approval for the EPP and any subsequent revisions;
- monitor and inspect the work being carried out; and
- liaise with relevant government agencies and external shareholders as required.

1.2.2 Designated Environment Coordinator(s)

- ensure the implementation of the EPP;
- be IOC's representative on-site;
- consider revisions requests, and review the EPP on an as needed basis;
- ensure revisions are distributed to EPP holders;
- maintain document control;
- report to the Senior Environment Coordinator;
- hold an environmental orientation session for the contractor and its personnel, and any other personnel to be involved in the project on an as needed basis;
- ensure EPP holders and their staff are familiar with the EPP and its procedures;
- ensure that all applicable approvals, authorisations, and permits are obtained and adhered to;
- monitor or designate a representative to monitor project work to ensure compliance with the EPP, and all regulatory requirements and commitments; and
- report to the Operational and Development Site Project Managers, Senior Environment Coordinator, and/or appropriate agency all incidents of non-compliance.

1.2.3 Contractor and Site Personnel

- familiarize themselves with the EPP;
- implement the EPP commitments to help reduce pollution;
- ensure all personnel and subcontractors comply with the EPP, all requirements of the contract and with all applicable laws and regulations;
- maintain training records;
- maintain regular contact with the Environment Coordinator, including, but not limited to:
- reporting concerns immediately; and
- reporting any spills or other event that may influence human or environmental health and/or safety.
- obtain all applicable approvals, authorizations, and permits;
- ensure the implementation of any conditions outlined in approvals, authorizations, and permits; and
- carry out clean-up, reclamation or restorative measures as directed by the Operational and Development Sites Project Managers, Environment Coordinators and/or appropriate government agency.

1.2.4 EPP Holders (can be contractors, operations, and all relevant stakeholders)

- keep with them the latest copy of the EPP themselves and their personnel with the EPP and any revisions; and
- initiate changes to improve the quality of the plan.

1.3 Environmental Orientation

Through orientation and on-line training specific to environment compliance, IOC will ensure that all personnel are competent in their roles and responsibilities towards the environment, as well as the potential environmental effects of the overall project and to their specific work activities. All workers will receive an environmental orientation prior to the start of any new activity and thereafter on an as-needed basis.

1.4 Summary of Important Dates

Contact the environment department for further details.

Critical Bird Nesting Period	Mid-May to Mid-August
Eagle and osprey	Mid-May - July 31
Fisheries timing windows	Varies see below
Bank swallow nesting and Bat Roosting Surveys	Mid-May to Mid-August

All development activities shall be within the constraints of the original lease agreements. Any extensions to the lease should be recorded.

1.4.1 Fisheries timing windows

To avoid impacts on fish in Newfoundland & Labrador, do not carry out in-water work:

- in tributaries and headwaters of scheduled salmon rivers in Labrador from September 15 to June 15 (spawning, incubating and hatching period); and
- in estuaries and the main stems of brown trout rivers from October 1 to November 30 (migrating period)

(taken from DFO website, June 20, 2018, <http://www.dfo-mpo.gc.ca/pnw-ppe/timing-periodes/index-eng.html>).

2 Section 2 Project Overview

The IOC mine site represents a continuation of ongoing IOC operations at the Carol Lake Mining Project within its original mining lease. All development activities shall be within the constraints of the original lease agreements. Any extensions to the lease should be recorded.

Planned changes to the mine: It is currently proposed to continue mining using existing methods, infrastructure, and processing facilities, with some modifications to an on-site haulage roads and transmission lines.

2.1 Construction

With regards to activities relating to the construction of any operational development, this EPP only outlines the environmental protection measures associated with the operations, construction, and decommissioning of the project.

2.2 Operations

This EPP outlines the environmental protection measures associated with any operational developments at IOC, including site preparation activities (e.g., clearing of trees, earth moving, dewatering, etc.) and mining activities.

2.3 Ongoing Site Preparation Activities

Ongoing site preparation activities and development work (i.e. preparation for material removal) include those activities required to support the continued mining of any Operational Development such as extension of roads, power lines, construction of physical features and environmental assessments. Operational Development areas that require tree clearing prior to any development activities, should reference procedures in Section 4 of Environmental Protection Plan.

Where required give examples, an environmental assessment shall be conducted at the planned Operational and Development Sites, by IOC Environment Department. Any obsolete infrastructure and utilities (i.e., disengaged power lines, poles, dewatering pipes) shall be removed prior to any operational development activity.

2.4 Overburden and Waste Rock Removal

Unconsolidated material or overburden that covers the Operational Development area will be removed to the hard rock surface in preparation for mining.

Overburden will be placed in designated storage areas as determined by IOC, which is managed by the mine planners.

Site preparation also involves:

1. The development of terraces within the operational development area by drilling and blasting the sloped natural ground to specified bench elevations in 13.7 m increments for IOC production equipment.
2. Waste rock at waste rock dumps located at IOC Mine Site, with the exception of those quantities is to be used as construction material. This material may be used to upgrade the existing network or on-site haul roads.
3. Alternatively, waste rock could be placed in the pits using conventional backfill techniques.
4. Waste rock and overburden piles will be sloped and bermed to prevent pooling of surface water.
5. Structures such as silt fences will be used as a means of sediment control as required, and collection ditches and settling ponds will be used as required to manage surface runoff and any groundwater flows.

Please refer to Rio Tinto E13- Chemically Reactive Mineral Waste Control Standard.

2.4.1 Roadways

Roads that require grading, culvert installation, adequate drainage, dust control, and maintenance, all of which are subject to specific guidelines and regulations. The location and extent of these roads will be finalized at the detailed design stage.

2.5 Marshalling and Storage Areas

Marshalling areas will be located at various locations on the project site to facilitate the receiving and storage of materials and equipment such as piping and culverts. Marshalling areas cannot be used to contain spills.

Proper spill control must be applied including drip pans. Existing facilities at the Carol Mining Project will be used wherever possible.

2.6 Associated Facilities and Infrastructure

1. Maintenance facilities, equipment and processing facilities will be used during the operational phase. If required, transmission lines will generally follow road rights-of-way.
2. Lunchroom/washroom facilities shall be used at the workforce area.
3. Maintenance facilities, equipment and processing facilities will be used during the operational phase. If required, transmission lines will generally follow road rights-of-way.
4. Lunchroom/washroom facilities shall be used at the workforce area.

2.7 Mining Activities at IOC

1. Mining activities at IOC will proceed from the highest bench elevation to the lowermost planned bench. The nominal bench height will be 13.7 m.
2. Bench accesses will initially be developed using waste rock as mining proceeds downwards. The haulage pit ramps will be 40 m wide, with a maximum gradient of 8%.
3. The bench face angle will be 35 to 90 degrees, and the overall pit slope angle will be 30 to 58 degrees.

2.8 Decommissioning

A rehabilitation and closure plan has been developed in accordance with the Newfoundland *Mining Act*. A sustainable closure configuration will be implemented throughout the operational life as appropriate.

The reclamation systems and abandonment facilities will be designed for long term stability, allowing for gradual erosion and deformation at a geomorphic rate comparable to that of the natural environment. Structures will be designed to remain functional for the long term (+1,000 years).

Progressive Reclamation: means reclaiming land and revegetating inactive areas as soon as possible, not waiting until the end-of-life of the mine. This reclamation of the mine and tailings areas will be staged over the life of the facility, resulting in minimal reclamation investment at the end of the mine life. Progressive reclamation activities will include contouring and re-vegetating areas that are considered inactive.

Decommissioning: The primary decommissioning criterion is to ensure a maintenance-free facility after mine closure

3 Section 3 Regulatory Requirements and Commitments

3.1 Approvals, Authorizations and Permits

The approvals, authorizations and permits required for development activities are listed in Table 1 below.

If you are unsure ask your Environment Coordinator.

Table 1: Regulatory Requirements Summary – Permits and Authorizations

Activity Requiring Compliance	Permit - Approval	Legislation	Responsible Agency	Comments
1. Activities that may affect fish habitat	Authorization pursuant to Section 35(2) of the <i>Fisheries Act</i>	<i>Fisheries Act</i> (Federal)	Habitat Management, DFO	A Fish Habitat Compensation Plan must be approved by DFO. A monitoring program shall be implemented to measure the program's effectiveness. Other activities having potential impact should be reviewed with Area Habitat office in Goose Bay.
2. Any development activity	Release from the <i>Environmental Protection Act</i>	<i>Environmental Assessment Regulations</i> (Government of NL)	Environmental Assessment Division, Dept. of Environment and Climate Change	
3. Drawdown of a lake, pond.	Certificate of Approval for drawdown of Development Area Waterbody.	<i>Water Resources Act</i> (Government of NL)	Water Resources Division, Dept. of Environment and Climate Change	A Certificate of Approval must be obtained.
4. Construction and operation	Certificate of approval	<i>Environmental Assessment Regulations</i> (Government of NL)	<i>Pollution Prevention Division</i>	A Certificate of Approval must be obtained.
5. Presence of eggs, nest, migratory bird, or activities that may affect areas frequented by migratory birds And Removal of abandoned nests	Compliance standard: no permit required	<i>Wildlife Regulations</i> pursuant to the <i>Wildlife Act</i> (Government of NL)	Wildlife Division, Department Fisheries, Forestry & Agriculture	It is unlawful to take or destroy the eggs or nest of any wild bird. IOC and contractor personnel will not harass or disturb wildlife or remove or destroy nests or eggs. Clearing of vegetation may result in the loss of nests.
	Permit required. Raptor and Corvids Nest Removal Permit or Permit required for removal of abandoned	<i>Migratory Bird Act Section 6 of the Migratory Bird Regulations</i> (Federal)	Environment and Climate Change Canada	It is forbidden or a take a nest or egg of a migratory bird or to be in possession of a live

Activity Requiring Compliance	Permit - Approval	Legislation	Responsible Agency	Comments
	or relocation of nests on IOC Structures			migratory bird, or its carcass, nest of egg
6. Water crossing (fording, culvert [cleaning-maintenance-installation] or bridges)	Water resources permit A permit is required to meet conditions in minimizing downstream impacts	<i>Water Resources Act</i> (Government of NL)	Department of Environment and Climate Change	
7. Operating of mill	Mill Licence	<i>Mining Act</i> (Government of NL)	Dept. Of Industry, Energy and Technology (IET)	Operating a mill requires a mill licence for a term of 5 years or longer.
8. Land disturbance, Mining Leases	Mineral Rights	<i>Minerals Act</i> (Government of NL)	Department of Industry, Energy and Technology (IET)	A mining lease shall be filed with government within 6 months of date of application.
9. Indigenous Stakeholders: Minimization of any potential adverse impacts of projects and developments on the asserted rights of Indigenous Stakeholders	Procedural and financial obligations	<i>Aboriginal Consultation Policy (t)</i> (Government of NL)	Office of Indigenous Affairs & Reconciliation	Consultation and accommodation with associated Indigenous Partners
10. Infilling of water body	Permit to Infill	<i>Water Resources Act</i> (Government of NL)	Department Environment and Climate Change	A permit is required to infill a body of water.
11. Activities that have the potential to affect wetlands	Permit to Alter a Body of Water. A permit is required to develop near wetlands requiring special conditions and alterations.	<i>Water Resources Act</i> (Government of NL)	Department of Environment & Climate Change	
	If wetland will be affected due to mining an offset must be established to remedy the difference	<i>Federal Policy on Wetland Conservation</i> (Federal)	Environment Climate Change Canada	
12. Any activity that may affect and endangered or threatened species	Compliance standard	<i>Endangered Species Act</i> (Government of NL) <i>Possibly Species at risk Act</i> (Federal)	Department of Fisheries, Forestry & Agriculture	Provide protection to endangered and threatened species and protection of their habitats
13. Fish habitat compensation provisions: Monitoring to verify the		<i>Fisheries Act</i> , Section 35(2), Harmful Alteration, Disruption, or	Fisheries and Oceans Canada	Monitoring requirements and schedule are detailed in the Fish Habitat Compensation

Activity Requiring Compliance	Permit - Approval	Legislation	Responsible Agency	Comments
effectiveness of the compensation plan		Destruction of Fish Habitat (Federal)		Agreement that is attached to the authorization issued by the Minister.
14. Any run-off from the project site being discharged to receiving waters (freshwater or marine).		<i>Fisheries Act</i> , Section 36(3), Deleterious Substances (Federal)	Fisheries and Oceans Canada	Any deposited substance or discharge must not be deleterious (i.e., must be acutely non-lethal). Liquid effluents that enter freshwater or marine waters must comply with the Act.
15. Mortality of migratory birds, and endangered species and any species under federal authority.		<i>Migratory Birds Convention Act</i> and Regulations (Federal)	Canadian Wildlife Service (CWS), Environment Canada	CWS should be notified about the mortality of any migratory bird in the project area, including passerine (songbirds), seabird and waterfowl species. Harmful substances (e.g., oil, wastes, etc.) that are harmful to migratory birds must not be deposited into waters that are frequented by them. Nests, eggs, nest shelters, eider duck shelters or duck boxes of migratory birds must not be disturbed or destroyed. Notice should also be given about the mortality of any species known to be endangered or under federal authority
16. Handling and transporting of dangerous goods.	If the materials are transported and handled fully in compliance with the regulations, a permit is not required. A Permit of Equivalent Level of Safety is required if a variance from the regulations is necessary.	<i>Transportation of Dangerous Goods Act</i> and Regulations (Federal) and <i>Interprovincial Movement of Hazardous Waste</i> (Federal)	Transport Canada And Environment Climate Change Canada	
17. Transporting fuel to the site.		<i>Transportation of Dangerous</i>	Department of Transportation	Transporting goods considered dangerous to public

Activity Requiring Compliance	Permit - Approval	Legislation	Responsible Agency	Comments
		<i>Goods Act and Regulations</i> (Government of NL)	and Infrastructure	safety must comply with regulations.
18. Activities that have the potential to interact with the environment and human health.		<i>Canadian Environmental Protection Act (CEPA)</i> (Federal)	Environment Climate Change Canada	CEPA provides a framework for setting environmental quality objectives, guidelines and codes of practice, pollution prevention plans, regulation of toxic substances, controlling pollution of other wastes and environmental emergency plans.
19. Activities surrounding blasting using explosives		<i>Explosives Act</i> (Federal)	Environment Climate Change Canada	Must comply with the storage and use of all explosives on site as per regulations.
		<i>Fire Protection Services Act</i> (Government of NL)	Justice and Public Safety	
20. Any Development Operation.		<i>Waste Material Disposal Act</i> (Government of NL)	Pollution Prevention Division, Dept of Environment and Climate Change	All waste material shall be considered prior to disposal, for reuse, resale, or recycling. All waste materials associated with the construction and operation, shall be disposed at an approved waste disposal site.
21. Day to day work activities	Various internal permits depending on the work performed (i.e. ground disturbance etc.)	<i>Occupational Health and Safety Act</i> (Government of NL)	Workplace Health and Safety, Department of Labour	Outlines minimum requirements for workplace health and safety. Workers have the right to refuse dangerous work and must be informed of potential hazards they may be exposed to during work. All workers must be provided with and use appropriate personal protective equipment.
22. Storage, handling and	Registration required for all fuel storage tank	<i>Storage and Handling of</i>	Pollution Prevention	A spill contingency plan should be

Activity Requiring Compliance	Permit - Approval	Legislation	Responsible Agency	Comments
disposal of gasoline and other fuels.	system other than those connected to a heating appliance of a capacity of 2,500 L or less	<i>Gasoline and Associated Products Regulations</i> (Government of NL)	Division, Dept of & Environment and Climate Change	developed that includes emergency response contacts/support and access to spill response equipment.
23. Handling and storage of hazardous materials.		<i>Workplace Hazardous Materials Information System</i> , under the <i>Occupational Health and Safety Act</i> (Government of NL)	Operations Division, Department of Digital Government and Service NL	Outlines procedures for handling hazardous materials and provides details on various hazardous materials.
24. General project activities.		<i>Historic Resources Act</i> (Government of NL)	Cultural Heritage, Department of Tourism, Culture Arts and Recreation	All archaeology sites and artefacts are considered to be the property of the Crown and must not be disturbed. Any archaeology materials encountered must be reported to the Provincial Archaeology Office.* (see section 5.f for contingency plan)
25. Cutting or Removal of Timber	Permit from IOC environment department	<i>Cutting of Timber Regulations</i> (Government of NL)	Department of Fisheries, Forestry & Agriculture.	Cutting and removal of timber shall be approved by the IOC Environment Department.
26. Activities that have the potential to interact with wildlife		<i>Wildlife Act</i> (Government of NL)	Department of Environment and Climate Change	Sighting of any wildlife in the area. For removal of any wildlife, contact the environment department who will advise the Dept. of Natural Resources
27. Activities that have the potential to interact with wildlife		<i>Endangered Species Act</i> (Government of NL)	Department of Fisheries, Forestry & Agriculture	Provides special protection for plant and animal species considered to be endangered, threatened, or vulnerable.
28. Air quality: Maintain good air quality levels as prescribed in regulations		<i>Air Pollution Control Regulations And Halocarbon Regulations</i>	Department of Environment and Climate Change	Burning is prohibited for certain materials listed in Schedule E of the regulations and the main site permit,

Activity Requiring Compliance	Permit - Approval	Legislation	Responsible Agency	Comments
		(Government of NL)		see Table below for prohibited items. In addition, certain fuels are prohibited as well. Check with Environment Coordinator for specific halocarbon management protocols (refrigerants etc.)
29. Discharging sewage and other materials into a body of water or public sewer shall comply with standards, condition, and provisions in these regulations		<i>Water Resources Act Environmental Control Water & Sewage Regulations</i> (Government of NL)	Department of Environment & Climate Change	Effluent samples and receiving water samples using analytical procedures.
30. Established the province's land use planning system		<i>Urban & Rural Planning Act</i> (Government of NL)	Department of Municipal and Provincial Affairs	Consultation with public and municipal governments so that development decisions can be subjected to independent reviews.
31. Monitor and record all emissions related to GHG		<i>Management of Greenhouse Gas Act</i> (Government of NL)	Department of Environment & Climate Change	Submission of an annual report regarding the greenhouse gas emissions released with third party verification.

*Should any archaeological remains be encountered, such as stone, bone or iron tools, concentrations of bone, charcoal or burned rock, fireplaces, house pits and/or foundations, activity in the area of the find must cease immediately and contact should be made with the Environment Coordinator who will then call with the Provincial Archaeologist in St. John's as soon as possible (see section 5.f for contingency plan).

3.2 Compliance/Conformance Monitoring

Compliance monitoring at the mine is related to applicable laws, contracts, relevant permits, approvals, commitments, and authorizations.

Conformance monitoring is related to all applicable to this plan, procedures, policies, and other requirements. Monitoring activities should ensure that all development project activities comply with applicable regulatory and other requirements and that mitigation measures are being employed effectively.

The Environment Department is responsible for environmental compliance/conformance monitoring on-site; and on the environment-related general, special, and technical clauses to be implemented as part of the contracts.

3.3 Reporting Environmental Issues

3.3.1 Internal Communication

Environmental performance and issues at any operational and development site or area will be communicated internally as required. The Operational and Development Site Project Managers are responsible for communicating IOC policies and procedures, legal and other requirements to project personnel. Project personnel will communicate all environmental incidents and near misses to the Environmental Coordinators as per *CR-E-E-PRO Environmental Reporting*.

3.3.2 External Communication

When required, the IOC Environment Department will report on environmental issues relating to the development site to the Newfoundland and Labrador Department of Environment and Climate Change. Issues which may be communicated include but are not necessarily limited to:

1. Stream crossings.
2. Burrow Sites.
3. Dust.
4. Erosion.
5. Historic resources.
6. Wildlife encounters.
7. Permits and authorizations.

Any activity having the potential environmental impact to fish and fish habitat outside the realm of the compensation agreement (such as stream crossings and culvert installations) should be forwarded to the IOC Environment Department, who will consult the Department of Fisheries and Oceans Canada in St. John's for review and subsequent issuance of appropriate Letters of Advice.

Other compliance reporting required by permits or through compliance requirements not listed above will also be submitted to the IOC Environment Department, or appropriate departments at IOC.

4 Environmental concerns and environmental protection procedures for planned project activities.

This Section provides a description of environmental protection procedures for the following anticipated project-related activities:

1. Marshalling and Storage Areas
2. Clearing Vegetation
3. Grubbing and Overburden Removal
4. Erosion Prevention and Siltation Controls
5. Buffer Zones
6. Water Course Crossings
7. Dewatering Work Areas and Site Drainage
8. Equipment Use and Maintenance
9. Handling and Transfer of Fuel and Other Hazardous Material
10. Solid Waste Disposal
11. Mineral Waste Rock and Overburden
12. Vehicle Traffic
13. Dust Control
14. Hazardous Waste Disposal
15. Road Maintenance
16. Trenching
17. Surveying
18. Onsite Traffic and Activity

When required, this EPP will be revised to include new or amended environmental protection procedures to ensure that activities conducted at the developing site are completed properly and that the site's significant environmental aspects are well managed.

4.1 Marshalling and Storage Areas

Environmental Concerns

Areas where equipment and supplies are stored and maintained through the development and operational phases of the Carol Lake Project.

Concerns include:

- Vegetation and soil disturbance may cause erosion and run-off of sediment into nearby water bodies.
- Spills/leaks of hydrocarbons from storing and maintenance activities.
- Noise.
- Biodiversity issues such as bird nests, denning sites.
- Open containers full of oil/water: this presents a danger to wildlife.

Environmental Protection Procedures:

1. Existing marshalling and storage areas will be used outside the development site, where feasible.
2. Any new marshalling, maintenance or storage areas required for the project will only be established within the IOC Labrador City property.
3. Establishing any new marshalling or storage areas will follow the procedures for vegetation clearing, grubbing and overburden removal, and erosion prevention (see specific sections of this EPP for details on the later).
4. Any marshalling or storage areas shall be located at least 100 m from a waterbody.
5. External storage areas will be placed on level terrain and kept free of ponding or run-off.

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6. Drainage from areas of exposed fill will be controlled by grade or ditching and directing run-off away from water bodies.
 7. Any maintenance work completed on equipment must have the appropriate spill material available and dip pans must be used.
 8. Secondary containment required where hazardous products are stored. The size of the containment should be a minimum 110% of the material volume.
 9. Marshalling and storage areas not required during operations will be rehabilitated under the environment department's supervision. The environment department will inspect the area before the site is abandoned to ensure it is clear of contamination.
 10. Debris is not to be stored on site. This material must be disposed of at an approved waste disposal site or scrap yard on a regular basis, with the prior approval of the site owner/operator.

4.2 Clearing Vegetation

Environmental Concerns

Vegetation clearing (e.g., trees, shrubs, etc.) will be required in advance of site preparation activities. Concerns include habitat loss, biodiversity disturbance such as impact to nesting birds, bat roosting, denning sites, erosion and sedimentation into vegetative areas and waterbodies, uncontrolled burning of slash, impact to historical/archaeological sites, and stockpiling vegetation in or near watercourses.

Environmental Protection Procedures

Before clearing begins:

1. Any land clearing is urged to be completed prior to or after the Critical Bird Nesting Season. If this can't be achieved, a bird and bat roosting survey will be completed, and areas of concern will be flagged with a permitter buffer (buffer is species specific). Continued surveys will be completed until the young has fledged the nest.
2. Verify the requirements of all applicable permits. An Internal Land Management and Disturbance permit must be completed by the originator and submitted to the Environment Department.
3. Clearing or removal of trees will be restricted to only those areas designated by IOC.
4. Project footprint will be minimized wherever possible and clearing limits and work areas must be clearly marked.
5. Avoid ecologically sensitive areas such as hardwoods and aquatic habitats wherever possible and practical. Consult with the environmental team to ensure that there are no ecologically sensitive areas and aquatic habitats.

During clearing

1. Clearing will consist of cutting to within 15 cm of the ground and disposing of all standing trees, as well as removing all shrubs, debris and other perishable materials from the area indicated on the engineering/survey drawings.
2. Where practical, vegetation will be stored and protected so that it can be later used as a seed source, moisture retention aid, and shade for new growth during reclamation.
3. Reasonable effort will be made to dispose of usable timber by either using it in project related construction, or by providing the timber for local use off-site. Otherwise, timber will be mulched and mixed with the overburden.

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4. Slash and any other construction material or debris will not be permitted to enter a watercourse and will be piled above spring flood levels. No burning is permitted on-site unless proper approvals acquired.
 5. Trees will be either sawed or mulched using mechanized cutting /mulching equipment. The use of mechanical clearing methods, such as bulldozers, will not occur except where it can be demonstrated that there is no merchantable timber, and where the resulting terrain disturbance and erosion will not result in the loss of topsoil or the sedimentation of water bodies.
 6. A 100 m buffer zone of undisturbed vegetation will be maintained between all water bodies and watercourses on the Carol Project. If this buffer cannot be maintained, the Environment Department must be consulted to determine the appropriate buffer requirement and approve additional mitigations.
 7. Timber shall be felled inward toward the work area to avoid damaging any standing trees within the immediate work area.
 8. Workers will not destroy or disturb any features indicative of a cultural or archaeological site. Such features should be avoided until a report has been made to the Provincial Archaeology Office and clearance to proceed has been received (see specific section of this EPP).
 9. IOC is aware of the value of wetlands and will attempt to avoid such disturbance of wetlands outside of the work areas where feasible.
 10. All equipment used will be handled and maintained according to the procedures.
 11. Firefighting tools and water delivery systems must be available.
 12. Where feasible, vegetation clearing will be scheduled to avoid disturbance during the critical nesting period, from May to August.
 13. If clearing is scheduled between May and August, nest surveys must be conducted in advance of vegetation clearing to avoid active nests during breeding season.
 14. **No clearing shall take place within 800 m of an active raptor nest between May 15 and July 31.** If a nest is encountered during clearing activities, the area is to be demarcated and clearing is to be avoided until the Environmental Department determines that work may continue in consultation with the NL Wildlife Division.
 15. Should additional nests/dens be identified during clearing activities, work must stop, and the Environmental Coordinator contacted immediately to establish buffer zones.

4.3 Grubbing and Overburden Removal

Environmental Concerns

The concerns associated with grubbing and disposal of related debris are the potential adverse effects on freshwater ecosystems and water quality through the release of sediment into watercourses, as well as the potential for disturbing historic resources.

Environmental Protection Procedures

1. Grubbing of the organic material and/or the upper soil horizons will be restricted to the minimum area required. The organic material must be removed separately from the upper soil horizon material.
2. The organic vegetation material and upper soil horizon material that has been grubbed will be spread in a manner to cover inactive exposed areas.

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3. If stockpiled material is to be disturbed, the site is to be inspected by the Environmental Coordinator and an Environment Consultant (Biologist) to ensure that bank swallow nests, if present, are not impacted (May 15 to July 31).
 4. Measures will be implemented to reduce and control runoff of sediment-laden water during grubbing, and the re-spreading and stockpiling of grubbed materials. Where grubbed materials are re-spread or stockpiled, as many stumps and roots as possible will be left on the ground surface to maintain soil cohesion, dissipate the energy of runoff, and promote natural re-vegetation.
 5. Runoff of sediment laden water during grubbing will be minimized by using such measures as settling ponds, ditch blocks, interception ditches and filter fabrics. Erosion control measures such as rip rap, filter fabrics, drainage channels and gravel, hay bales or wood chip mulches will be implemented in areas prone to soil loss.
 6. Where erosion into a water body is a concern, the length of time that inactive grubbed areas will be left exposed to the natural elements will be minimized to prevent unnecessary erosion.
 7. Grubbing activities will adhere to the buffer zone requirements outlined in Section 5.
 8. During grubbing, care will be taken to ensure that grubbed material will not be pushed into areas that are to be left undisturbed. Grubbing material will be mixed with the overburden for future rehabilitation.
 9. Discovery of historic resources will be handled according to the procedures outlined in Section 6.
 10. IOC is aware of the value of wetlands and will attempt to avoid such disturbance of wetlands outside of the work areas where feasible.
 11. All equipment used will be handled and maintained according to the procedures in Section 10.
 12. There should be avoidance of grubbing in high slope areas near water bodies.
 13. Dust control is to be provided during clearing and grubbing operations as outlined in Section 15.

4.4 Erosion Prevention and Siltation Controls

Environmental Concerns

Eroded material may alter drainage patterns, increase stream velocities, cause siltation in water bodies and, subsequently, decrease suitable habitat for aquatic and terrestrial animals.

Before the start of any major works (such as a change in drainage patterns), an erosion plan shall be reviewed and approved by an Environment Coordinator and engineers.

Environmental Protection Procedures

1. All work in the vicinity of the developing site, will be conducted according to the conditions set out in the permits and/or approvals and authorizations from the Newfoundland and Labrador Department of Environment and Climate Change (NL ECC), and DFO.
2. Areas to be disturbed should be minimized where possible and practical. Vegetative buffers will be maintained around waterbodies and sensitive areas.
3. Drainage ditches will be stabilized (e.g., lining with vegetation or rock, terracing, interceptor swales, installation of rock check dams) to reduce soil erosion. Any such measures will be properly maintained following installation.
4. Excavation, embankment construction and grading in the vicinity of stream crossings will be done in a manner that avoids or reduces erosion and sedimentation of watercourses or bodies.

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5. All areas of exposed erodible soil will be stabilized by back-blading, grading and/or compacting to meet engineered slope requirements. Roughening slopes with horizontal depressions will also reduce the risk of erosion.
 6. Where there is potential for erosion along exposed erodible slopes and a natural vegetation buffer of less than 20 m from the high-water mark exists between erodible areas and water bodies, a settling pond or silt fence will be constructed to control silt runoff. Engineering requirements will vary depending on the locations of the silt fence and will take into consideration such factors as drainage/surface area of exposed soil and time of year that the silt fences are used.
 7. If an environmental inspection reveals that silt is entering a watercourse, immediate actions need to be implemented. The necessary or appropriate measures will be determined in the field with the support of the environment team.
 8. Erosion control measures should anticipate before you start with the erosion plan. If there are siltation problems the plan will be reviewed and amended. All necessary measures will be determined in the field with the support of the environment team.
 9. All stream bank sections that contain loose or erodible materials will be stabilized.
 10. All areas will be monitored for erosion and appropriate repair action taken as necessary.
 11. Existing or new siltation control structures used in this work will be monitored regularly by the Environment Coordinators for excessive accumulation of sediment. Accumulated sediment from control structures will be removed as necessary to ensure the effectiveness of the systems.
 12. Remove excess water from siltation control systems prior to excavation of sediment. Trucks will be equipped with liners when required to prevent loss of wet sediment during transport.

4.5 Buffer Zones

Environmental Concerns

Buffer zones are vegetated boundaries maintained along water bodies. Without adequate buffer zone vegetation, streams, ponds, and lakes can become laden with silt from run-off. Vegetation also provides cover for fish and habitat for various mammals and birds. Streamside vegetation may:

1. provide shade thereby helping to regulate water temperature.
2. provide stream bank stability thereby preventing erosion and subsequent introduction of sediment into the water.
3. intercept precipitation, and through evaporation and transpiration, regulate the amount of water discharged into the stream.
4. provide insect drop which is a food source for fish.
5. provide habitat for birds and mammals.
6. introduce leaf litter and decaying vegetative matter into the stream which provides food for aquatic organisms on which fish feed.

Environmental Protection Procedures

1. A minimum buffer zone of 100 m of undisturbed natural vegetation is to be maintained and clearly marked between work areas and all water bodies and sensitive areas. Where buffer zones can't be maintained, regulatory consultation and permitting requirements will be applied for and adhered to.
2. If this buffer zone, as prescribed in Table 2 below, cannot be maintained, the buffer requirement will be discussed and determined in consultation with the Environmental Coordinator.

Any work within 15 m of a water body will require a permit under the *Water Resources Act*.

3. Sediment control structures are to be placed outside of the buffer requirements and should be part of the erosion /sediment control plan.
4. Bulk fuel storage will maintain a minimum buffer zone of 100 m from high water marks of waterbodies and ecologically sensitive areas and Provincial and Municipal Protected Watersheds (*see section 11 Storage, Handling and Transfer of Fuel and Other Hazardous Material*).

Table 2. Water Body Width of Buffer Zone

Water body	Buffer Zone
Intake pond/lake/reservoir	minimum of 150 m
River intake	minimum of 150 m for 1 km upstream and 100 m downstream
Main river channel	minimum of 75 m
Major tributaries/lakes/ponds	minimum of 50 m
Other water bodies	minimum of 30 m

4.6 Watercourse Crossings

Environmental Concerns

The project will involve the installation of a road adjacent to a pipeline corridor.

The environmental concerns associated with stream crossings and culvert installations include:

- erosion/siltation;
- disturbance of waterfowl;
- potential mortality of fish; and
- loss of fish habitat.

All watercourses and water bodies will be examined on a site-specific basis to evaluate the specific mitigations required.

When fish are, or potentially present at a proposed watercourse crossing, and habitat assessment shall be conducted by a qualified Environment Consultant. Information such as photos, the nature (water depth, flow, and substrate type) and quantity of fish habitat at the site will be noted and reported. The type of crossing (fording, culvert, or bridge) and design will also be noted by the monitor for the purpose of establishing regulatory requirements. Approval is required by the Water Resource Division.

Also, an evaluation of soil erosion potential will be conducted at each of the stream crossings. This assessment of erosion risk will assist in the development of specific erosion stabilization methods and effective sedimentation control practices on a site-specific basis.

Proposed crossing of a watercourse visible on a 1:50,000 topographic map shall require a permit from Department of Environment and Climate Change (ECC). Appropriate protection is still required for streams greater than 1.0 m in width (at its narrowest point from the high-water mark) not found on the 1:50,000 topographic map (from NL Environmental Protection Guidelines for Ecologically Based Forest Resource Management). The Environment Department should be consulted on all crossings to ensure proper permits and mitigations are established prior to conducting any work. (check buffer zones in section 5).

The NL Forest Service on alienated Crown land and the appropriate company on leased, licenced, private or charter land will provide the operator with a map indicating the harvesting area and no-cut treed buffer zones and will ensure that the operator is familiar with the boundaries.

No forestry activities are permitted within the buffer zones.

Environmental Protection Procedures

Stream crossings will be constructed in compliance with the required Culvert Approval and Letters of Advice from the NL ECC, and DFO, respectively. IOC will consult with DFO to develop mitigation strategies to reduce effects of in-stream work during sensitive periods.

The following measures will be implemented to reduce the potential effects of stream crossings:

1. If fish are present at a stream crossing, construction activities between September 1 and June 15 will be undertaken under the direct supervision of the Environment Coordinator.
2. Work will be performed in such a way as to ensure deleterious substances including, but not limited to, materials such as sediment, fuel and oil do not enter watercourses and water bodies.
3. The number of water crossings will be minimized.
4. Procedures for buffer zones that are outlined in Section 5 will be followed.

Culverts

In those locations where culverts are required, application will be made to the NL ECC, and DFO. The culverts used will be sized to handle a minimum 1 in 10-year return period flood (check with engineering) and will be constructed in accordance with all provincial requirements.

A culvert will not be installed before site specific information is gathered before the work begins, information such as localized stream gradient, fish habitat type and species present have been evaluated.

Culverts are to be installed according to DFO guidelines which are listed below:

Maintenance (debris removal):

- Gradual removal such that flooding downstream, extreme flows downstream, release of suspended sediment and fish stranding can be avoided;
- Time work in water to respect timing windows; and
- Relevant measures to avoid harm are followed.

Repairs:

- No temporary or permanent increase in existing footprint below the high-water mark;
- No new temporary or permanent fill placed below the high-water mark;
- Relevant measures to avoid harm are followed;
- Channel realignment is not required;
- No narrowing of the channel;
- Any obstruction to fish passage will respect timing windows;
- Provides for fish passage;
- Work can be done in isolation of flowing water; and
- Species at Risk where SARA-listed aquatic species occur, no culvert repairs will take place.

Removal:

- No temporary or permanent increase in existing footprint below the high-water mark;
- Relevant measures to avoid harm are followed;
- Channel realignment is not required;
- No narrowing of the channel;
- Any obstruction to fish passage will respect timing windows;

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- Work can be done in isolation of flowing water; and
 - The banks and bed of the waterbody are restored to replicate conditions upstream and downstream of the work area and provide for fish passage.

Species at Risk (SARA)

Where critical habitat or residences of SARA-listed aquatic species occur, or endangered or threatened shellfish occur, no dredging or excavation of the waterbody will take place except where exempted in the recovery strategy for that species.

Where SARA-listed aquatic species, their residences or critical habitat occur:

- No permanent increase in existing footprint above the high-water mark if the riparian area is identified as part of the critical habitat of an aquatic listed species at risk; and
- No removal of riparian vegetation if the riparian area is identified as part of the critical habitat of an aquatic listed species at risk.

(Taken from DFO Working near water June 2018 <http://www.dfo-mpo.gc.ca/pnw-ppe/index-eng.html>)

In addition, the following measures will also be implemented:

1. Install culvert(s) in accordance with best engineering and environmental practices.
2. Unless otherwise indicated, all work should take place in dry conditions, either using cofferdams or by diverting the stream.
3. In the event of fish being present, installation of cylindrical culverts shall be counter sunk such that the culvert bottom is 15% the diameter below the streambed (for culverts greater than 2000 mm in diameter), and 300 mm for culverts up to 2000 mm in diameter.
4. In multiple (gang) culvert installations, install one culvert at an elevation lower than the others.
5. Ensure that the natural low flow regime of the watercourse is not altered.
6. Use riprap outlets and inlets to prevent erosion of fill slopes.
7. Use culverts of sufficient length to extend a short distance (minimum of 300 mm) beyond the toe of the fill material.
8. Use backfilling material which is of a texture that shall support the culvert and limit seepage and subsequent washing out.
9. Align culverts such that the original direction of stream flow is not significantly altered.
10. Remove fill and construction debris from the culvert area to a location above the peak flow level to prevent its entry into the stream.
11. Confine construction activity to the immediate area of the culvert.
12. Fill material shall not be removed from streambeds or banks except when installing a culvert when removal of material is necessary to ensure a flat foundation.
13. Limit and restrict the use of heavy equipment in and near watercourses; an excavator will be used from shore rather than a bulldozer in the watercourse. Where it is necessary to do so, in-stream work will be performed by rubber-tired vehicles only and will only be done in compliance with approvals from the NL MEA, and DFO, respectively.
14. As required, cofferdams of non-erodible material shall be used to separate work areas from the watercourse when excavating for culverts and footings.

Cofferdams shall be removed upon completion of construction and the streambed returned as closely as possible to its original condition.

Fording

If a place where a river or other body of water is shallow enough to be crossed by wading, fording of watercourses will be avoided as much as possible and where necessary will be limited to situations of a single round trip (i.e., multiple use of a site will be facilitated by a temporary bridge). When fording any watercourse, all relevant guidelines/regulations will be adhered to including the NL ECC Environmental Guidelines for Fording.

The following will be applied to any fording activity:

1. In the unlikely event that fording is required in fish-bearing water, areas of spawning habitat will be avoided.
2. Crossings shall be restricted to a single location and crossings made at right angles to the watercourse.
3. Equipment activity within the watercourse shall be reduced by limiting the number of crossings.
4. Ensure that all equipment is mechanically sound to avoid leaks of oil, gasoline, and hydraulic fluids.
5. Stabilize the entire fording area using vegetation mats, corduroy roads, or coarse material (125 mm diameter or greater) when such material is available from a reasonably close location within the right-of-way, and the ford area is not natural bedrock, or is easily disturbed by fording. When the substrate of the ford area is not subject to easy disturbance by fording, or coarse material is not easily available within the right-of-way, then fording under existing substrate conditions may occur under the direction of the Environment Coordinators.
6. Ensure that fording activities are halted during high flow periods.
7. Stabilize all bank sections which contain loose or erodible materials. If banks must be sloped for stabilization, no material shall be deposited within the watercourse. Sloping shall be accomplished by back-blading and the material removed shall be deposited above the high-water mark of the watercourse.
8. Fording activities shall not decrease the depth of the watercourses to less than 20 cm. Where the existing depth is less than 20 cm, that depth shall be maintained.
9. All fording activities will comply with the required approvals from the NL MEA and DFO.

4.7 Dewatering Work and Site Drainage

Environmental Concerns

The major concerns associated with site dewatering and the drainage of any water body at a developing site are potential siltation and direct fish mortality and/or habitat destruction for freshwater species.

Environmental Protection Procedures

1. Filtration or other erosion control best management practices, such as settling ponds, silt fences and dykes, will be used to remove silt from, and reduce the turbidity of water pumped from work areas before discharging.

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2. Site water may be discharged to vegetated work areas to further reduce any potential effects on watercourses if this does not create new erosion problems.
 3. The area of settling ponds will be gauged to accommodate the anticipated volume of discharged water.
 4. Discharged water needs to follow natural surface drainage patterns as much as possible.
 5. Perform water treatment and quality monitoring prior to discharge to the environment, in compliance with applicable federal and provincial regulatory requirements. Consult environment department for proper treatment / monitoring protocols.
 6. For fish relocation: Use methods for live capture of fish that are established and recognized in NL and documented in a Fish Removal Plan (to be developed on case-by-case basis).

4.8 Equipment Use and Maintenance

Environmental Concerns

A variety of vehicles and heavy equipment will be used throughout the project, as well as in accompanying support and supply facilities and activities. Environmental concerns associated with operating and using such equipment includes noise, air emissions, accidental spills, artificial lighting, and leaks that may contaminate on-site water bodies or sensitive receptors.

Environmental Protection Procedure

1. Pre-use inspections are to be completed on all equipment. All equipment shall be regularly maintained and inspected. If problems are identified the equipment will be serviced to prevent the risk of a spill/leak.

Any leaking equipment brought on site will be refused entry to the work area and put as non-conformance to company policies.

2. Construction equipment will be on good operating condition, free of leaks and with all appropriate emission filters.
3. All pieces of equipment will have exhaust systems that are regularly inspected and properly functioning to manufacturers specifications.
4. Spill kits will be strategically located on site, clearly labelled, and regularly maintained.
5. Drip pans will be placed and maintained underneath pumps or any other equipment which can leak.
6. Hoses and connections on equipment will be inspected routinely for leaks and drips and will be disposed of immediately in a proper container free of leaks not on the ground.
7. Equipment maintenance and fuelling activities will be performed at sites designated by the Environment Coordinator and in compliance with applicable regulations.
8. All maintenance on the mobile fleet (e.g., haul trucks) will be performed at the Mine Maintenance Facility or at a designated area.
9. Only minor repairs and maintenance (e.g., lubrication) of 'non-mobile' equipment, such as the shovel or drilling equipment, will be performed on-site. All major repairs are to be performed at the Mine Maintenance Facility.
10. All leaks will be repaired and reported immediately to Security, who will notify the Environmental Department.

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11. All fuel and other hazardous materials will be handled according to the procedures in Section 11.
 12. Vehicles and equipment will be stored at designated areas a minimum of 100 m from water bodies when not in use.
 13. All equipment (e.g. diesel generator, etc.) shall meet requirements of the *NL Air Pollution Control Regulations* under the *Environmental Protection Act*, as required.

4.9 Storage, Handling and Transfer of Fuel and Other Hazardous Material

Typical hazardous substances that may be used on site include, but are not necessarily limited to:

- chlorinated and non-chlorinated solvents (e.g., cleaner, degreasers);
- flammable gases (e.g., acetylene);
- waste petroleum products (e.g., used engine oil);
- corrosives (e.g., battery acid);
- glycol (e.g., antifreeze);
- ozone-depleting gases (e.g., freon); and
- petroleum, oil, and lubricants.

Environmental Concerns

The primary concern with using hazardous substances is that there may be an uncontrolled release to the environment through spillage, and subsequent adverse effects on terrestrial and aquatic habitat and species, soil, groundwater quality, and human health and safety.

Environmental Protection Procedures

1. The Workplace Hazardous Materials Information System (WHMIS) Regulations under the *Occupational Health and Safety Act* will apply to all handling and storage of hazardous materials. All relevant current Safety Data Sheets (SDS) will be readily available on site.
2. All necessary precautions will be taken to prevent and reduce the spillage, misplacement or loss of fuels and other hazardous materials. In the event of a spill on-land or in the freshwater environment, contact your supervisor who will then call Security (709) 944-8400, ext. 8320.
3. Satellite fuel storage tanks (and associated fuelling equipment) will largely be replaced with a mobile fuelling truck, which will be responsible for re-fuelling mobile equipment. Personnel transferring fuel from tank trucks to mobile units will inspect transfer equipment prior to product transfer and will be in attendance for the duration of refuelling operations.
4. All fuel storage systems will be registered and comply with the Storage and Handling of Gasoline and Associated Products (GAP) Regulations. Verification of the storage tank approval will be retained for IOC.
5. Only persons who are qualified and trained in handling these materials as stated in the manufacturer's instructions and government laws and regulations will handle fuel and other hazardous materials.
6. Fuel and other hazardous materials will be stored at least 100 m from any surface water.
7. Handling and fuelling procedures will comply with the GAP Regulations and any additional requirements put forth by the NL ECC to limit potential contamination of soil or water.
8. Appropriate fuel spill control and clean up material must be available during fuelling activities.
9. Any above-ground fuel container, except for those exempted under the GAP Regulations, will be surrounded by an impervious dyke of sufficient height (minimum height 0.6 m) to contain:

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- where a dyked area contains only one storage tank, the dyked area shall retain not less than 110% of the capacity of the tank;
 - where a dyked area contains more than one storage tank, the dyked area shall retain not less than 110% of the capacity of the largest tank or 100% of the capacity of the largest tank plus 10% of the aggregate capacity of all the other tanks whichever is greater. Otherwise approved self-dyked storage tanks will be used where required;
 - all dykes of earthwork construction will have a flat top not less than 0.6 m wide and be constructed and maintained to be liquid tight to a permeability of 25 L/m²/day. The distance between a storage tank shell and the centre line of a dyke will be at least one half the tank height; and
 - drain dykes often with vac truck or other means before they overflow.
10. Fuel storage areas and non-portable transfer lines will be clearly marked or barricaded to ensure that they are not damaged by moving vehicles. The markers will be visible under all weather conditions. Barriers will be constructed in compliance with the GAP Regulations.
 11. Waste oils, lubricants, and other used oil will be retained in a tank or closed container and disposed of in accordance with the *Waste Material Disposal Act* and the *Used Oil Control Regulations*.
 12. Any soil contaminated by small leaks of oil or grease from equipment will be disposed of according to *Pollution and Prevention Act*.
 13. All storage tank systems will be inspected on a regular basis by the Environment Coordinator as per Section 18 of the GAP Regulations. This involves, but is not limited to, gauging or dipping, reconciliation of records, and the proper maintenance of reconciliation records for a period of two years.
 14. Contracted fuel suppliers will, before transporting or positioning fuel or oil, have on file at IOC a copy of their fuel and hazardous material spills contingency plan which is required under GAP Regulations, and which is acceptable to IOC. The fuel and hazardous material spills contingency plan for IOC is provided in Section 5.c.
 15. Transportation of hazardous and dangerous materials shall be conducted in accordance with provincial, territorial, and federal transportation regulations. Transportation documents shall be retained in a retrievable filing system and stored for the duration of the undertaking.
 16. Smoking is prohibited within 10 m of a fuel storage area.
 17. Fuelling or servicing of mobile equipment is to be conducted in designated areas.
 18. Drum storage areas will not be located within 100 m of a water body.
 19. Drums containing hydrocarbon or other hazardous materials will be transported, stored, handled, and disposed of such that spillage or leakage does not occur.
 20. Drums will be tightly sealed against corrosion and rust and surrounded by an impermeable barrier in a dry building with an impermeable floor. The location of drum storage areas must be approved by IOC.
 21. Small quantities of hazardous material (drums, cans, and other containers under 20 L volume) will be stored in a secure location protected from weather and freezing, as well as vehicular traffic.
 22. Where hazardous materials are to be stored outdoors, a designated area will be established, graded, and fitted with an impermeable membrane covered with local soil and surrounded by an earth berm.
 23. Within thirty (30) days of decommissioning of a storage tank system, the system will be emptied of all products, the tank and associated piping will be removed (including any contaminated soil) and the area will be cleaned of contamination, the tank marked empty, and the site restored.

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24. Decommissioning of any temporary storage tank system will be conducted according to the Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products (CCME 1994).
 25. Bulk fuel storage facilities will be dipped on a weekly basis to accurately gauge fuel consumption. These consumption rates will allow for visually undetectable sources of contamination to be identified and corrected. Records of these dips shall be made available upon request.
 26. If required, a hazardous waste storage area will be constructed in compliance with all applicable federal and provincial legislation.
 27. All petroleum and chemicals must be stored on a secondary containment.

4.10 Solid Waste Disposal

Environmental Concerns

Solid waste (e.g., domestic, and industrial wastes, paper, cardboard, and wood), if not properly controlled and disposed of, will be unsightly and could cause human safety and health concerns. It could also attract wildlife leading to the potential for human-wildlife conflicts.

Environmental Protection Procedures

1. All solid waste will be handled according to the provincial *Waste Material Disposal Act*.
2. Solid waste produced by site personnel and operations will be regularly collected and disposed of at the IOC Landfill (*refer to IOC Landfill Operation and Maintenance procedure*)
3. Waste accumulated on site prior to disposal will be confined so that it does not pose an environmental or health hazard.
4. Work areas will be kept clear of waste and litter to reduce the potential for attracting wildlife and reducing potential interactions with wildlife (*see procedures in Section 5.d for handling wildlife encounters*).
5. Any waste that may attract animals (i.e., food) will be stored in covered, wildlife-proof containers.
6. Burning of waste is not permitted.
7. All hazardous wastes generated, will be handled according to the procedures for handling fuel and hazardous materials (Section 11).

4.11 Mineral Waste Rock and Overburden

Environmental Concerns

The principal concern associated with the placement of waste mineral rock and overburden is siltation of the aquatic environment, pertaining to water quality and substrate, as well as loss of habitat and displacement of wildlife. Potential for dust generation from exposed soil/rock may also be a concern and required to be assessed prior to stock piling.

Environment Protection Procedures

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1. Waste rock and overburden storage areas will be located at least 100 meters from a water body.
 2. Overburden and separate organic stockpile locations and volumes will be recorded from salvage to placement.
 3. Structures such as silt fences will be used as a means of sediment control, and collection ditches and settling ponds will be used to manage surface runoff and any groundwater flows.
 4. Waste rock and overburden piles will be sloped and bermed to prevent pooling of surface water.
 5. Waste rock and overburden storage areas will be secured as appropriate and marked with signs to ensure the safety of employees and the public.
 6. Stabilize stockpiles with vegetative cover or temporary covers of mulch or similar until vegetative cover can be established to reduce erosion and dust generation.
 7. Implement progressive rehabilitation measures when areas are available.

4.12 Vehicle Traffic

Environmental Concerns

Vehicular traffic can result in interactions with wildlife, fugitive dust emissions, noise, and historical resources. IOC is committed to the proper operation and maintenance of its vehicles to reduce environmental effects.

Environmental Protection Procedures

1. All vehicle and equipment use, including use of all-terrain vehicles, will be restricted to designated routes within and between work, marshalling, maintenance and storage areas.
2. All vehicles and equipment will be properly maintained to meet emissions standards.
3. Travel in areas outside designated work areas will not be permitted.
4. All vehicles and equipment will yield to wildlife (see procedures in Section 5.d. for handling wildlife encounters).
5. Chasing and/or harassing wildlife with vehicles and equipment will not be permitted.
6. Maintaining and refuelling vehicles will be restricted to designated areas (See Section 10).
7. Heavy equipment (e.g., dump trucks and front-end loaders) will only be used in work areas:

Site roads will be monitored for signs of erosion and appropriate action will be taken to repair roads, when necessary; and

All personnel driving in the pit are required to have a valid pit permit. Personnel must comply with the requirements dictated in the Pit Permit training course.

4.13 Dust Control

Environmental Concern

The environmental concerns associated with dust include human health effects and potential effects on aquatic ecosystems and vegetation.

Environmental Protection Procedures

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1. Plan activities to minimize dust emissions and implement dust control procedures.
 2. Dust from operating activities will be controlled using water. In the event of excessive dust, water will be applied to travel and work surfaces. Waste oil will not be used for dust control, but other agents such as calcium chloride may be used with the approval of the appropriate regulatory agencies.
 3. Dust suppression on site roads will be done by watering the roads as part of IOC's ongoing fugitive dust reduction measures.
 4. Dust will be controlled by retaining trees and shrubs to act as windbreaks and natural erosion prevention. The amount of vegetation to be cleared will be minimized.
 5. Confinement of vehicular traffic to established access routes and lower speed limits will be implemented to reduce dust generation.
 6. Re-vegetation of inactive exposed areas to be completed as directed by the Environment Department.
 7. Use damp feed when crushing rock for road aggregate.
 8. Drills must utilize appropriate dust suppression equipment to prevent dust generation.

4.14 Hazardous Waste Disposal

Environmental Concerns

The primary concern with disposing of hazardous substances is that there may be an uncontrolled release to the environment through leakage or accidental spillage, and subsequent adverse effects on terrestrial and aquatic habitat and species, soil, groundwater quality, and human health and safety.

Environmental Protection Procedures

1. All hazardous waste will be handled according to the provincial *Waste Material Disposal Act*. Waste classified as "hazardous" or "special" that cannot be disposed of in regular landfill sites will be sent for disposal at an approved hazardous waste management company.
2. All necessary precautions will be taken to prevent and reduce the spillage, misplacement or loss of fuels and other hazardous materials.
3. Hazardous waste materials will only be handled by persons who are qualified and trained in handling these materials as stipulated in government laws and regulations.
4. Waste accumulated on site prior to disposal will be confined so that it does not pose an environmental or health hazard.
5. Waste material will not be disposed of on-site or in a body of water.
6. Burning of waste is not permitted.
7. Where hazardous waste materials are to be stored outdoors, a designated area will be established, graded, and fitted with an impermeable membrane covered with local soil and surrounded by an earth berm.
8. Waste oils, lubricants, and other used oil will be retained in a tank or closed container and disposed of in accordance with the *Waste Material Disposal Act*.
9. Any soil contaminated by small leaks of oil or grease from equipment will be disposed of according to the *Waste Material Disposal Act*.
10. All hazardous wastes generated, will be handled according to the procedures for handling fuel and hazardous materials (Section 11).

4.15 Road Maintenance

Environmental Concern

Routine grading and maintenance of the haulage and development roads may result in material entering roadside ditches, diversions, and culvert areas.

Environmental Protection Procedures

1. All grader operators and loader operators involved in road maintenance are to be informed of proper road maintenance techniques.
2. All culverts crossing roadways must be clearly marked. Grading or pushing material in these areas is strictly forbidden.
3. The diversion channel parallel to the main haulage road must also be clearly marked to prevent accidental in-filling from grading operations.

4.16 Trenching

Environmental Concerns

Environmental concerns associated with trenching include potential runoff of sediment-laden water, which could affect freshwater fish habitat and water quality, lower the quality of water, and destroy historic resources.

Environmental Protection Procedures

1. Topsoil and excavated overburden will be stored in stockpiles for later use during rehabilitation.
2. Any unsuitable material will be disposed of in a disposal area approved by the Environment Coordinator.
3. Excavators and backhoes should be used to excavate trenches in areas around overburden and waste rock stockpiles to minimize land disturbance. The use of bulldozers should be avoided.
4. If required, dewatering of trenches will make use of measures to reduce and control the release of sediment laden water with filtration through erosion control devices, settling ponds, straw bales, geotextiles, or other devices.
5. When feasible, trenches should be backfilled, and the finished grade is to be level with the surrounding surface.
6. If a historic/archaeological site is encountered, all work must cease in the area and the Environment Department will consult with the relevant regulatory agencies to determine buffer requirements and next steps.

4.17 Surveying

Environmental Concerns

Surveying activities may disturb wildlife species, vegetation, and historic resources.

Environmental Protection Procedures

1. Width of survey lines will be limited to that which is necessary for line of sight and unobstructed passage.

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2. Whenever possible, cutting lines to the boundary between trees and open areas will be avoided.
 3. Cutting of survey lines will be kept to a minimum. Where possible, alternate areas not requiring cut lines will be used.
 4. All trees not exactly on transit lines shall be left standing.
 5. When surveying the development area limit, areas that will be cleared require a modified adherence to the above, except trees, shrubs, and areas to be saved or left natural as noted on the plans or marked in the field.
 6. No attempt to harass or disturb wildlife will be made by any person (refer to Section 5.d.).
 7. Vehicles will yield the right-of-way to wildlife.

Traversing

1. Access by heavy equipment to sensitive areas such as wetlands will only be through established rights-of-way.
2. All-terrain vehicles (ATVs) will not be allowed off the right-of-way except as approved by the onsite manager/supervisor. The use of ATVs will be restricted to designated trails, thus minimizing ground disturbance. ATV use will comply with the Motorized Snow Mobile and All-Terrain Vehicle Regulations, 1996 under the *Motorized Snow Mobile and All-Terrain Vehicle Act* and the Environmental Guidelines for Stream Crossings by All-Terrain Vehicles issued by Department of Environment and Climate Change .
3. No motorized vehicles will enter the areas designated as sensitive without notification and approval of the Site Manager, for establishing targets, permanent benchmarks, and transponder locations.
4. In normal ground conditions a 15 mm x 400 mm long rebar is driven approximately 350mm into the surface with an 8-lb sledgehammer. When bedrock or a large boulder is encountered less than 300 mm below the ground surface, a 15 mm x 150 mm long rebar is cemented in a hole drilled in the rock. The rebar will be set into the rock a minimum distance of 80 mm.

4.18 Public Traffic and Activity

Environmental Concerns

Development activities, such as quarry mining, exploration, surveying, drilling, and blasting, or activities that involve the clearing or removal of the existing land, may affect the public (i.e., private roads, private cabins, etc) in and around the developing areas.

Environmental Protection Procedures

1. All operating activities will comply with federal and provincial regulations;
2. Public notice will identify the schedule and nature of activities and to recommend precautions; and
3. Development Area boundaries will be clearly marked.

5 Section 5 Contingency Plans

Contingency plans to address accidents and unplanned situations have been developed and will be modified as required throughout the project. Notwithstanding the existence of these contingency plans, a policy to implement preventative measures as the first line of defence against the possibility of accidents will be adopted.

Refer to the latest plans on Mine to Port website.

5.1 Culvert Failure

The two main causes for failure of a properly installed culvert are a blockage or exceptionally high discharges. Regular inspection and maintenance will avoid blockages, by debris or ice. Failure due to exceptionally high flows cannot be avoided once the culvert is installed and sustained high flows will often limit the ability to mitigate a failure.

Environmental Concerns

The environmental effects of culvert failure are usually a massive release of suspended fine sediment and larger substrate material into the stream. The suspended and finer materials can be transported for considerable distances downstream where fish habitat and fish eggs may be covered and smothered while fish fry and food organisms may be smothered, disturbed, or displaced from their habitat. Introduced coarse substrate may fill pools, disturb spawning gravel, and change or deflect flows, which may lead to additional erosion downstream.

Prevention

1. All culvert installation will comply with federal and provincial regulations (Section 6.11, Watercourse Crossings). All necessary permits and authorization will be obtained for culvert installation.
2. Culverts that are installed will be sized appropriately to reduce the risk of washout due to high flows.
3. Culverts will be inspected regularly, and measures will be taken to ensure stability of the installation, remove debris, and prevent ice blockage.

Response Measures

1. There is often little that can safely be done to address culvert failure from high flow once the failure begins. However, high flows are often episodic and short-lived, so it is appropriate to prepare for remedial measures that can be done when flow subsides.
2. Following a culvert failure, measures will be taken to stabilize the roadbed and stream bank to reduce the risk of additional erosion.
3. As soon as high flow subsides and it is safe to do so, large debris such as concrete, culvert pipe or newly fallen trees will be removed from the stream and placed where there is no risk of reintroduction into the stream.
4. Provincial and federal authorities are to be notified (Section 7.0 Contact List) and further remedial work in the stream will only proceed following consultation with DFO.
5. All necessary provincial and federal permits and authorizations will be obtained prior to conducting any additional in-stream work to restore the stream channel or fish habitat.

5.2 Road Washout

Road washout can occur due to flooding, poorly installed culverts, poorly installed and maintained ditches, or failure of the shoulder or roadbed.

Environmental Concerns

The environmental effects of road washout are the same as for culvert failure. This usually includes a massive release of suspended fine sediment and larger substrate material into the stream. The suspended and finer materials can be transported for considerable distances downstream where fish habitat and fish eggs may be covered and smothered while fish fry and food organisms may be smothered, disturbed, or displaced from their habitat. Introduced coarse substrate may fill pools, disturb spawning gravel, and change or deflect flows, which may lead to additional erosion downstream.

Prevention

Ditching and site drainage will be inspected regularly, and measures will be taken to ensure stability of the installations, remove debris, and prevent ice blockage.

Response Measures

1. There is often little that can safely be done to address a road washout from high flow once the failure begins. However, high flows are often episodic and short-lived, so it is appropriate to prepare for remedial measures that can be taken when flow subsides.
2. Following a road washout, measures will be taken to stabilize the roadbed and adjacent stream banks to reduce the risk of additional erosion.
3. As soon as high flow subsides and it is safe to do so, large debris such as guard-rails, concrete footings, culvert pipe or newly fallen trees will be removed from the stream and placed where there is no risk of reintroduction into the stream.
4. Provincial and federal authorities are to be notified (Section 7 Contact List) and further remedial work in the stream will only proceed following consultation with DFO.
5. All necessary provincial and federal permits and authorizations will be obtained prior to conducting any additional instream work to restore the stream channel or fish habitat.

5.3 Fuel and Hazardous Material Spills

Environmental Concerns

Fuel and hazardous materials can be damaging to vegetation, soil, surface water, ground water, wildlife, aquatic organisms, historic resources and human health and safety.

Response Measures

1. All spills are to be immediately reported to Security, who will contact the Coast Guard see contingency plans.
2. Spills are to be immediately confined and cleaned up as per CR-E-E-PRO Spill Response & Reporting.
3. All contaminated material is to be transported to the IOC Waste Transfer Building for off-site disposal as per the *Waste Material Disposal Act*.

5.4 Wildlife Encounters

Environmental Concerns

Wildlife encounters pose a risk for stress or injury to both the wildlife and site personnel. Control measures and environmental protection procedures have been put in place to reduce this risk to wildlife and humans. As a protection measure, hunting, trapping, or fishing by project personnel is not permitted at the site.

Prevention

The following procedures are to be implemented in order to prevent wildlife encounters:

1. Site and working areas will be kept clean of food scraps and garbage.
2. Waste will be collected for disposal in wildlife/bear-resistant containers. Waste will be transferred to the on-site landfill routinely as needed.

Response Measures

All project personnel will abide by the following rules in the case of wildlife encounters:

1. No attempt will be made by any person at the project site to chase, catch, divert, follow, or otherwise harass wildlife by vehicle or on foot.
2. Equipment and vehicles will yield the right-of-way to wildlife.
3. No personal pets, domestic or wild, will be allowed on the site.
4. All personnel should be aware of the potential for encounters with wildlife (black bears, wolves, foxes, etc.) and instructed to immediately report all sightings to Security. At their discretion, the IOC Environmental Department will notify the Newfoundland and Labrador Department of Environment and Climate Change ().
5. When nuisance animals (e.g. black bear) are identified in the project area, the Environment Coordinator will be responsible for all subsequent actions. Responsive actions will also be the responsibility of the Environment Coordinator, who may consult with Department of Forest Resources and Agrifoods (DFRA). All actions must comply with Wildlife Division regulations and permits.
6. The Environment Coordinator will authorize the use of deterrent measures for wildlife.
7. All incidents that result in the displacement or killing of wildlife must be reported to Security.
8. Under provincial wildlife regulations, the displacement and release of any animal is the sole jurisdiction of NL DFRA and is to be undertaken only under appropriate supervision.
9. If the nest of any raptor or other bird is encountered during development, activity in the vicinity of the nest is to be curtailed until NL DFRA is contacted and appropriate mitigation is applied.

5.5 Forest Fires

Environmental Concerns

Activities related to the project could result in a fire, which could spread to the surrounding area. Such events could be damaging to vegetation and wildlife, as well as human health and safety.

Response Measures

IOC or the contractor will take all precautions necessary to prevent fire hazards when working at the site. These include but are not limited to:

1. Disposal of all flammable waste on a regular basis.
2. Smoking will be permitted in designated areas only.

-
3. IOC or the contractor making available, in proper operating condition, sufficient firefighting equipment to suit its labour force and fire hazards. Such equipment will comply with and be maintained to the manufacturer's standards and personnel are to be trained in the use of such equipment.
 4. In the event of a forest fire, IOC or the contractor will take immediate steps to contain or extinguish the fire.
 5. IOC will appoint a supervisory staff member as On-Scene-Commander for the purpose of fighting any forest fires.
 6. Fires shall be reported immediately to Security, and the Wabush Forestry office (Department of Fisheries, Forestry and Agriculture).
 7. (709) 282-6881 and ultimately to the Forest Management Unit office in Corner Brook (709) 637-2408. The following information will be provided:

name of the reporter and phone number;
time of detection of the fire;
size of the fire;
location of the fire; and
the police will also be notified immediately at (709) 944-7602.

5.6 Discovery of Historic Resources or Archaeological Sites

Environmental Concerns

Historic resource material that is disturbed, destroyed, or improperly removed from a site represents a cultural loss of information and history that could otherwise be handled and interpreted in an efficient and appropriate manner.

Response Measures

In case of a suspected discovery of historic or archaeological sites, the following procedures shall apply:

1. Stop all work in the immediate area of the discovery until authorized personnel from IOC, having consulted with the Provincial Archaeologist, permit resumption of the work.
2. Report the find immediately to the Environment Coordinator.
3. The Environment Coordinator will report the find with the following information to the Provincial Archaeology Office, Historic Resources Division, Department of Tourism and Culture, St. John's, and comply with the instruction provided:
 - nature of the find;
 - precise descriptive and map location and the time of the find;
 - nature of the activity resulting in the find;
 - identity of the person(s) making the find;
 - present location of the material, if moved, and any protective measures initiated for the material and the site; and
 - any extenuating circumstances.

Under the *Historic Resources Act, RSNL 1990 c.H-4*, all archaeological sites and artefacts are the property of the Crown and shall not be disturbed.

6 Section 6 Environmental Protection Plan Control Revisions

Holders of controlled copies (i.e., those versions which contain all of the up-to-date procedures) of the EPP are included in Appendix B.

EPPs are revised as necessary to reflect site-specific environmental protection requirements and allow updates as work progresses. All EPP holders may initiate revisions by forwarding proposed revisions to the Environment Coordinator. The following information will be provided on the Revision Request Form (see Appendix C) for all revision requests:

- section to be revised;
- nature of the revision;
- rationale for the revision (i.e., environment/worker safety); and
- who submitted the revision request.

The Environment Coordinators will seek approval for revisions from the Manager Environment & Sustainable Development. When the Environment Coordinator receives approval for the revision request, details of the revision will be distributed to all EPP holders and will be documented in the Revision History Log (Appendix D). Each revision will be accompanied by:

- revision instructions;
- list of sections being superseded; and
- an updated Table of Contents indicating the current status of each section in the EPP.

When EPP Holders receive a revision, they will, within two working days:

- read the text of the revision;
- check the control sheet to ensure that all the listed pages have been received;
- remove and destroy the superseded pages from their copy of the EPP;
- insert the revised pages in the proper place in their copy of the EPP;
- page check the EPP, using the updated table of contents to ensure the EPP is complete and current;
- enter the revision number and date entered on the Revision Control Record;
- incorporate the revision into the area of responsibility, as appropriate; and
- ensure that their personnel are familiar with the revisions.

7 Section 7 Contact List

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Newfoundland and Labrador Regional Office
Tel: (709) 772-2083 or 1-800-563-9089

FISHERIES AND OCEANS CANADA
Happy Valley Goose Bay, NL
Tel. (709) 896-6150
Fax: (709) 896-8419

Digital Government and Service NL
Happy Valley-Goose Bay, Labrador
Tel. (709) 896-5428
Fax. (709) 896-4340

ROYAL NEWFOUNDLAND CONSTABULARY
417 Booth Street
Labrador City, NL
Tel: (709) 944-7602

DEPARTMENT OF Fisheries, Forestry and Agriculture District Office
Wabush, NL
Tel: (709) 282-6881

DEPARTMENT OF ENVIRONMENT and Climate Change
Wildlife Division
General Enquiries
T: (709) 637-2025

8 Section 8 Reference Material

Canadian Council of Ministers of the Environment. 1994. Environmental Code of Practice for Aboveground Storage Tank Systems Containing Petroleum Products.

Department of Municipal Affairs and Environment. 1994. Water Resources Management Division. Chapter 3A. Environmental Guidelines for Stream Crossings by All-Terrain Vehicles.

Department of Municipal Affairs and Environment. RSN1990 C W-4 Waste Material Disposal Act.

Department of Municipal Affairs and Environment. 2003. Storage and Handling of Gasoline and Associated Products Regulations.

Department of Municipal Affairs and Environment. RSNL 1990 c.H-4 Historic Resources Act

Department of Municipal Affairs and Environment. SNL2002 C W-4.01 Water Resources Act

Government of Alberta, Alberta Transportation, June 2011, Erosion Control Manual, 444 pp

Services Newfoundland & Labrador. Fisheries and Land Resources. RSNL 1990 Motorized Snow Vehicles and All-Terrain Vehicles Act

NL: Department of Natural Resources. Environmental Guidelines for Construction and Mineral Exploration Companies.

Government of Canada Department of Fisheries and Oceans. Measures to avoid causing harm to fish and fish habitat including aquatic species at risks (website reviewed June 2018 <http://www.dfo-mpo.gc.ca/pnw-ppp/measures-mesures/measures-mesures-eng.html>)

Gosse, M.M., A.S. Power, D.E. Hyslop, and S.L. Pierce. 1998. Guidelines for Protection of Freshwater Fish Habitat in Newfoundland and Labrador. Fisheries and Oceans, St. John's, NF. X + 105 pp., 2 appendices.

Iron Ore Company of Canada. CR-E-E-PRO Spill Response & Reporting.

Rio Tinto Standards. E13- Chemically Reactive Mineral Waste Control Standard.

Wright, D.G., and G.E. Hopky. 1998. Guidelines for the use of explosives in or near Canadian Fisheries Waters. Can. Tech. Rep. Fish. Aquat. Sci. 2107: iv+34p.

Appendix A List of Abbreviations and Acronyms

LIST OF ABBREVIATIONS AND ACRONYMS

CCME	Canadian Council of Ministers of the Environment
DFO	Department of Fisheries and Oceans Canada
EPP	Environmental Protection Plan
GAP	Storage and Handling of Gasoline and Associated Products
IOC	Iron Ore Company of Canada
NL MAE	Newfoundland and Labrador Municipal Affairs and Environment
SDS	Safety Data Sheet
NEAR	Newfoundland Environment Assessment Regulations
WHMIS	Workplace Hazardous Materials Information System
NL ECC	Newfoundland and Labrador Environment and Climate Change

Appendix B EPP Copy Distribution List

CONTROLLED COPY DISTRIBUTION LIST

Department or Organization	Individual or Location
Environment Department	Environment N:/ Directory System
Manager Environment & Sustainable Development	Patrick Lauziere
Manager Mine Operation	Scott Melvin
Manager Mine Technical Services	Rodney Williams

Appendix C Revision Request Form

REVISION REQUEST FORM

SECTION TO BE REVISED:

NATURE OF REVISION:

RATIONALE FOR REVISION:
(i.e., environment/worker safety, etc.)

SUBMITTED BY:

Please submit request to the Environment Coordinator

Appendix D Erosion and sediment control - best management practices examples

TAKEN FROM ALBERTA TRANSPORTATION MANUAL:
EXCELLENT
HTTP://WWW.TRANSPORTATION.ALBERTA.CA/CONTENT/DOCTYPE372/PRODUCTION/EROSIONCONTROLMANUAL.PDF

REFERENCE

HERE ARE A FEW EXCERPTS FROM THE MANUAL

Silt Fence Sediment Control	B.M.P. #1
--------------------------------	-----------

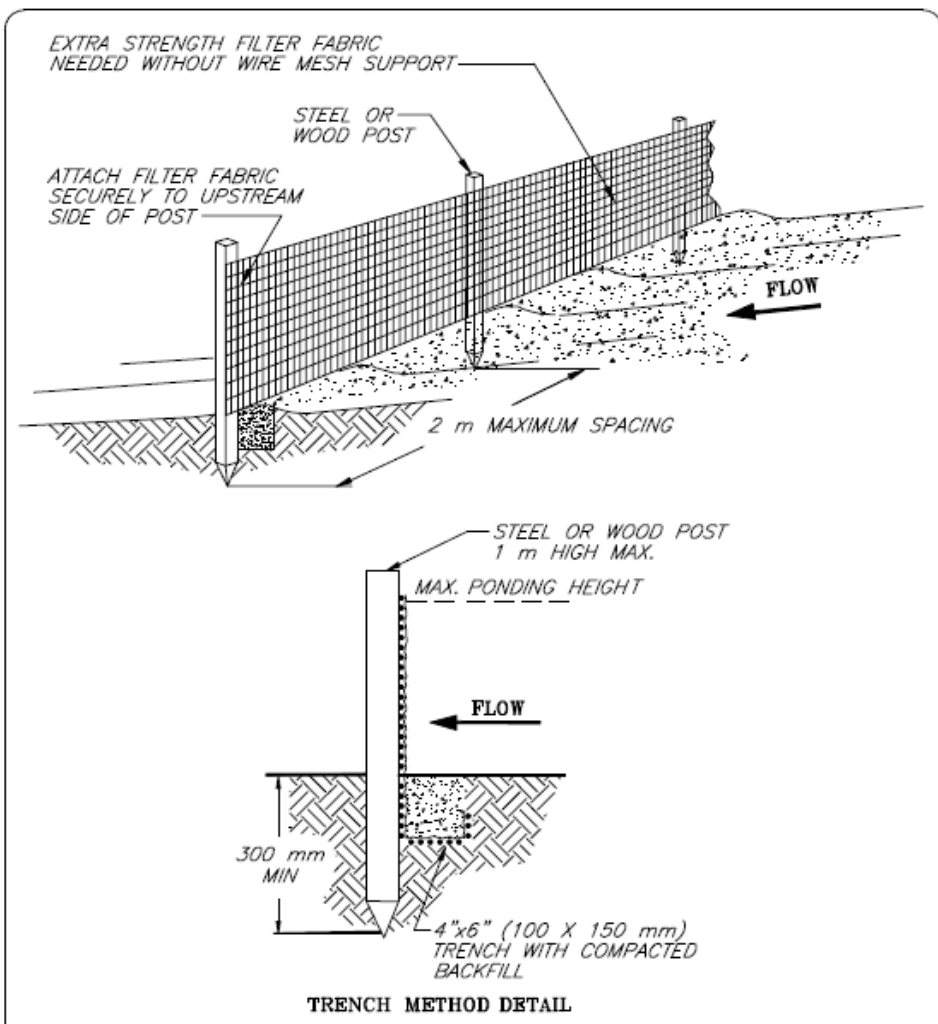
- Sediment build up should be removed once it accumulates to a depth of 0.2 m
- Remove fence after vegetation is established
- Deactivate fabric by cutting-off top portion of fabric above ground; bottom trenched-in portion of fence fabric can be left in-ground thus minimizing ground disturbance

Similar Measures

- Straw Bales
- Rock Barrier
- Permeable/Synthetic Barriers

Design Considerations

- For a silt fence system to work as a system, the following factors should be considered:
 - a) quantity – adequate number and frequency of fence for efficient ponding and sedimentation
 - b) installation – workmanship
 - c) compaction – backfill and trenching of fabric
 - d) support – posts adequately embedded, appropriate selection of post material and spacing
 - e) attachment – secure fabric to post
- Install silt fences in a 'J' hook or 'smile' configuration



- NOTES:
1. SILT FENCE SHALL BE PLACED ON SLOPE CONTOURS TO MAXIMIZE PONDING EFFICIENCY.
 2. INSPECT AND REPAIR FENCE DAILY AND AFTER EACH STORM EVENT AND REMOVE SEDIMENT WHEN ACCUMULATED SILT REACHES 200 mm.
 3. REMOVED SEDIMENT SHALL BE DEPOSITED TO AN AREA WILL NOT CONTRIBUTE SEDIMENT OFF-SITE.
 4. THIS FIGURE IS PROVIDED FOR GUIDANCE ONLY AND DOES NOT CONSTITUTE A DESIGN. A SITE SPECIFIC DESIGN IS REQUIRED FROM DESIGNER/ENGINEER.

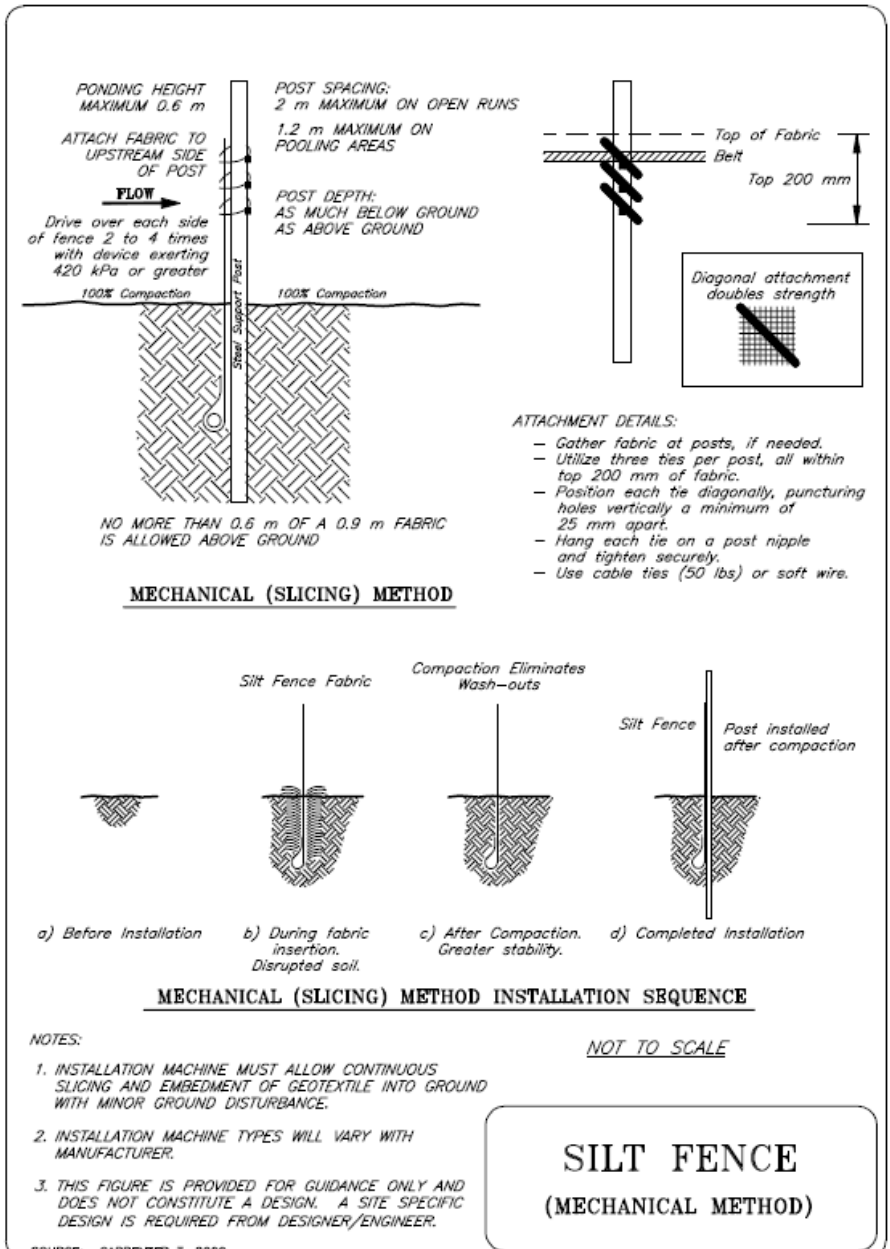
NOT TO SCALE

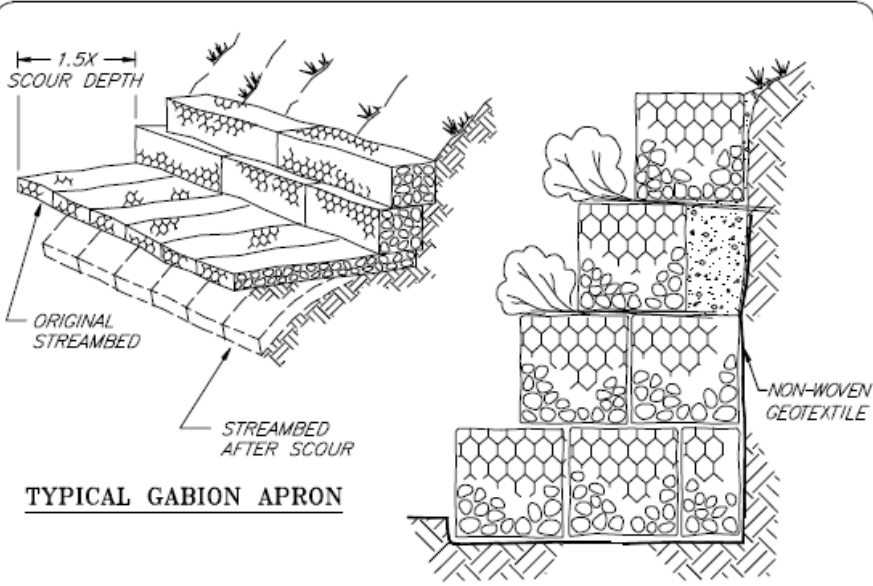
SILT FENCE
(TRENCH METHOD)

FILE: SILTFENC

B.M.P. #1
Typical Section
Page 1 of 3

© 1994 JOHN McCULLAH
From: Soil-Applied Earthcare - EROSION DRAW 3.0

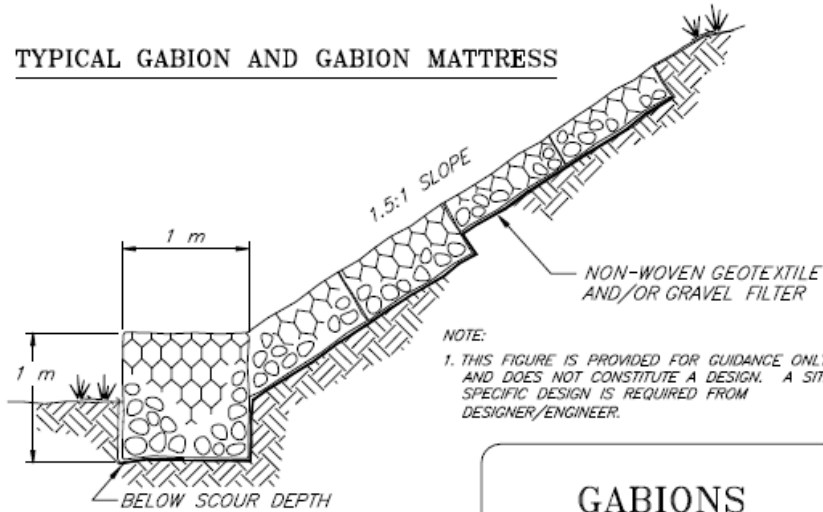




TYPICAL GABION APRON

TYPICAL VEGETATED ROCK GABION

TYPICAL GABION AND GABION MATTRESS



**GABIONS
(SLOPE AND BANK)**

From: Salix—Applied Earthcare - EROSION DRAW 3.0
© 1996 JOHN McCULLAH

**Government
of Alberta** ■
Transportation

B.M.P. #2a
Typical Section

Appendix E Revision History Log

Version	Date Issued	Name of Last Issuer	Revision Notes
Version	Date Issued	Name of Last Issuer	Revision Notes
0.1	June 9, 2003	Lee Preziosi	Draft EPP (Version 0.1) for review
0.2	July 4, 2003	Lee Preziosi	Draft EPP (Version 0.2) for review
01	July 4, 2003	Lee Preziosi	Final EPP (Version 01) Issued
02	February 16, 2004	Lee Preziosi	Revised taking into consideration DFO's Regional Habitat Co-ordinator's comments. Changes made are in bold.
03	May 16, 2005	Sonya Flynn	Revised with new ESH Policy, removed Call-out procedure, new IOC Logo added, update of names, Note on Draining of Hakim Lake
04	July 31, 2007	Jody Clark	Annual review; revised Environmental Administrator to Environment Coordinator.
05	April 1, 2008	Garry Greene	Annual review. Revised Garry Greene to Primary Ore Environment Coordinator. In Appendix B changed Arn Do to Kresho Galovich. Revised Department of Forestry Resources and Agrifoods to Department of Natural Resources Forestry and Wildlife Division. Revised Jody Clark Environment Manager to Patrick Lauziere Superintendent Environment.
06	October 28, 2010	Garry Greene	Consolidated all three EPP's., (Luce, Sherwood, Plateau Quarry) into general EPP that covers the entire IOC Labrador City Operations.
07	July 21, 2017	Danielle Kinsman	Review and update of EPP for the Sherwood North Development Project
08	June 20, 2018	Denise Cormier Tina Cassel	Update EPP to include comments from Sherwood, added culvert cleaning info, updated reference material, and regulatory information, added BMP appendix and project specific Appendix
09	March 2024	Tina Cassell Melanie Lafosse	Updated Gov't Department and contacts. Environment Dept Titles. New Template.

Appendix F Project Specific Information

Document control

Document control			
Approved by	Jody Wentzell		
Related documents	IOC Standards, Procedures and Plans		
Version control			
Version No.	0e9	Initial version issued	June 2003
Date issued	June 2003	Update 09	March 2024
Distributed	Internally / Externally (delete as appropriate)		
Author	Lee Preziosi, Tina Cassell, Melanie Lafosse		
Rio Tinto IOC	• Environment Department		

Appendix C

Terrestrial Baseline Studies



March 1, 2024

IOC Western Hillside Project Terrestrial Biophysical Assessment

Prepared for:

Tina Cassell
Senior Coordinator
Environmental Projects
Iron Company of Canada

REF # 074-310





SEM Ltd. is a NL-based Indigenous multidisciplinary consulting firm with a team of specialists ready to take our clients' business to the next level. Our agile professionals, expert innovators and educated problem solvers are always ready to take on any project – big or small.

We are dedicated to the communities in which we work, and our culture revolves around inclusion, engagement, and achieving our goals for clients and their communities.

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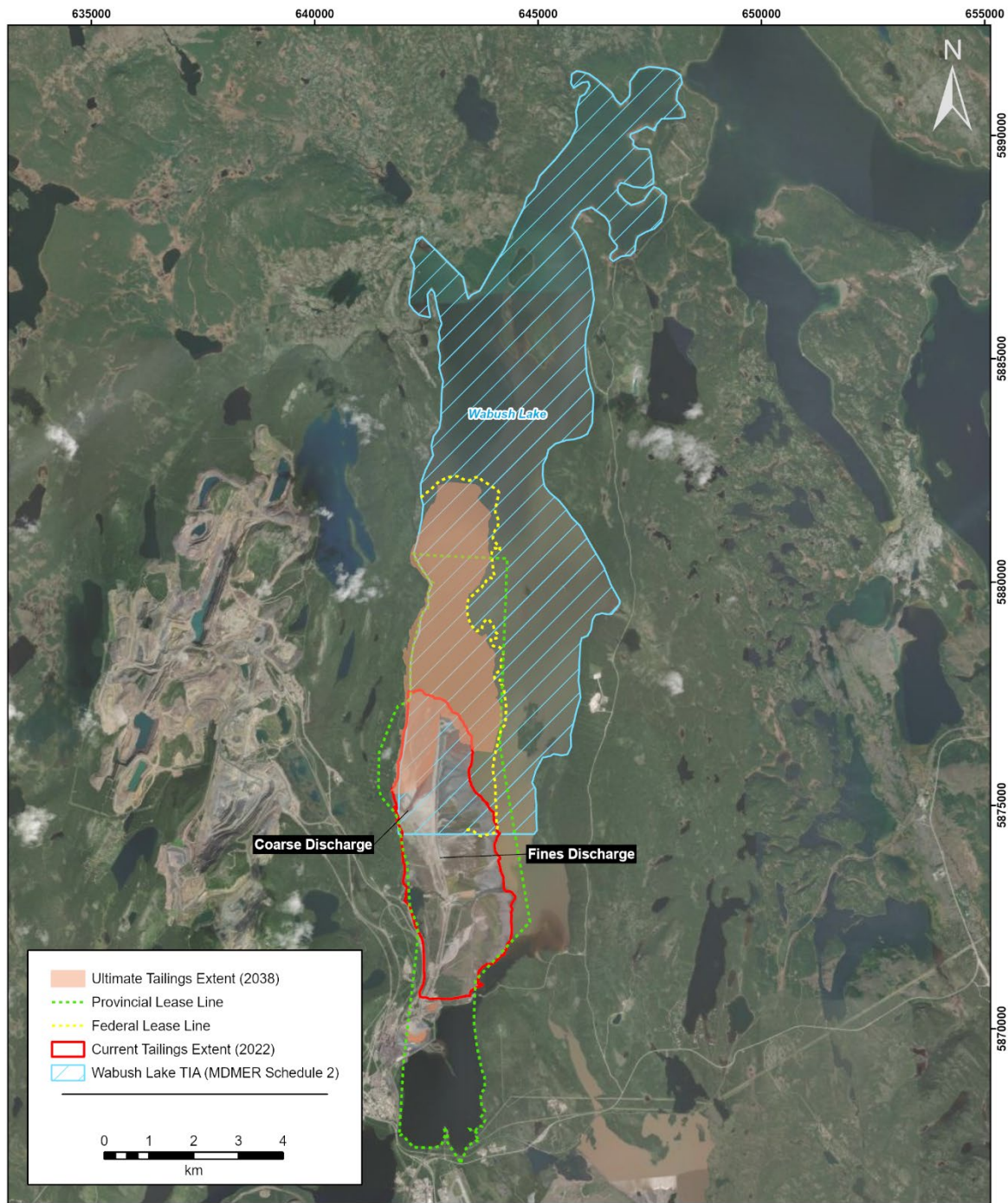
Appendix A S-rank Definitions

1.0 Background

Iron Ore Company of Canada's (IOC) Carol Project mine has been in production since 1962, employing open pit mining techniques to extract iron ore and produce refined iron in concentrate and pellet form. The open pit and milling operations are to the northeast of the Town of Labrador City while the main tailings area is within the Wabush Lake watershed. IOC has been using the tailings storage facility (TSF) located in Wabush Lake since 1964, and it has served as the sole TSF for mining operations. Wabush Lake was designated as a tailings impoundment area (TIA) as per the *Metal and Diamond Mining Effluent Regulations* (MDMER) (Schedule 2) in 2009. IOC also operates under two lease boundaries (federal and provincial), which are within the TIA (Figure 1.1).

As mining operations progress, the tailings deposition will continue to extend northward and infill the shoreline of the lake. IOC has developed a new tailings management plan (TMP) to optimize the storage capacity of the Wabush Lake TIA. The proposed Western Hillside Project will involve advancing five coarse discharge pipelines and an access road through a forested area along the Western Hillside of Wabush Lake. It has been determined that depositing tailings from west to east into the lake from the shoreline will be the most effective way to maximize storage capacity.

In 2023, Sikumiut Environmental Management Ltd. (SEM) was contracted by IOC to complete a Terrestrial Biophysical Assessment for the Western Hillside project, the information from which would contribute to an Environmental Registration document. The goal of these studies was to inventory the flora and fauna present within the Study Area and identify any interactions of the Project with these elements. Interactions were addressed with Rio Tinto's mitigation hierarchy (Avoidance, Minimization, Rehabilitation, Offsets), a conceptual framework for assessing biodiversity risks and opportunities and developing appropriate responses.



	Western Hillside Project - Environmental Assessment	AUTHOR: JC	PREPARED BY:
	Wabush Lake Tailings Impoundment Area	COORDINATE SYSTEM: NAD83 UTM Zone 19	DATE: 13/04/2023

Figure 1.1 Wabush Lake Tailings Impoundment Area Boundaries and Offset Area.

Several pieces of Federal and Provincial legislation pertain to the terrestrial Valuable Components (VCs) associated with this Project. First, the *Migratory Birds Convention Act* (MBCA) prohibits killing or harming individuals or destroying the eggs or young of several Families of migratory bird species. This Act protects most bird species known in and around the Study Area and Labrador West, with some exceptions. This Act has implications for the clearing of land at IOC, but under the Biodiversity Conservation Strategy (BCS) there are processes in place to ensure that surveys are conducted and documented prior to land clearing activities anywhere on IOC property. Secondly, the *Species at Risk Act* (SARA) protects Species at Risk (SAR) in Canada. SAR habitats are also protected under SARA, prohibiting the destruction of critical habitat of an Endangered or Threatened SAR. No approvals or permits under SARA were required with respect to this Project as surveys would not interact with SAR directly (e.g., we deployed passive recorders (bat detectors) which do not affect SAR bats, but simply record their acoustic presence). Provincially, The *Wildlife Act* gives protection to wildlife and prohibits the hunting, taking, or killing of wildlife for specific places, times, and methods (with certain exemptions for permit and licence holders). The Newfoundland and Labrador *Endangered Species Act* (NL ESA) lists and provides regulations on provincial SAR and is intended to protect plant and animal species listed as Endangered, Threatened, or Vulnerable in NL.

2.0 Purpose

The purpose of this report is to provide IOC with comprehensive baseline information regarding the terrestrial VCs within the Western Hillside Study Area. The information provided in this document will be summarized in the Environmental Registration Document for the Western Hillside Project.

3.0 Methodology

3.1 Study Team

SEM assembled a Study Team of qualified and experienced professionals for the terrestrial biophysical assessment. The Study Team and their roles are identified in Table 3.1.

Table 3.1 SEM Study Team.

Team Member	Title	Role
Steve Gullage	VP Environment and Climate Change	Project Management, Client Liaison, Field Studies, Reporting
Chris Hearn	Terrestrial Biologist	Field Study Mobilization, Field Studies, Reporting
John Crocker	GIS Analyst	Ecological Land Classification, Map Preparation, GIS
Deon Dicks	Field Technician	Field Surveys, Mobilization
Emma Wells	Biologist	Reporting

3.2 Study Area

The Study Area for the Terrestrial Biophysical Assessment coincides with the same area as the Aquatic Habitat Assessment. Figure 3.1 depicts the boundary for this Assessment.



Figure 3.1 Study Area for the Terrestrial Biophysical Assessment for the Western Hillside Project.

3.3 Survey Methods

A thorough biophysical assessment was conducted for the Study Area, aiming to identify the current habitats (ecotypes) through an Ecological Land Classification (ELC), survey the wildlife species inhabiting the Study Area, and identify any rare flora present on-site. Several desktop and field surveys contributed to the information for this biophysical assessment, including the following components, or 'Valued Components' (VCs):

- Ecological Land Classification;
- Wetlands;
- Rare Flora;
- Avifauna, including:
 - Passeriformes and Other Perching Birds;
 - Raptors; and
 - Waterfowl and Waterbirds.
- Mammals;
- Amphibians; and
- Species at Risk and Species of Conservation Concern.

Prior to field efforts, a data request was submitted to the Atlantic Canada Conservation Data Centre (ACDC) to obtain a preliminary list of rare species and Species of Conservation Concern (SCC).

3.3.1 Ecological Land Classification

SEM employed a two-method approach for the identification of the habitat types that exist throughout the Study Area. First, a comprehensive literature review and data compilation exercise was conducted to amalgamate existing information for the Study Area, at both regional and local scales. Secondly, detailed ELC mapping was completed for the Study Area, to identify the habitat types that may interact with the different components of the Project, including the projected tailings infilling along the shoreline of Wabush Lake, the proposed pipeline and access road alignment, and the potential offsetting Study Area to the south of Hillside Pond (Cassell Creek).

Recognizing that unique fine-scale habitats often correlate with an increased potential for rare wildlife and plant species, SEM employed habitat type classifications to identify areas with heightened potential for such occurrences (e.g., wetlands, rock outcrops). For this classification, SEM utilized high-resolution colour imagery collected with a SenseFly eBee remotely piloted aircraft system (RPAS). The resulting imagery dataset was comprised of a series of high-resolution digital images (3.3 cm/pixel) captured directly from the sensor onboard the RPAS (in stereo). The orthorectified imagery was imported into ArcGIS for interpretation, and the habitat polygons were interpreted from aerial imagery by GIS analysts informed by information gathered from ground-truthing efforts in the field by SEM biologists. SEM biologists experienced in classifying habitat types based on vegetation used methods consistent with the Forest Site Classification Manual (Meades & Moores 1994), which is a detailed field guide for forest site classification for Newfoundland; but is also consistent with habitat types found in Labrador.

Digitization of polygons was complemented by a point file within ArcGIS, populated with attribute information related to each vegetation polygon. Centroid point data were entered based on the SEM biologists field experience and familiarity with regional ecotypes, incorporating information collected from the field. Ecotypes were further verified in the field through predetermined sampled points plotted during the boundary interpretation stage. This field verification process enhanced the characterization of ecotypes, including species composition, with the gathered information used to refine ecotype boundaries and aggregate ecotypes based on similar characteristics.

3.3.1.1 Wetlands

Wetlands in Labrador West can be characterized according to the Canadian Wetland Classification System (CWCS) into five classes: (i) bog; (ii) fen; (iii) swamp; (iv) marsh; and (v) shallow-water wetlands (CWCS 1997). The five classes fit into two larger categories known as organic wetlands and mineral wetlands, referring to their accumulation of peat. SEM is experienced in wetland classification based on vegetation, as well as wetland delineation, which allows for detailed wetlands to be mapped out based on the soil, vegetation, and abiotic factors.

A wetland delineation field survey was unnecessary for this project, as wetlands were delineated during the ELC process at a scale sufficient for the purposes required for this Project. The various classes of wetlands were documented, but for the purposes of the ELC, the wetlands classes were combined for map clarity (and their ecological differences were relatively insignificant). Wetland class information is presented in the results section.

3.3.2 Rare Flora

The rare flora VC required the identification of any rare species in the Study Area. This study began with an information query to the ACCDC to obtain a rare species list of records for a 5 km radius around the Study Area (Figure 3.2), and a desktop analysis of habitat types within the Study Area, with the purpose of predicting those of higher probability of occurrence. The ACCDC compiles provincial lists of plants and animals and assigns an “S-rank”, or conservation status rank, along with the legal status for each species if they are also a SAR (Atlantic Canada Conservation Data Centre 2012). The S-rank definitions can be found in Appendix A. A “Species of Conservation Concern” includes any species with a rank of S1 to S3.

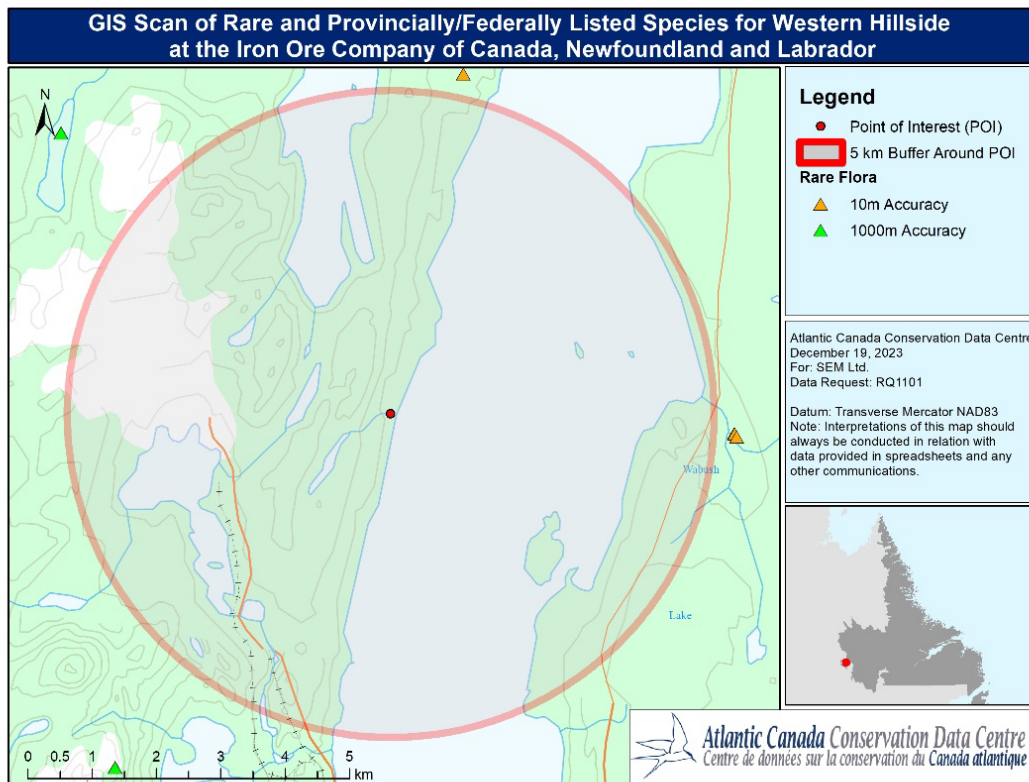


Figure 3.2 ACCDC GIS Scan of Rare and Provincially/Federally Listed Species within the Study Area.

The list of rare species generated from the ACCDC request was researched for habitat preferences, and habitat associations were compiled for each SCC. This literature search provided a more refined focus on relevant habitats during surveys for SCCs throughout the terrestrial surveys in the Study Area.

SEM compiled a list of potential rare flora based on the ACCDC records, along with a map delineating wetlands and other specialized habitats like rock outcrops, talus slopes, cliffs, watercourses, and old-growth forests, all of which have elevated potential for hosting rare flora species. Rare flora species in Labrador are most often associated with wetland habitats, which are found throughout the center of the Study Area. In addition, rare plant surveys previously conducted on the IOC property were referenced to assess the potential for this Study Area, based on any common habitat characteristics.

Species of SAR under federal and provincial legislation (i.e., SARA and NL ESA) were captured within this rare species inquiry and through desktop studies. SAR from ACCDC data were considered high priority when completing rare flora surveys, although all flora species were documented throughout.

The field component of the rare vascular plant survey was conducted on two trips, from June 19-21, 2023, and September 7-8, 2023, strategically timed for observing most species of flowering vascular plants in the region. A targeted approach was undertaken to increase efficiency and ensure sufficient coverage for each habitat type and the target habitats. Locations of rare plants were recorded using a handheld GPS and first sightings of each species (regardless of rarity) were documented as per NL Wildlife Division (NLWD) protocol. The number of individuals of each SCC was estimated at each discrete site to indicate the abundance of individuals of the species and the spatial extent of the habitat occupied. In cases where a species couldn't be identified in the field, specimens or plant portions were collected and later identified in the laboratory using various botanical keys and optical equipment. Photographs were taken of potentially rare species which could not be identified in the field to allow for later identification. A list of vascular plants present in the Study Area was created based on field observations, laboratory identifications, and photograph analysis.

3.3.3 Avifauna

Resident and migratory birds in the Labrador City area represent several Orders, including Anseriformes (Waterfowl), Galliformes (Gamebirds), Gaviiformes (Loons), Accipitriformes (Raptors), Charadriiformes (Shorebirds), Columbiformes (Doves), Strigiformes (Owls), Caprimulgiformes (Nightjars), Coraciiformes (Kingfishers), Piciformes (Woodpeckers), and Passeriformes (Perching Birds). Most Families of birds are federally protected by the MBCA (1994) including all waterfowl species, shorebirds, woodpeckers, and most families of perching birds. Several species are also listed on Schedule 1 of SARA and the NL ESA, including Bank Swallow (*Riparia riparia*). Raptors and owls are not federally protected under the MBCA but are protected by Provincial legislation under the *Wildlife Act* (1990).

Recently, additional protection for migratory birds has been introduced through the *Migratory Birds Regulations, 2022* (MBR). These regulations list 18 species on Schedule 1 which will have enhanced protections including the multi-year protection of nests. In Newfoundland, this subset of protections primarily pertains to marine shorebirds or waterbirds that nest on the coast or have specific habitat types that do not occur in Labrador West. However, if any of these species were observed in the Study Area it would be documented and species-specific surveys would be completed (MBR 2022).

To identify resident and migratory bird species in the Study Area, SEM employed a comprehensive approach combining desktop research with a field assessment of species presence/absence and relative abundance. A desktop data/information compilation exercise was conducted before field surveys to gather information for the species previously known within or near the Study Area, and throughout the region. This desktop study also included a review of the ACCDC data query results for the Study Area. Secondly, field survey maps were generated using ArcGIS with demarcated Study Area boundaries. The

survey was conducted from June 19-21st, 2023 (peak breeding season) to produce an inventory of the number of species (i.e., species richness) and relative abundance within the boundaries of the Study Area.

For the field survey SEM amalgamated several techniques together to maximize detections and behavioural observations within the Study Area. An experienced biologist, equipped with high-quality optics traversed transects across the Study Area, proportionally spending time in each habitat type along the way. All bird activity was recorded and GPS coordinates were recorded for each observation. This “atlassing” approach increases the likelihood of detecting multiple bird groups and species. All auditory and visual observations were recorded including breeding evidence (e.g., singing males, carrying nest material or food, courtship, etc.), number of individuals observed, and the direction and distance from the transect line. Behavioral cues are highly valuable in this breeding bird surveying methodology. SEM documented any nests observed and used survey techniques to minimize disturbance (ECCC 2023). In addition, surveys were not conducted in inclement weather, such as heavy wind or rain, as it diminishes bird detectability. Wind intensity was assessed using the Beaufort scale, and visibility served as an indicator of weather extremes that could limit bird activity during the day (ECCC 2023).

3.3.3.1 Passeriformes and other Perching Birds

Avifauna surveys included the detection of Passeriformes and other Perching Birds within the Study Area. These surveys entailed documenting bird observations through visual and auditory cues along the transect. This group of birds comprised most observations within the Study Area, and most observations consist of singing males defending territories and attracting mates. This group of birds represents the greatest abundance of individuals in a terrestrial setting, and the collectively have the greatest density of nests and probable interactions with land-clearing activities.

Surveys for Passeriformes and Perching Birds entailed dawn surveys that concluded mid-morning, typically around 10 am or when bird activity diminished to the degree of invalidity for the survey. These surveys involve hiking transects through the various habitat types, and quietly listening and observing and recording observations of singing males, male and female pairs, courtship behaviours, nests, young, food carrying, agitation, or other breeding cues.

3.3.3.2 Raptors and Owls

Concurrent with Passerines and Perching bird surveys throughout the Study Area, SEM integrated a raptor survey component by strategically conducting ten-minute sky scans in appropriate locations (i.e., areas of open canopy) to seek observations of soaring raptors. Since this only applies to some species, raptors and owls were also surveyed based on visual and auditory detections concurrent with the Passeriformes and Other Perching Birds surveys.

Raptor nests are often more easily detected from above, so high points throughout the Study Area were used to scan the surrounding cliff edges and tall trees for nests. Raptor nests would be protected under the *Wildlife Act* (1995) and large buffer zones are put in place for these species. GPS coordinates of raptor observations including auditory, visual, nests, or pellets/scat, were documented throughout the terrestrial surveys. Pellets produced by birds of prey appear as furry clumps of regurgitated waste products from previous prey consumed. These pellets can be observed to deduce the presence of various Raptors and owls. By observing the fur and bones of the pellets, it is also possible to identify the species of prey that was consumed. SEM biologists documented the number, locations, and any other supplemental data that could be obtained from any pellet/scat that was observed throughout the Study Area.

Short-eared Owl (*Asio flammeus*), listed as Vulnerable by the Province and Special Concern federally, was given additional attention during our surveys. This diurnal owl can often be observed during the day, and is particularly active at dawn when our bird surveys were conducted. It was known before field surveys that this species was unlikely as there were no patches of sufficient open habitat greater than 20 hectares, which appears to be a minimum patch size for this species for breeding (ECCC 2018).

3.3.3.3 Waterfowl and Waterbirds

Using information from a desktop review and the ACCDC data SEM created a list of the waterfowl and waterbirds possibly using the Study Area. A GIS exercise was completed to identify wetlands and other waterbodies in the Study Area to focus survey efforts.

SEM biologists conducted surveys for waterfowl and waterbirds concurrently with all the other terrestrial surveys to ensure any observations of flyovers to and from Wabush Lake, Hillside Pond, or other waterbodies were observed. In addition, during the Rare Flora survey all wetlands were revisited, and additional waterfowl and waterbird observations were incorporated into the database.

While on the shores of any waterbodies during field surveys, SEM opportunistically conducted 15-minute scans of shorelines and open water, utilizing high-quality binoculars. Observations of any shorebirds, along the coastlines, waterfowl, or waterbirds in the water, or flying birds were recorded, including information on species, the number of individuals, sex, and any breeding evidence observed.

3.3.4 Mammals

The boreal forest and surrounding ecoregion in Labrador West support a diverse suite of mammal species. Historical data, obtained through desktop research and SEM's database from previous work in the region, were cross-referenced with the ELC to derive a preliminary list of probable/possible mammal species to

be found within the Study Area. SEM employed two techniques to observe mammals within the Study Area, transect surveys and camera trapping.

For the transect surveys, SEM covered habitats within the entire Study Area. Additional transects were established along existing trails and around anthropogenically altered sites such as the old drill pad exploration lines, which exist in the southern part of the Study Area. These transects were conducted to recognize the preference of many wildlife species for anthropogenic corridors (Latham & Boutin 2015).

SEM biologists recorded sign of all mammal species including small mammals (e.g., voles, squirrels), furbearers, and larger mammals such as black bear (*Ursus americanus*) and moose (*Alces alces*). Signs observed included tracks, trails, scat, browsing evidence, den construction, tunnelling, bark scaling, and auditory detections. The abundance of these signs served as indicators of the Study Area's relative use by different mammal species.

No mammal SAR were deemed to be possible/probable for these surveys, aside from possibly a rare observation of caribou tracks or pellets. A separate bioacoustics survey was conducted for bat SAR as they cannot be surveyed effectively with ground surveys.

3.3.4.1 Mammals - Camera Trap Methodology

Surveys using camera trapping methods for monitoring the wolf population (as part of IOC's Biodiversity Conservation Strategy (BCS)) have been ongoing at IOC since 2021. Three Browning Strike Force® HD Pro X Cameras were deployed in June on travel corridors and pinch points where wildlife is likely to frequent. The well-established game trail along Western Hillside provides an effective corridor for wildlife viewing as animals such as bears and wolves prefer to travel along established trails (Latham and Boutin 2015). Signs including tracks and scat were used to establish the best locations for the cameras. Each camera was equipped with a 20-megapixel resolution and 80 ft motion detection. The cameras also utilized infrared LED lighting to allow video to be collected at night and were set with a trigger speed of 0.22 seconds to quickly capture movement. Videos were taken in 1600 x 900 HD+ and sound was also recorded. SEM equipped each camera with batteries and high storage capacity SD cards to reduce the frequency of visits to the site. To assess the footage from the cameras, the SD cards were collected and downloaded to a computer for analysis.

Based on previous studies completed for the BCS, wolves travelled similar routes in and out of the landfill on IOC property. It was hypothesized that the wolves were travelling through the Western Hillside Study Area to reach the landfill. Still-frames of each wolf and bear were saved to help identify wolves frequenting the Study Area and in turn possibly using the landfill for foraging purposes. Table 3.2 below indicates the locations of each camera, a brief description of habitat type/significance and the duration of deployment.

Table 3.2 Wildlife Camera Trap locations – Western Hillside, 2023.

ID	Location	Coordinates (UTM)	Dates Deployed	Description/Significance
Cam1	Tailings	641830, 5875945	2023-06-19 to 2023-09-08	Wolf tracks leading to previously cut drill pad explorations lines – travel corridor pinch point.
Cam2	Drill Pad Road	641752, 5875766	2023-06-19 to 2023-09-08	Easily travelled road created for drill pad exploration – travel corridor to mine site.
Cam3	Game Trail	642029, 5878305	2023-06-19 to 2023-09-08	Well defined game trail, at a Hillside Pond Stream crossing, travelling along south to north along mostly black spruce forested habitats, existing inside the Study Area for close to the full length of the Study Area.

Camera 1 (Tailings Area)

The selection of the location for Camera 1 was based on the identification of signs indicating wolf movement along the tailings, extending into the forested area. A thorough site assessment confirmed recent wolf activity along the tailings (e.g., tracks), particularly along the shoreline leading to this specific location.

Camera 2 (Drill Pad Road)

Western Hillside Camera 2 was situated in the Drill Pad Road area and was strategically placed at the convergence of a cut line terminating at the tailings and a newly constructed road for drill road exploration. The decision to position the camera at this location was informed by the presence of tracks along the tailings leading to the regrown shrubs along the old cut line.

Camera 3 (Game Trail)

Strategically placed along a well-defined game trail traversing Western Hillside, Western Hillside Camera 3 was set up on a well-defined game trail hosting recent signs of wolf and bear activity, including scat, and tracks along this heavily used, easily travelled pathway.

3.3.4.2 Bat Surveys

Bat species known from the Labrador West area, little brown bat (*Myotis lucifugus*) and Northern myotis (*Myotis septentrionalis*), were emergency listed in 2014 under SARA because of rapid population declines, primarily attributed to the impacts of White Nose Syndrome (WNS), a contagious disease that arouses bats from hibernation during winter, inevitably ending in death (COSEWIC 2013; Environment and Climate Change Canada [ECCC] 2018).

As part of the BCS, SEM has previously conducted multi-year surveys in IOC to detect the presence of these species. Based on results from previous efforts, SEM has compiled data indicating the presence of both myotis species. Hoary bat (*Lasiurus cinereus*), listed endangered in 2023 by SARA, was also detected along Lorraine Lake but their use of the area is relatively unknown as they are migratory species, and may not be breeding locally.

SEM deployed three (3) passive detectors above wetlands/waterbodies to collect auditory recordings of bats using echolocation and communications calls. These surveys were conducted mainly with use of Anabat™ Swift Passive Bat Detectors. The detectors were equipped with an acoustic microphone which recorded at full spectrum detecting frequencies of 10 kHz (min) to 250 kHz (max). Two SD cards were placed in each detector to ensure sufficient space for recordings. Each detector was set to record from sunset to sunrise at each location. Table 3.3 indicates the locations of each detector.

Table 3.3 Bat Detector Deployment Information.

Detectors ID	Location	Habitat	Date of Deployment
WH1	641826.01 m E, 5875941.80 m N	Shrub Thicket – Black Spruce Closed – Open to Tailings	June 19 – September 26, 2023
WH2	642354.69 m E, 5880330.24 m N	Still water Cove on Wabush Lake - Treed Wetland meets Shoreline	
WH3	642536.26 m E, 5879807.97 m N	Shoreline Alder – Closed Black Spruce Forest Over Lake	

3.3.5 Amphibians

There are seven species of amphibians known from Labrador, including two-lined salamander (*Eurycea bislineata*), blue-spotted salamander (*Ambystoma laterale*), American toad (*Bufo americanus*), mink frog (*Rana septentrionalis*), wood frog (*Rana sylvatica*), northern leopard frog (*Rana pipiens*), and spring peeper (*Hyla crucifer*). Northern leopard frog is not known from western Labrador. None of these species are listed on SARA or the NL ESA.

Amphibians were surveyed throughout all the other component surveys, in appropriate habitats (i.e., wetlands). As per the other terrestrial components, amphibians were first assessed with a desktop literature and a data compilation/search. Concurrent with the other transect surveys, amphibian surveys were completed in appropriate habitats (i.e., wetlands) and incorporated auditory detection for frog and toad species in the area with specific surveys dedicated to areas with suitable habitat types such as wetlands, waterbodies, vernal pools, streams, rivers, and other areas with suitable habitat for various amphibian species that exist in Labrador West. Frogs and toads frequently call to attract mates and defend territories and can be readily detected if present during the appropriate temporal window. All encounters of amphibians were documented, and their GPS locations were recorded.

3.3.6 Species at Risk and Species of Conservation Concern

Wildlife and plant species in Newfoundland and Labrador may be listed as a Species at Risk (SAR) either Provincially under NL ESA or federally under SARA. These Provincial and federal lists often have many species in common, with some exceptions. Generally, the NL ESA lists indigenous species, subspecies, and populations that are considered Endangered, Threatened, or Vulnerable within the Province of Newfoundland and Labrador. The mandate of SARA is “to provide for the recovery of wildlife species that are Extirpated, Endangered, or Threatened as a result of human activity, and to manage species of Special Concern to prevent them from becoming Endangered or Threatened”. SARA’s list is produced from recommendations of an independent body of experts (Committee on the Status of Endangered Wildlife in Canada).

In addition to SAR, SCC were also considered in SEM’s evaluation. SCC comprise those species that are not listed on the NL ESA or the SARA list but may be rare or of concern according to the ACCDC records. These species are most frequently in the rare plants category.

To obtain a list of candidate SAR and SCC for the Study Area, SEM conducted a literature review to compile historical records of SAR observations in the Study Area (if existing) and the region. Desktop research and data compilation were completed to obtain the flora, avifauna, mammal, or amphibian species that may inhabit the Study Area either permanently, seasonally, or at specific stages in their life cycle. Prior surveys of SAR at IOC provided further insight into the SAR and habitats possible for the Study Area. In addition, online databases, including The Cornell Lab of Ornithology’s eBird website, facilitated establishing the historical presence of many potential SAR in the region. After gathering information on the possible SAR and their associated habitats, ELC maps were reviewed to assess SAR habitats within the Study Area. The locations of these habitat types were identified for future assessment during the field surveys.

To pair with the literature review, SEM conducted comprehensive field surveys for potential SAR and SCC within the Study Area from June 19-21st, 2023, and opportunistically throughout the summer and fall while conducting other surveys in the Study Area. Specific surveys developed for each SAR were completed supplementally during other survey transects on habitats that have suitable habitat for these species (e.g., Short-eared Owl (*Asio flammeus*) surveys in open-foraging/nesting habitat during raptor and breeding bird surveys).

4.0 Results

The Terrestrial Biophysical Assessment of the Western Hillside Study Area was completed through a combination of literature review, data compilation and field surveys. For each terrestrial wildlife/botanical group, a survey was completed to identify presence/absence and relative abundance within the Study Area. Field surveys were completed June 19-21 and September 7-8, 2023. The ELC conducted on the property was used to classify the entire property into specific habitat types based on the dominant vegetation species. Surveys aimed to proportionally represent the habitat types present and also focus on any specialized habitat types.

The Study Area was comprised of a diversity of habitat types including several types of forests and wetlands, and drier upland rocky outcrops and heaths. The species assemblages observed were typical of this region and SEM's other extensive work at IOC. The following sections summarize the results from the surveys, the literature review, and data compilation efforts.

4.1 Ecological Land Classification

Labrador West falls within the Mid Subarctic Forest Ecoregion (Michikamau) and is characterized predominantly by spruce-dominated forests, string bogs and fens, and open spruce-lichen forests (Parks and Natural Areas 2007). Through an intensive desktop review of previous studies (including several ELCs SEM has conducted for IOC and in Labrador West) and with a GIS, SEM identified several habitat types in this region and assessed their potential within the Study Area. Based on aerial imagery, the Study Area was predicted to have predominantly coniferous forest cover with areas of open coniferous forest, treed wetland, and rocky outcrop. With imagery we could only classify to coniferous forest, wetland, rocky outcrop, and open or closed areas. A ground-truthing program ensured that our ELC had a high level of accuracy and helped develop a highly detailed ELC map (Figure 4.1) which outlined all the ecotypes occurring throughout the Study Area.

Detailed explanations of each habitat type can be observed below but for the purposes of the ELC map, less detailed ecotype classifications were designated for larger swaths of contiguous habitat to allow for simpler presentation and quantification of the general ecotypes of the Study Area. Table 4.1 lists the area of each ecotypes identified and the percent coverage of the terrestrial component of the Study Area.

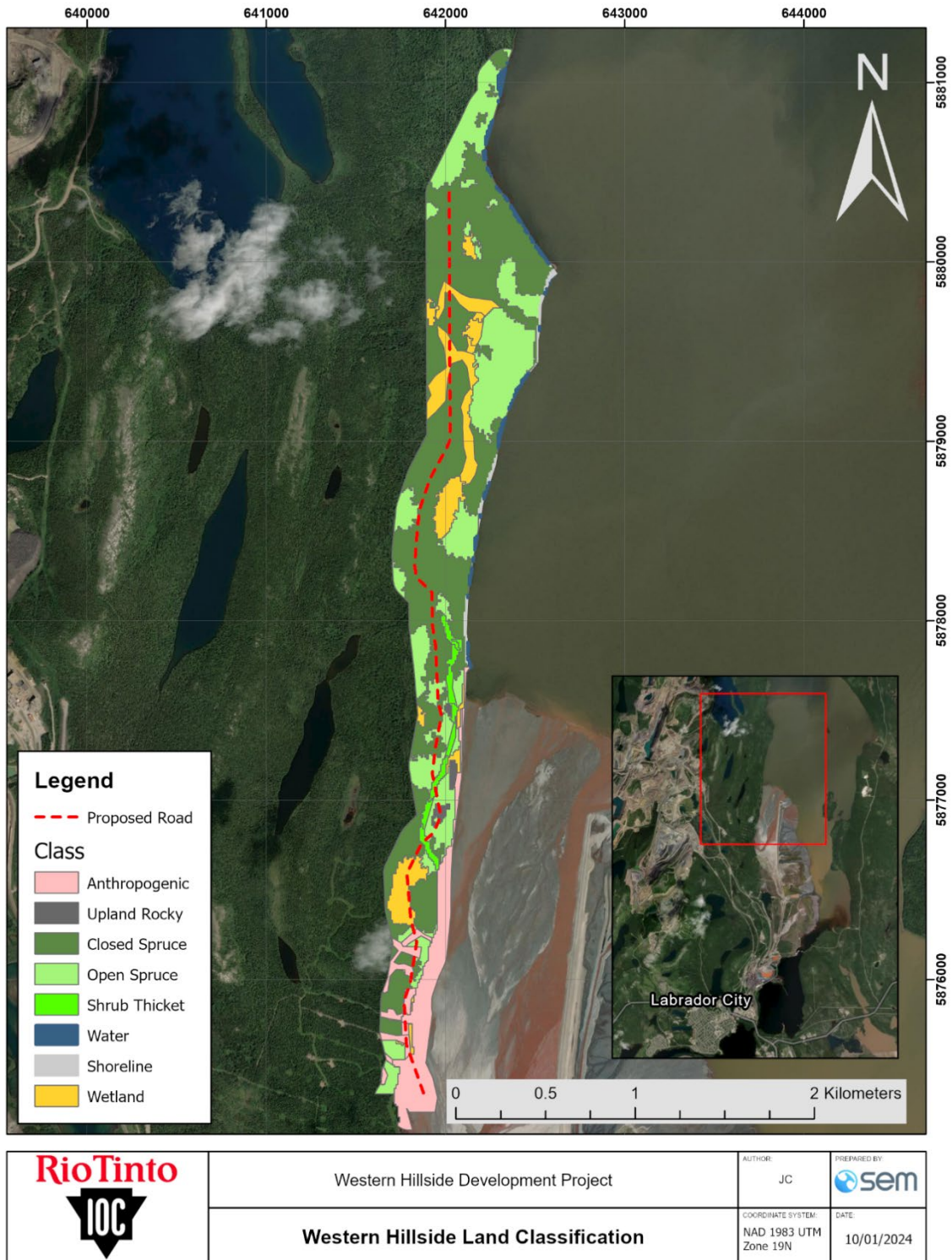


Figure 4.1 Ecological Land Classification Map Depicting Ecotypes Throughout the Study Area.

Table 4.1 ELC Ecotype Composition.

ELC Ecotype/Habitat	Area (ha)	Percentage of Study Area (%)
Anthropogenic	23.83	10.79
Closed Spruce	106.49	48.22
Open Spruce	58.85	26.65
Shoreline	1.27	0.58
Shrub Thicket	4.82	2.18
Upland Rocky	1.40	0.63
Water	0.89	0.40
Wetland	23.27	10.54

4.1.1 Anthropogenic

This ecotype collectively represents the various areas in which human influence has significantly altered the ecosystem for commercial use. The Anthropogenic ecotype often is associated with partial or full removal of native vegetation. This clearing of land and/or the cutting of trails may produce “edge effects” that alter vegetation communities and alter species compositions (Braithwaite & Mallik 2012). In these areas non-native species often become more prevalent due to the altered habitat (i.e., creation of areas of disturbed soil, compaction, altered drainage, etc.) and the tendency to inadvertently transport seeds from other anthropogenic areas on vehicles. The anthropogenic ELC type is mainly dominated by the tailings which is a large bare strip of deep sand with zero vegetation. This anthropogenic ELC type comprises close to 11% of the terrestrial land cover of the Study Area. The tailings get pushed into the terrestrial habitat at the periphery of the lake in the riparian zone (Figure 4.2). Other anthropogenically influenced ecotypes that exist in the Study Area are the regrowing exploration roads dominated by shrubs (Shrub Thicket in the detailed ELC). The edges of the newly constructed exploration roads in the south portion of the Study Area also host transitional species of vegetation which may not occur elsewhere in the more pristine Study Area. Species which prefer newly disturbed soil types and other common roadside species occur here including a non-native invasive species yellow tansy (*Tanacetum vulgare*) which was likely introduced during the excavation, dispersed by machinery during excavation.



Figure 4.2 Anthropogenically Altered Area Along the Shore of Wabush Lake, Depicting Tailings Along the Forest Edge.

4.1.2 Closed Spruce

The Closed Spruce ecotype is the most abundant natural terrestrial ecotype in the Study Area comprising over 48% of the ecotypes. This ecotype occurs primarily on upland areas with relatively moist conditions and closed canopy (Figure 4.3). Black spruce (*Picea mariana*), white spruce (*Picea glauca*), and balsam fir (*Abies balsamea*) dominate the tree layer. The forest floor and herb layer (lower than 1 m) is comprised of several species of feathermosses including Schreber's moss (*Pleurozium schreberi*), stair-step moss (*Hylocomium splendens*), and plume moss (*Ptilium crista-castrensis*), bunchberry (*Cornus canadensis*), creeping snowberry (*Gaultheria hispidula*), Labrador tea (*Ledum groenlandicum*), glandular birch (*Betula glandulosum*), sweetgale (*Myrica gale*), low bush blueberry (*Vaccinium angustifolium*), twinflower (*Linna borealis*), blue bead lily (*Clintonia borealis*), and interrupted clubmoss (*Lycopodium annotinum*). Wetland transitions within closed spruce forests may have different understories and shrub layer species. Feathermosses often give way to Sphagnum mosses and wetland shrubs often dominate the shrub layer (1-5 m growth). Most Closed Spruce ecotypes have few shrubs, however, and mainly consist of low-growing herbs, shrubs, ferns, and heath species below the closed coniferous canopy.



Figure 4.3 Closed Spruce Ecotype, Which Dominates Almost Half of the Study Area.

4.1.3 Open Spruce

A distinctive ecotype characteristic to the region (and to much of Labrador), the Open Spruce forest (Figure 4.4) contrasts with the much more humid Closed Spruce forests. Open Spruce occupies over 26% of the Study Area. Open Spruce is often found in more elevated upland areas over bedrock, with relatively drier conditions. The ground vegetation is dominated by a carpet of lichen species from the Genus *Cladonia*, the “caribou lichens” such as *Cladonia rangiferina*, *Cladonia stellaris*, and *Cladonia mitis* (Meades and Moores 1994). The shrub layer is often characterized by glandular birch, Labrador tea, and lowbush blueberry. In the Study Area, this ecotype represents most of the elevated drier land, and often has areas of exposed bedrock.



Figure 4.4 Open Spruce Forest Type.

4.1.4 Shoreline

The shoreline ecotype located along Wabush Lake is characterized by boulders, cobble, gravel, and sand (Figure 4.5). Runoff from the Western Hillside percolates between rocks and cobble before running into the lake. Though this ecotype spans the length of the linear terrestrial area along the eastern edge, it only represents 0.5% of the total terrestrial cover of the Study Area. Riparian species are most dominant and continue inland beyond the rocky exposed edge to a more shrub-dominated ecosystem. A riparian zone represents the transitional zone between a waterbody and the surrounding terrestrial environment (Quinn *et al.* 2001). Riparian zones are an important ecosystem with highly distinct features shaped by microclimates that affect the species, and abiotic features that compose the areas. Wetlands, tree stands, shrubland, or other ecosystems in these areas may be highly influenced by these factors and are distinct enough to be represented as a unique ecotype in the ELC. Influenced by the erosional forces of water and wind associated with waterbodies, riparian zones are often specialized habitats in terms of vegetation, and

rare species may sometimes establish. During rare flora surveys SEM observed species here not occurring elsewhere in the Study Area. This rocky shoreline is periodically bisected by “water” on the ELC map where overhanging forest covered the shoreline. Anthropogenic materials such as materials likely used for camp setups or former cabin sites exist at this point along the shoreline just inside the treeline likely influencing several factors of the shoreline composition based on potential alterations through human activity, but it largely exists as a sediment deposition beach area based on natural erosion and tailings deposition from the mine.



Figure 4.5 Shoreline along Wabush Lake.



Figure 4.6 Northeastern Shoreline Habitat of the Study Area Showing Riparian Vegetation Transitions from Terrestrial Forest.

4.1.5 Shrub Thicket

The Shrub Thicket ecotype occupied 2.2% of the terrestrial Study Area and was located primarily in an area of exploratory drillpads and road-cut regrowth (Figure 4.7). Trees were cleared years ago, and shrubs became the dominant vegetation. The main vegetation present included green alder (*Alnus viridis*), graminoids, labrador tea, twinflower, and young balsam fir and black spruce trees. This habitat type enhanced the diversity of birds observed during surveys due to the preferences of birds that use shrublands. Species such as Yellow Warbler (*Setophaga petechia*) were regularly observed during avifauna surveys in the Study Area in these shrubland thickets.



Figure 4.7 Shrub Thicket Ecotype Identified in an Area that was Previously Cut for Road Access.

4.1.6 Deciduous Forest

Besides broadleaf ecotypes of shrubs listed above, there were several small patches of closed mature forest with deciduous trees dominating the canopy. These areas were mostly dominated by white birch or shared the canopy with large black spruce on the edges of Closed Spruce forests. Interrupted club-moss dominated the ground vegetation along with creeping snowberry and feathermosses. In some patches of this habitat (Figure 4.8), a white birch-fern ecotype existed where shrubs were mostly absent, club mosses persisted sharing a co dominance of the ground vegetation with ferns like Northern oak fern.



Figure 4.8 Ground Vegetation of the White Birch–Fern Deciduous Habitat Stands of the Study Area.

4.1.7 Upland Rocky Ecotype

The Upland Rocky ecotype was located in the higher elevation zones within the Study Area. The ecotype resembled the large flat-lying exposed rock typical of Canadian shield in more northerly zones, often associated with Taiga habitat (Shilts *et al.* 1987). This ecotype was relatively insignificant in size and not included on the ELC. The exposed rock precludes much vegetation growth and was largely composed of bare rock with some upland *Cladonia* lichen species or low-growing heath species.

The steep cliffs of exposed bedrock displayed crystalline features in the mineralization of the rock, with minimal surfaces for vegetation growth. The vegetation present was comprised primarily of stunted vegetation including young black spruce and balsam fir trees in shrub-like appearance and height, graminoids, lichens, Labrador tea, heath species, and other herbs. These rocky habitats may produce conditions for specialized rare plant species known to Labrador, so these areas were targeted during Rare Flora surveys. Some unique species of plant were observed here and are discussed in the Rare Flora section.



Figure 4.9 The typical Cliff-like Upland Rocky Ecotype of the Study Area.



Figure 4.10 Typical Flat-lying Rocky Outcrop of the Study Area.

4.1.8 Wetlands

Wetlands cover approximately 10.5% of the terrestrial portion of the Study Area. The wetlands are comprised primarily of fens, which are characterized by the movement of mineral-rich but nutrient-poor surface water through pools, channels, and seepage (CWCS 1997). The primary sub-classification of fen observed in the Study Area were treed fens. Ground cover on treed fens consisted of sparsely populated tree species like eastern larch and black spruce, while the shrub layer consisted of glandular birch, bog laurel, and sweet gale. Other species observed included *Carex* (i.e., sedge) species, other graminoid species (i.e., grasses and rushes), mosses (primarily *Sphagnum* species), and marsh cinquefoil (*Potentilla fruticosa*).



Figure 4.11 Typical Treed Fen Wetland Ecotype in the Study Area.



Figure 4.12 Treed Fen Illustrating Wetland Vegetation Including S2 Rare Plant Species “False Hellebore” (bottom right corner).

4.2 Rare Flora

The goals of the Rare Flora study were to identify, and to map observed or likely occurrences of plant species listed under SARA and/or the NL ESA. The study also targeted species currently ranked regionally rare to uncommon (i.e., ranked S1 to S3) by the ACCDC. Species with some uncertainty (due to lack of information) may be marked with a range (e.g., S1S3) which means the species may occur over the region at rarity level between S1 and S3 but currently remains unclear.

Several SAR listed under SARA and/or the NL ESA are known to occur in Newfoundland and Labrador (Table 4.2). The number of plants ranked as regionally rare and/or uncommon is constantly changing due to new information in many areas that have been insufficiently surveyed in the past.

Table 4.2 Newfoundland and Labrador Plant Species at Risk

Common Name	Scientific Name	Provincial Status	SARA Status
Alaska Rein Orchid	<i>Platanthera unalascensis</i>	Endangered (2013)	NA
Barrens Willow	<i>Salix jejuna</i>	Endangered (2001)	Endangered (2003)
Black Ash	<i>Fraxinus nigra</i>	Threatened (2021)	Under consideration for addition
Bodin's Milkvetch	<i>Astragalus bodinii</i>	Threatened (2013)	NA
Crowded Wormseed Mustard	<i>Erysimum inconspicuum var. coarctatum</i>	Endangered (2006)	NA
Cutleaf Fleabane	<i>Erigeron compositus</i>	Endangered (2013)	NA
Feathery False Solomon's Seal	<i>Maianthemum racemosum subspecies racemosum</i>	Endangered (2013)	NA
Fernald's Braya	<i>Braya fernaldii</i>	Threatened (2000)	Endangered (2003)
Fernald's Milk-vetch	<i>Astragalus robbinsii var. fernaldii</i>	Vulnerable (2002)	Special Concern (2003)
Gmelin's Watercrowfoot	<i>Ranunculus gmelinii</i>	Endangered (2015)	NA
Griscom's Arnica	<i>Arnica griscomii subsp. griscomii</i>	Endangered (2015)	Threatened (2019)
Lindley's Aster	<i>Symphyotrichum ciliolatum</i>	Endangered (2013)	NA
Long's Braya	<i>Braya longii</i>	Endangered (2000)	Endangered (2003)
Low Northern Rockcress	<i>Neotorularia humilis (= Braya humilis)</i>	Endangered (2004)	NA
Mackenzie's Sweetvetch	<i>Hedysarum boreale subsp. Mackenzii</i>	Threatened (2022)	NA
Mountain Bladder Fern	<i>Cystopteris montana</i>	Endangered (2016)	NA
Mountain Holly Fern	<i>Polystichum scopulinum</i>	NA	Threatened (2006)
Mountain Fern	<i>Thelypteris quelpaertensis</i>	Vulnerable (2006)	NA
Northern Bog Aster	<i>Symphyotrichum boreale</i>	Endangered (2010)	NA
Northern Twayblade	<i>Listera borealis</i>	Endangered (2016)	NA
Oval-leaved Creeping Spearwort	<i>Ranunculus flammula var. ovalis</i>	Endangered (2013)	NA
Porsild's Bryum	<i>Mielichhoferia macrocarpa (=Bryum porsildii)</i>	Threatened (2004)	Threatened (2011)
Rattlesnakeroot	<i>Prenanthes racemosa</i>	Endangered (2010)	NA
Red Pine	<i>Pinus resinosa</i>	Threatened (2022)	NA
Rock Dwelling Sedge	<i>Carex petricosa var. misandroides</i>	Endangered (2013)	NA
Sharpleaf Aster	<i>Oclemena acuminata</i>	Threatened (2015)	NA
Tradescant's Aster	<i>Symphyotrichum tradescantii</i>	Threatened (2015)	NA
Vreelands's Striped Coralroot	<i>Corallorhiza striata var. vreelandii</i>	Endangered (2013)	NA
Water Pygmyweed	<i>Tillaea aquatica</i>	Vulnerable (2015)	NA
Woolly Arnica	<i>Arnica angustifolia subsp. tomentosa</i>	Endangered (2015)	NA

Of the federally listed SAR flora, only the Fernald's milk vetch is known to occur in Labrador (NL ESA 2021), but the Study Area is outside of its known range.

Table 4.3 depicts the species previously observed from other IOC projects and considered possible for the Western Hillside Study Area. Note these are not "Species at Risk" and do not have legislative protection. However, IOC is dedicated to biodiversity conservation (as shown by the myriad efforts under the Biodiversity Conservation Strategy) and will take all necessary precautions to avoid any of these species if found in the Study Area. The ACCDC request for records on rare plants within a 5 km radius of the Western Hillside Study Area yielded no results (perhaps due to lack of survey effort in the area, as is often the case in Labrador). The species in Table 4.3 were given priority during surveys through the Western Hillside Study Area.

Table 4.3 ACCDC Records of Rare Plants Historically Observed in the Study Area.

Common Name	Scientific Name	Ranking
American False Hellebore	<i>Veratrum viride var. viride</i>	S2
Beautiful Sedge	<i>Carex concinna</i>	S2
Chestnut-Colored Sedge	<i>Carex castanea</i>	S1S2
Green Spleenwort	<i>Asplenium viride</i>	S1S2
Leafy Northern Green Orchid	<i>Platanthera aquilonis</i>	S3S4
Marsh Muhly	<i>Muhlenbergia glomerata</i>	S2?
Marsh Valerian	<i>Valeriana dioica subsp. sylvatica</i>	S1
White-Stem Pondweed	<i>Potamogeton praelongus</i>	S2S4
Yellow Sedge	<i>Carex flava</i>	S3S4

During the field assessment of rare plants in the Study Area, SEM personnel meticulously recorded all identified vascular (or non-vascular species of rare significance) vegetation found along the transects within the designated Study Area. Subsequently, a comprehensive plant list was compiled, complete with ACCDC rankings as detailed in Table 4.4.

Table 4.4 Vegetation List for the Study Area Including S-Ranking (Provincial/Regional).

Scientific Name	Common Name	S-Rank
<i>Abies balsamea</i>	Balsam Fir	S5
<i>Achillea millefolium</i>	Common Yarrow	SNA
<i>Actaea rubra</i>	Red Baneberry	S4S5
<i>Agrostis scabra</i>	Rough Bentgrass	SNR
<i>Alnus incana</i>	Mountain Alder	S4
<i>Alnus viridis</i>	Green Alder	S5
<i>Amelanchier canadensis</i>	Serviceberry	SNR
<i>Anaphalis margaritacea</i>	Pearly Everlasting	S4S5
<i>Andromeda polifolia</i>	Bog Rosemary	S5

<i>Arabis alpina</i>	Alpine Rockcress	S4
<i>Athyrium filix-femina</i> ssp. <i>Angustum</i>	Common Lady Fern	S4
<i>Bazzania trilobata</i>	Three-lobed Liverwort	S3S4
<i>Betula glandulosa</i>	Glandular Birch	S5
<i>Betula papyrifera</i>	White Birch	SNA
<i>Calamagrostis canadensis</i>	Bluejoint Reedgrass	S5
<i>Carex lasiocarpa</i>	Slender Sedge	S1
<i>Carex lenticularis</i>	Lakeshore Sedge	S4
<i>Carex limosa</i>	Mud Sedge	S5
<i>Carex magellanica</i>	Boreal Bog Sedge	S5
<i>Carex Pedunculata</i>	Longstalk Sedge	SNR
<i>Carex platyphylla</i>	Broad-leafed Sedge	SNR
<i>Carex retrorsa</i>	Retrorse Sedge	SNR
<i>Carex stipata</i>	Awlfruit Sedge	S3
<i>Carex trisperma</i>	Three-seed Sedge	S4S5
<i>Carex utriculata</i>	Common Beaked-sedge	S2S4
<i>Chamaedaphne calyculata</i>	Leatherleaf	S5
<i>Chamaenerion angustifolium</i>	Fireweed	S5
<i>Cladium mariscoides</i>	Smooth Saw-grass	SNR
<i>Clintonia borealis</i>	Blue Bead Lily	S5
<i>Conocephalum salebrosum</i>	Green-scented Liverwort	S2S3
<i>Coptis trifolia</i>	Three-leaf Goldthread	S5
<i>Coptis trifolia</i>	White-fringed Bog Orchid	SNR
<i>Corallorhiza trifida</i>	Yellow Coralroot	S4
<i>Cornus sericea</i>	Red-osier Dogwood	SNR
<i>Cornus suecica</i>	Swedish Dwarf Cornel	S4
<i>Dasiphora fruticosa</i>	Shrubby Cinquefoil	S3
<i>Dicranum scoparium</i>	Common Broom moss	S4
<i>Diphasiastrum complanatum</i>	Ground Cedar	S5
<i>Dryopteris carthusiana</i>	Spinulose Shieldfern	S4
<i>Empetrum nigrum</i>	Black Crowberry	S5
<i>Epilobium ciliatum</i>	Northern Willowherb	S5
<i>Equisetum arvense</i>	Field Horsetail	S5
<i>Equisetum sylvaticum</i>	Woodland Horsetail	S5
<i>Fragaria virginiana</i>	Virginia Strawberry	S3S4
<i>Galium triflorum</i>	Fragrant Bedstraw	S4
<i>Gaylussacia baccata</i>	Black Huckleberry	SNR
<i>Gaylussacia dumosa</i>	Dwarf Huckleberry	SNR
<i>Gaultheria hispidula</i>	Creeping Snowberry	S5
<i>Geocaulon lividum</i>	False Toadflax	S5
<i>Geum macrophyllum</i>	Large-leaved Avens	S3S4
<i>Geum rivale</i>	Purple Avens	S3S4

<i>Gymnocarpium dryopteris</i>	Northern Oak Fern	S5
<i>Hieracium aurantiaca</i>	Orange Hawkweed	SNA
<i>Hieracium caespitosum</i>	Meadow Hawkweed	SNA
<i>Hylocomium splendens</i>	Stair-step Moss	S4
<i>Ilex mucronata</i>	Mountain Holly	S5
<i>Juncus alpinoarticulatus</i>	Northern Green Rush	S3S4
<i>Juncus articulatus</i>	Jointed Rush	SNR
<i>Juncus bufonius</i>	Toad Rush	S2S4
<i>Juncus tenuis</i>	Path Rush	S2S3
<i>Juniperus communis</i>	Ground Juniper	S4
<i>Kalmia polifolia</i>	Pale Bog Laurel	S5
<i>Larix laricina</i>	Eastern Larch	S5
<i>Linnaea borealis</i>	Twinflower	S5
<i>Lonicera caerulea</i>	Fly Honeysuckle	S5
<i>Lycopodium annotinum</i>	Interrupted Club-Moss	S5
<i>Lysimachia borealis</i>	Starflower	S5
<i>Marchantia quadrata</i>	Narrow Mushroom-headed Liverwort	S3S5
<i>Menjanthes trifoliata</i>	Bog Buckbean	S5
<i>Mianthemum canadense</i>	Canada Mayflower	S5
<i>Mitella nuda</i>	Naked Mitrewort	SNR
<i>Moneses uniflora</i>	One-flowered Wintergreen	S4
<i>Monotropa uniflora</i>	Indian Pipe	S2S4
<i>Myrica gale</i>	Sweetgale	S5
<i>Orthilia secunda</i>	One-sided Pyrola	S5
<i>Osmorhiza longistylis</i>	Mountain Sweet Cicely	SNR
<i>Packera aurea</i>	Golden Ragwort	S3S4
<i>Parnassia palustris</i>	Northern Grass of Parnassus	S3S4
<i>Petasites frigidus</i>	Arctic Butterbur	SNR
<i>Phalaris arubinacea</i>	Reed Canary Grass	SNR
<i>Phegopteris connectilis</i>	Northern Beechfern	S5
<i>Picae mariana</i>	Black Spruce	S5
<i>Picea glauca</i>	White Spruce	S5
<i>Pleurozium schreberi</i>	Schreber's Moss	S4
<i>Polytrichum commune</i>	Haircap Moss	S4
<i>Potamogeton spp.</i>	Pondweed spp.	S3 to S5
<i>Prunus pensylvanica</i>	Pincherry	S4
<i>Pteridium aquilinum</i>	Bracken Fern	SNR
<i>Ptilium crista-castrensis</i>	Knight's Plume Moss	S4
<i>Pyrola americana</i>	Round-leaved Pyrola	SNR
<i>Pyrola asarifolia</i>	Pink Wintergreen	S3S4
<i>Pyrola chlorantha</i>	Greenleaved Wintergreen	S5
<i>Rhizomnium pseudopunctatum</i>	False Spotted rhizomnium	S3S4

<i>Rhododendron groenlandicum</i>	Labrador tea	S5
<i>Rhytidiadelphus triquetrus</i>	Shaggy Moss	S4
<i>Ribes glandulosum</i>	Skunk Currant	S5
<i>Ribes lacustre</i>	Swamp Currant	S3S4
<i>Ribes triste</i>	Swamp Redcurrant	S3
<i>Rubus chamaemorus</i>	Bakeapple	S5
<i>Rubus pubescens</i>	Dewberry	S5
<i>Salix arctica</i>	Arctic Willow	S4
<i>Salix discolor</i>	Bebb's Willow	S3S4
<i>Salix lucida</i>	Shining Willow	SNR
<i>Salix reticulata</i>	Net-veined Willow	S2S4
<i>Sanguisorba canadensis</i>	Canada Burnett	SNR
<i>Solidago macrophylla</i>	Broad-leaved Goldenrod	S5
<i>Sorbus americana</i>	Mountain Ash	S4
<i>Sphagnum capillifolium</i>	Northern peatmoss	S4S5
<i>Sphagnum girgensohnii</i>	Girgensohn's bogmoss	S4S5
<i>Sphagnum magellanicum</i>	Magellan's Peat Moss	S4
<i>Stellaria graminea</i>	Snake-needle Grass	SNA
<i>Streptopus amplexifolius</i>	Claspleaf Twisted-Stalk	S5
<i>Symphyotrichum boreale</i>	Northern Bog Aster	SNR
<i>Tanacetum vulgare</i>	Common Tansy	SNA
<i>Tofieldia pusilla</i>	Small False Asphodel	S4
<i>Triantha glutinosa</i>	Sticky False Asphodel	S3S4
<i>Trichophorum cespitosum</i>	Deer Grass	S5
<i>Triglochin maritima</i>	Seaside Arrowgrass	SNR
<i>Vaccinium angustifolium</i>	Low Bush Blueberry	S5
<i>Vaccinium oxycoccos</i>	Bog Cranberry	S5
<i>Vaccinium uliginosum</i>	Bog Bilberry	S5
<i>Vaccinium vitis-idaea</i>	Lingonberry	S5
<i>Viburnum edule</i>	Highbush Cranberry	S5
<i>Viola blanda</i>	Sweet White Violet	S4
<i>Viola cucullata</i>	Marsh Blue Violet	SNR
<i>Viola labradorica</i>	Labrador Violet	S4S5
<i>Woodsia ilvensis</i>	Rusty Woodsia	S3S4

Of the species determined to exist in the Study Area during rare plant and habitat surveys, Table 4.5 lists those species with rare rankings (S1 to S3) provincially/regionally under Natureserve S-rank system.

Table 4.5 Rare Plant Species Observed on the Study Area.

Scientific Name	Common Name	S-Rank
<i>Bazzania trilobata</i>	Three-lobed Liverwort	S3S4
<i>Carex lasiocarpa</i>	Slender sedge	S1

<i>Carex stipata</i>	Awlfruit Sedge	S3
<i>Carex utriculata</i>	Common Beaked-sedge	S2S4
<i>Conocephalum salebrosum</i>	Green-scented Liverwort	S2S3
<i>Dasiphora fruticosa</i>	Shrubby Cinquefoil	S3
<i>Fragaria virginiana</i>	Virginia Strawberry	S3S4
<i>Geum macrophyllum</i>	Large-leaved Avens	S3S4
<i>Geum rivale</i>	Purple Avens	S3S4
<i>Juncus alpinoarticulatus</i>	Northern Green Rush	S3S4
<i>Juncus bufonius</i>	Toad Rush	S2S4
<i>Juncus tenuis</i>	Path Rush	S2S3
<i>Marchantia quadrata</i>	Narrow Mushroom-headed Liverwort	S3S5
<i>Monotropa uniflora</i>	Indian Pipe	S2S4
<i>Packera aurea</i>	Golden Ragwort	S3S4
<i>Parnassia palustris</i>	Northern Grass of Parnassus	S3S4
<i>Pyrola asarifolia</i>	Pink Wintergreen	S3S4
<i>Rhizomnium Pseudopunctatum</i>	False Spotted Rhizomnium	S3S4
<i>Ribes lacustre</i>	Swamp Currant	S3S4
<i>Ribes triste</i>	Swamp Redcurrant	S3
<i>Salix discolor</i>	Bebb's Willow	S3S4
<i>Salix reticulata</i>	Net-veined Willow	S2S4
<i>Veratrum viride</i>	American False Hellebore	S2
<i>Viola renifolia</i>	Kidney-leaved Violet	S3S4
<i>Woodsia ilvensis</i>	Rusty Woodsia	S3S4

4.2.1 S1 and S2 Species observed in the Study Area

4.2.1.1 Slender Sedge (*Carex lasiocarpa*) – S1 Ranking

Slender sedge was observed in the wetland areas, particularly in the larger bog toward the mid-southern region just south of the old cut-line shrub thicket and just north of the new exploratory drill pad roads ($n \geq 500$). This species is listed Secure (S5) in the surrounding regions including the island of Newfoundland, but in Labrador is S1. It is possible that this high ranking is due to a lack of survey effort, as is often the case in the remote areas of Labrador.



Figure 4.13 Slender Sedge Specimen on the Bog-Fen Complex in the Study Area, 2023.

4.2.1.2 American False Hellebore (*Veratrum viride*) – S2 Ranking

American false hellebore was observed in multiple locations within the Study Area, with a total of approximately 300 individual plants being observed along the transects associated with rare plant surveys and from observations during other surveys in the Study Area. The margins between wetland and forested sites provided the most individual observations and groupings of 20 or more were seen at various locations in proximity of each other, specifically along treed wetlands. This species thrives in moist to wet environments, spanning various soil types such as sandy, loamy, and organic, particularly in proximity to wetlands and water bodies (Mulligan & Munro 1987). Notably, significant clusters of American false hellebore, illustrated in Figure 4.14, were observed along the margins of wetlands throughout the Study Area. Despite receiving an S2 ranking, SEM's observations indicate that this species is relatively common in moist sites throughout Labrador West, suggesting that the ranking may be influenced by a potential lack of survey effort.



Figure 4.14 Large American False Hellebore Individuals in the Study Area.

4.3 Avifauna

The Study Area is situated within Bird Conservation Region (BCR) 7 NL, encompassing the Taiga Shield and Hudson Plains but is near the border of BCR 8 NL which is more representative of the ecotypes present. This region is characterized by dense coniferous forests, primarily dominated by black and white spruce, balsam fir, white birch, and eastern larch in the northern extent of this BCR (ECCC 2013). This better fit with BCR 8 NL is evident in the ELC results and habitat data obtained through the ELC portion of this study described in previous sections of this report.

The Study Area is utilized seasonally or permanently by a diverse range of resident and migratory species (ECCC 2014). These avifauna species include representatives from various bird orders such as Anseriformes (waterfowl), Galliformes (gamebirds), Gaviiformes (loons), Accipitriformes (raptors),

Charadriiformes (shorebirds), Columbiformes (doves), Strigiformes (owls), Caprimulgiformes (nightjars), Coraciiformes (kingfishers), Piciformes (woodpeckers), and Passeriformes (perching birds). Many of these Orders harbor provincially and federally protected birds.

A comprehensive literature search and data compilation exercise was conducted including a query to the ACCDC and the eBird online database. A list of potential species for the Study Area was formulated prior to surveys. SEM biologists were knowledgeable of the avian assemblages present in Labrador West, having conducted similar work in the region over the past several years. Each bird group is discussed below.

Table 4.6 ACCDC Avifauna Results, Study Area, 2015.

ACCDC Request File Results, Western Hillside, 2015			
Scientific Name	Common Name	S Rank (2015)	Observation Count
<i>Euphagus carolinus</i>	Rusty Blackbird	S3B, SUM	13
<i>Falco sparverius</i>	American Kestrel	S2B, SUM	10
<i>Buteo jamaicensis</i>	Red-Tailed Hawk	S3S4B, SUM	10
<i>Circus hudsonius</i>	Northern Harrier	S3B, SUM	9
<i>Aquila chrysaetos</i>	Golden Eagle	S2B, SUM	5
<i>Bucephala islandica</i>	Barrow's Goldeneye	S3S4M	3
<i>Histrionicus histrionicus</i>	Harlequin Duck	S3B, SUM	3
<i>Falco peregrinus subsp. anatum</i>	Peregrine Falcon	S2B, SUM	2
<i>Calidris canutus</i>	Red Knot	S2M	2
<i>Asio flammeus</i>	Short-eared Owl	S3S4B, SUM	1
<i>Hirundo rustica</i>	Barn Swallow	SNA	1

4.3.1 Passerines and other Perching Birds

An avifauna habitat assessment was completed prior to field surveys to determine the avian species that were likely to occur in the Study Area. The Study Area encompassed a broad diversity of bird habitats, and the species richness of Passerines and other Perching Birds would correspond to that diversity of habitat types.

4.3.2 Raptors and Owls

From previous work completed in the Labrador West region, several species of raptors and owls are known to exist in the region. Table 4.7 represents those raptors and owls that may also use the Western Hillside Study Area.

Table 4.7 Raptor Species Previously Observed in the Study Area.

Common Name	Scientific Name	Provincial Status	COSEWIC Status	SARA Status (S1)
American kestrel	<i>Falco sparverius</i>	NA	N/A	NA
Bald Eagle	<i>Haliaeetus leucocephalus</i>	NA	Not at Risk (1984)	NA
Boreal Owl	<i>Aegolius funereus</i>	NA	Not at Risk (1995)	NA
Golden Eagle	<i>Aquila chrysaetos</i>	NA	Not at Risk (1996)	NA
Great-horned Owl	<i>Bubo virginianus</i>	NA		NA
Merlin	<i>Falco columbarius</i>	NA	Not at Risk (1985)	NA
Northern Goshawk	<i>Accipiter gentilis</i>	NA	Not at Risk (1995)	NA
Northern Harrier	<i>Circus cyaneus</i>	NA	Not at Risk (1993)	NA
Northern Hawk Owl	<i>Surnia ulula</i>	NA	Not at Risk (1992)	NA
Osprey	<i>Pandion haliaetus</i>	NA	NA	NA
Red-tailed Hawk	<i>Buteo jamaicensis</i>	NA	Not at Risk (1995)	NA
Rough-legged Hawk	<i>Buteo lagopus</i>	NA	Not at Risk (1995)	NA
Short-eared Owl	<i>Asio flammeus</i>	Vulnerable (2008)	Threatened (2021)	Special Concern (2012)

4.3.3 Waterfowl and Waterbirds

Several species of waterfowl and waterbirds were observed during previous surveys at IOC with some of the most common being Canada Goose, Common Loon, Common Goldeneye, Greater Yellowlegs, Wilson's Snipe, Spotted Sandpiper, Mallard, and Belted Kingfisher. In addition to those observations, there are several other species that would likely be using the waterbodies and wetlands in the Study Area, based on surveys of other sites in the Labrador City/Wabush area, as per Table 4.8.

Table 4.8 Waterfowl and Waterbird Species Previously Observed at IOC in Labrador West.

Common Name	Scientific Name	Provincial Status	COSEWIC Status	SARA Status (S1)
American Black Duck	<i>Anas rubripes</i>	NA	NA	NA
Common Goldeneye	<i>Bucephala clangula</i>	NA	Not at Risk (1984)	NA
Common Merganser	<i>Mergus merganser</i>	NA	Not at Risk (1995)	NA
Green-winged Teal	<i>Anas crecca</i>	NA	Not at Risk (1996)	NA
Northern Pintail	<i>Anas acuta</i>	NA	NA	NA
Red-breasted Merganser	<i>Mergus serrator</i>	NA	Not at Risk (1985)	NA
Ring-necked Duck	<i>Aythya collaris</i>	NA	Not at Risk (1995)	NA
Surf Scoter	<i>Melanitta perspicillata</i>	NA	Not at Risk (1993)	NA
Black Scoter	<i>Melanitta nigra</i>	NA	Not at Risk (1992)	NA
Snow Goose	<i>Chen caerulescens</i> (migration only)	NA	NA	NA

4.3.4 Avifauna Field Survey Results (All Groups of Birds)

Table 4.9 illustrates birds that were observed while traversing the Study Area. A total of 33 species were observed during the terrestrial surveys for avifauna on the Study Area. The top eight (8) species, all Passeriformes, make up the vast majority of observations. Two species of raptors, Sharp-shinned Hawk (*Accipiter striatus*) and Osprey (*Pandion haliaetus*) were observed.

Table 4.9 Birds Observed in the Study Area.

Species Common Name	Latin Name	Count
Tennessee Warbler	<i>Leiothlypis peregrina</i>	67
Ruby-crowned Kinglet	<i>Regulus calendula</i>	49
Swainson's Thrush	<i>Catharus ustulatus</i>	33
Yellow-rumped Warbler	<i>Setophaga coronata</i>	28
American Robin	<i>Turdus migratorius</i>	17
Dark-eyed Junco	<i>Junco hyemalis</i>	16
Hermit Thrush	<i>Catharus guttatus</i>	12
White-crowned Sparrow	<i>Zonotrichia leucophrys</i>	9
White-Winged Crossbill	<i>Loxia leucoptera</i>	6
Yellow-bellied Flycatcher	<i>Empidonax flaviventris</i>	6
Canada Jay	<i>Perisoreus canadensis</i>	4
Herring Gull	<i>Larus argentatus</i>	4
Common Raven	<i>Corvus corax</i>	3
Fox Sparrow	<i>Passerella iliaca</i>	3
Osprey	<i>Pandion haliaetus</i>	3
Winter Wren	<i>Troglodytes hiemalis</i>	3
Magnolia Warbler	<i>Setophaga magnolia</i>	2
Northern Flicker	<i>Colaptes auratus</i>	2
Northern Waterthrush	<i>Parkesia noveboracensis</i>	2
Orange-crowned Warbler	<i>Vermivora celata</i>	2
Wilson's Warbler	<i>Cardellina pusilla</i>	2
Woodpecker spp.	<i>Picidae</i>	2
Alder Flycatcher	<i>Empidonax alnorum</i>	1
Bank Swallow	<i>Riparia riparia</i>	1
Black and White Warbler	<i>Mniotilta varia</i>	1
Boreal Chickadee	<i>Poecile hudsonicus</i>	1
Cedar Waxwing	<i>Bombycilla cedrorum</i>	1
Golden-crowned Kinglet	<i>Regulus satrapa</i>	1
Greater Yellowlegs	<i>Tringa melanoleuca</i>	1
Sharp-Shinned Hawk	<i>Accipiter striatus</i>	1
Spotted Sandpiper	<i>Actitis macularius</i>	1
Spruce Grouse	<i>Falciennis canadensis</i>	1
Three-toed Woodpecker	<i>Picoides dorsalis</i>	1

Several nests were observed during surveys, including American Robin, Yellow-rumped Warbler and Dark-eyed Junco. An American Robin nest was observed with nestlings within the Study Area in a closed forest habitat. The pair of robins were observed aggressively protecting the nest from a Sharp-shinned Hawk and the pair aggressively chased away the predator. The nest sites are illustrated in the below map.

Auditory and visual observations (i.e., without finding the nests) during peak breeding/nesting season indicates the *possible* nesting of these birds in the area. Some species in Table 4.9 are not likely to nest in the area (e.g., Herring Gull) and were likely flying between waterbodies. Bank Swallow was also likely not nesting in the Study Area due to the lack of sandy slopes required for the species.

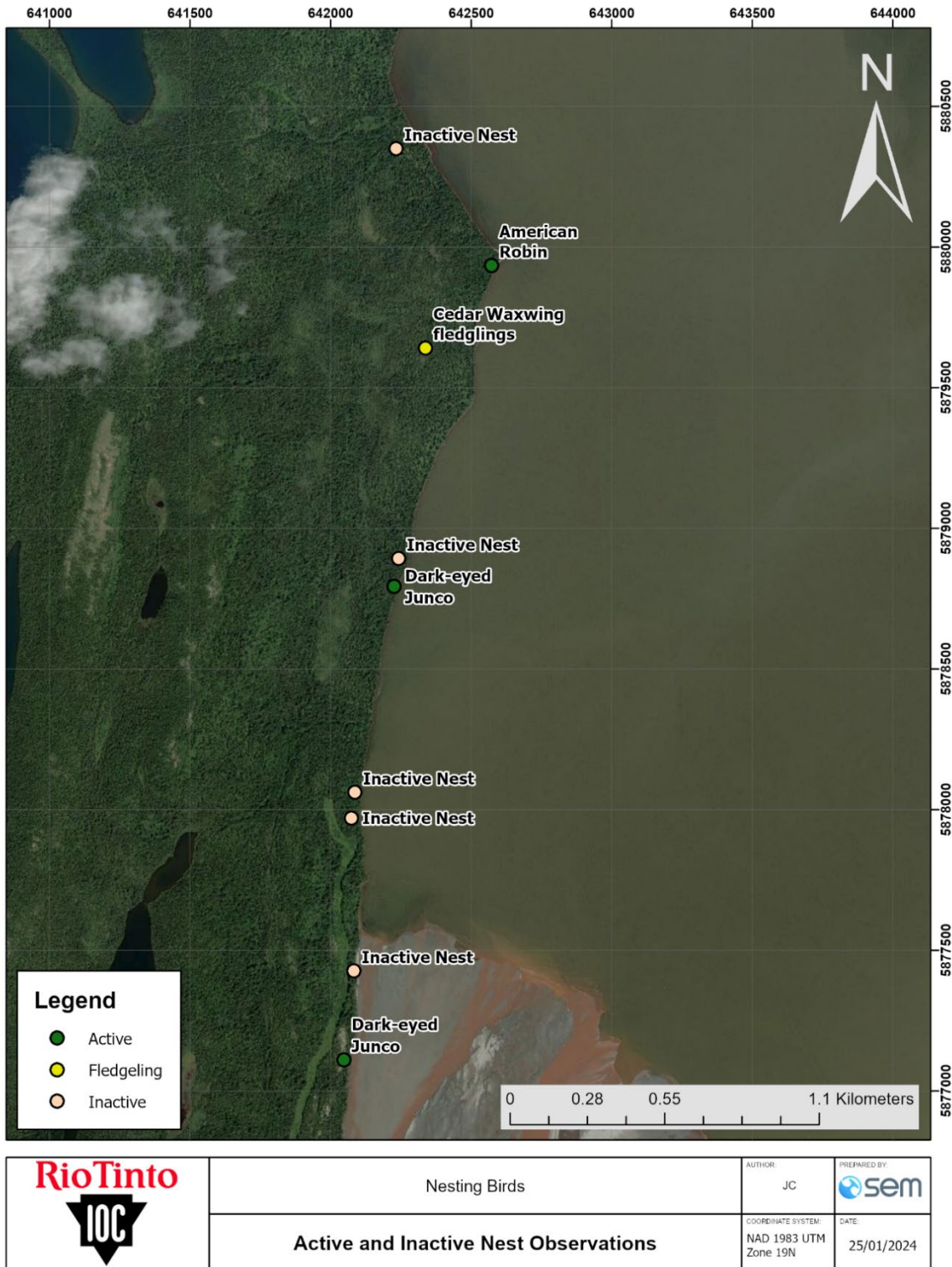


Figure 4.15 Maps of nests (Active/Inactive) Along the Study Area.

4.4 Mammals

SEM has conducted several mammal surveys for IOC since 2017, including Sherwood North, Smallwood, and Humphrey South, a bat monitoring program, a wolf and bear monitoring program, and several bat habitat assessments. The results from those previous wildlife surveys facilitated the assessment of the Western Hillside Study Area. In addition to existing information from those surveys, species occurrence and distribution of mammals were established from track/sign survey transects throughout the Study Area.

Transect data from other projects were combined with information from literature searches to give a comprehensive list of wildlife that use this region of Labrador West and specifically areas adjacent to Wabush and Labrador City. Mammal species detected during previous surveys included black bear, Canada lynx (*Lynx canadensis*), grey wolf (*Canis lupus*), moose, muskrat, red fox (*Vulpes vulpes*), and red squirrel (*Tamiasciurus hudsonicus*). Moose, grey wolf, and red squirrel were the most detected mammal species but other species such as snowshoe hare (*Lepus americanus*), marten (*Martes americana*), short-tailed weasel (*Mustela ermine*), northern flying squirrel (*Glaucomys sabrinus*), and porcupine (*Erethizon dorsatum*) were documented in past assessments near Labrador City. This information, combined with the regional ELC data were used to identify the variety of habitats for mammals and any potential habitats for SAR within the project boundaries (e.g., Little brown bat).

Mammal species observed by visual observation during those previous surveys included red squirrel, snowshoe hare and moose. Other species that were observed by sign were black bear, porcupine, gray wolf, and vole. These species were detected from scat, caches, bark scaling, and tracks along transects throughout the various habitat types of the Study Area. Red squirrels are often detected more frequently than most other mammal species due to their vociferous nature and population density in most coniferous landscapes. Similarly, snowshoe hare tends to be easily detected due to the frequency of hare trails in coniferous and mixed forests.

4.4.1 Camera Trap and Terrestrial Survey Results

From transects throughout the Study Area and with the use of the Browning Camera Traps, SEM determined what mammals are using the Study Area, including SAR mammals (i.e., several bat species) also occupying the Study Area.

Camera trap locations in the Study Area are shown below in Figure 4.16. It is likely that some of the wolves captured on camera during the 2023 Study Area surveys had also been previously captured on the landfill cameras in the years prior. The network of travel corridors between the previously monitored landfill wolves and western hillside wolves are possibly linked.

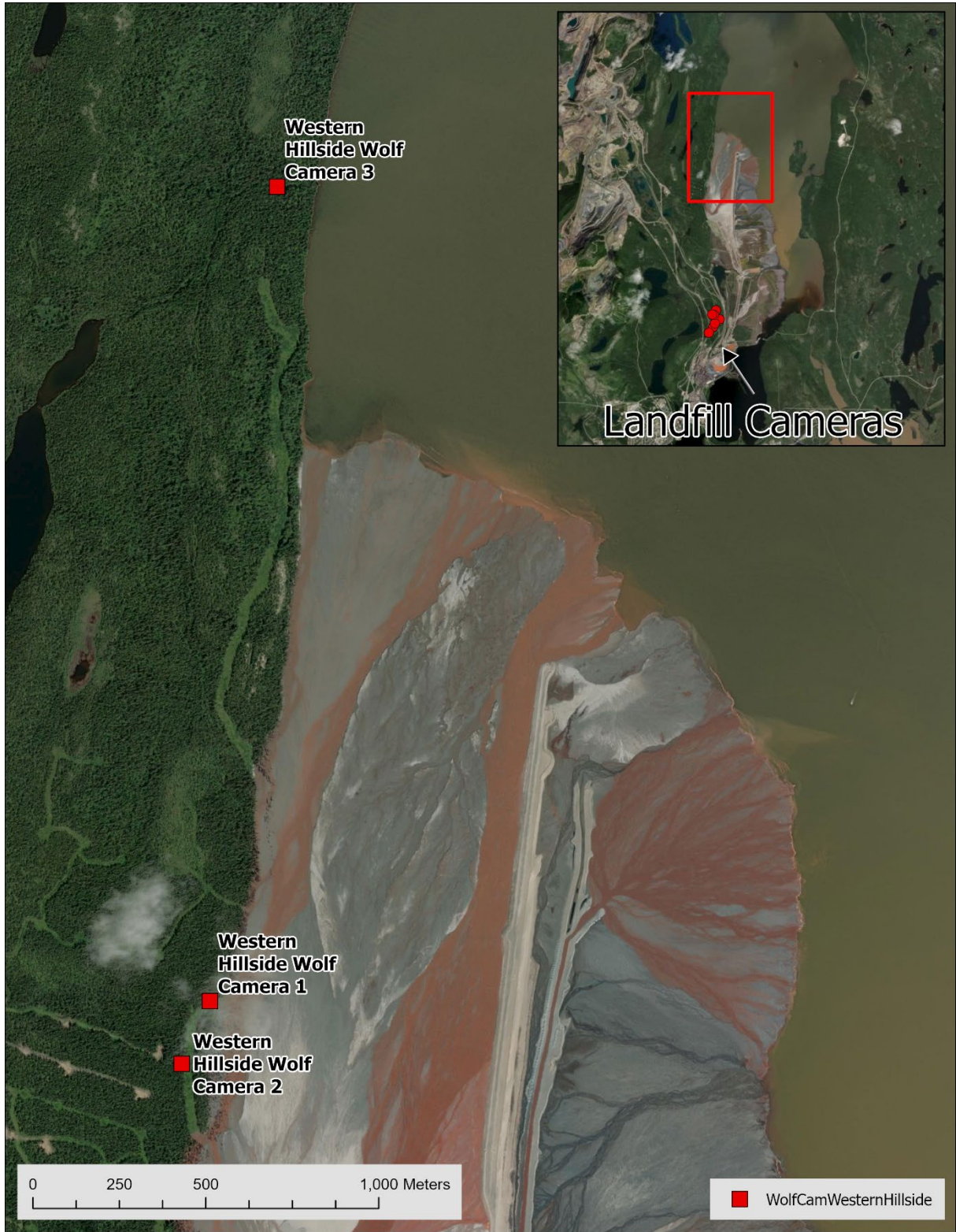


Figure 4.16 Western Hillside Camera Trap Locations, 2023.

Other species detected via the camera traps were red fox, black bear, and red squirrel which were also detected through terrestrial surveys throughout the Study Area via scat, tracks, caches, and other observations made by SEM personnel while traversing the habitats. Snowshoe hare, vole, and other small rodents were observed through secondary observations of tracks, game trails, and scat. Porcupine (*Erethizon dorsatum*) observations were also obtained during terrestrial surveys which included scat observations, and bark scaling. Defined smaller-width trails leading to Wabush Lake were observed in the southern end of the Study Area suggesting a water-dwelling mammal like muskrat (*Ondatra zibethicus*), beaver (*Castor canadensis*) or river otter (*Lontra canadensis*). Moose tracks were also observed in the central portion of the Study Area where the elevated hillsides flattened, and some wet boggy areas allowed SEM personnel to observe tracks in the muddy depressions.

Like historical studies, the red squirrel was the most abundantly observed species with their abundant caches, loud calls, and frequent movements, this species is ubiquitous in the forests of Labrador West. The heavily travelled game trail used for the camera trap locations was a particularly effective area to observe the sign of species using the Study Area (Figure 4.17).



Figure 4.17 Black Bear Scat Along the main Game Trail in the Study Area (Left) Grey Wolf Tracks Along a Well-travelled Tailings Surface (Right).

4.4.1.1 Western Hillside Camera 1 (Tailings)

Upon review and analysis of collected photos and videos, it was revealed that multiple Labrador grey wolves travelled along this route, with three confirmed individuals utilizing the tailings as a travel corridor and moving from the southern portions of IOC (located south of Western Hillside Camera 1) to the northern sections and even beyond the northernmost camera (Western Hillside Camera 3). Red foxes were also confirmed to use this travel route but unlike other camera traps, no black bears were observed in this location.

This specific area served as a significant point of entry and exit from the tailings, aligning with expectations derived from a previously cut line that had regenerated with second-growth shrubs. Wolves captured on Western Hillside Wolf Camera 1 were subsequently documented on Western Hillside Wolf Camera 3, swiftly traversing the tailings, and entering a game trail where the strategically placed third camera was located.

4.4.1.2 Western Hillside Camera 2 (Drill Pad Road)

The expectation was that this camera would capture wolves as they departed from the tailings, navigating through easily accessible cut lines. However, observations revealed that wolves infrequently traversed this camera's field, indicating a potential preference for a route along the forest line parallel to the tailings further south, possibly avoiding dense shrubbery. This conclusion was drawn from the results of Camera 1 where wolves were observed departing the tailings and heading toward the shrub thicket and presumably toward Camera 2. Periodically, a wolf was recorded on the camera, aligning with its appearance on Western Hillside Camera 1, suggesting movement from one area to another. Nonetheless, such occurrences were rare, and the detection rate notably lagged that of Western Hillside Wolf Camera 1. Red foxes were also observed using this route as well.

The challenge presented by shrubs on the old cut line may direct wolves to stay on the tailings or within mature conifers along the shoreline, rather than navigating through thick shrubs. While alternative roadways south of the drill pad exploration exist, it remains uncertain whether wolves opt for these routes based on the observations from this camera trapping survey.

4.4.1.3 Western Hillside Camera 3 (Game Trail)

This camera proved particularly effective in generating a high frequency of wildlife observations, predominantly featuring wolves (Figure 4.18). Among the regular recordings were three distinct wolves, easily identified through their consistent appearances on this trail, complemented by occasional sightings of a sizable black bear assumed to be the same individual across several recordings (Figure 4.19).

The stump positioned in front of the camera served as a distinctive marking point for each passing wolf, offering valuable insights into their behaviors. By analyzing urination positioning, it was possible to determine the sex of the wolves, revealing two females and one probable male individual.



Figure 4.18 Labrador Grey Wolf, Western Hillside Camera 3, (July 11, 2023).



Figure 4.19 Black Bear, Western Hillside Camera 3 (August 14, 2023).

4.4.2 Bat Detections

With the Anabat Swift bat detectors positioned strategically throughout Western Hillside, SEM determined the species of bats present at the site, all of which are currently listed federally as Endangered under SARA, and provincially under NL ESA (Figure 4.20). SEM observed little brown bat, Northern myotis, and hoary bat. Hoary bats are a migratory species with a range reaching through Labrador into the north but are less typical for the region of the Study Area.

Little brown bat was observed most frequently with 26 total observations, especially at Bat Detector 3 where a slight cove in the lake near a small stream outlet likely provided foraging opportunities. Northern myotis accounted for 17 detections, especially at Bat Detector 1, and hoary bat was detected 15 times, mostly at Bat Detector 1 at an opening to the tailings where shrub thicket abruptly ends and a space between black spruce allowed the microphone to detect bats flying over both tailings and shrub thicket.

Table 4.10 Bat Detection Results, Western Hillside 2023.

Bat Detector	Coordinates	Habitat Description	Bat Species	Total Detections
Detector 1	641826.01 m E, 5875941.80 m N	Shrub Thicket (old cut line) meets tailings at a break in black spruce forest	Hoary bat (<i>Lasiurus cinereus</i>)	12
			Little brown bat (<i>Myotis lucifugus</i>)	3
			Northern myotis (<i>Myotis septentrionalis</i>)	10
Detector 2	642354.69 m E, 5880330.24 m N	Shoreline Habitat - Shallow cove with Stillwater foraging habitat	Hoary Bat	2
			Little brown bat	1
			Northern myotis	1
Detector 3	642536.26 m E, 5879807.97 m N	Shoreline Habitat - Deep water Cove where treed wetland meets Lakeshore	Hoary Bat	1
			Little brown bat	22
			Northern myotis	6
Bat Detection Totals				58

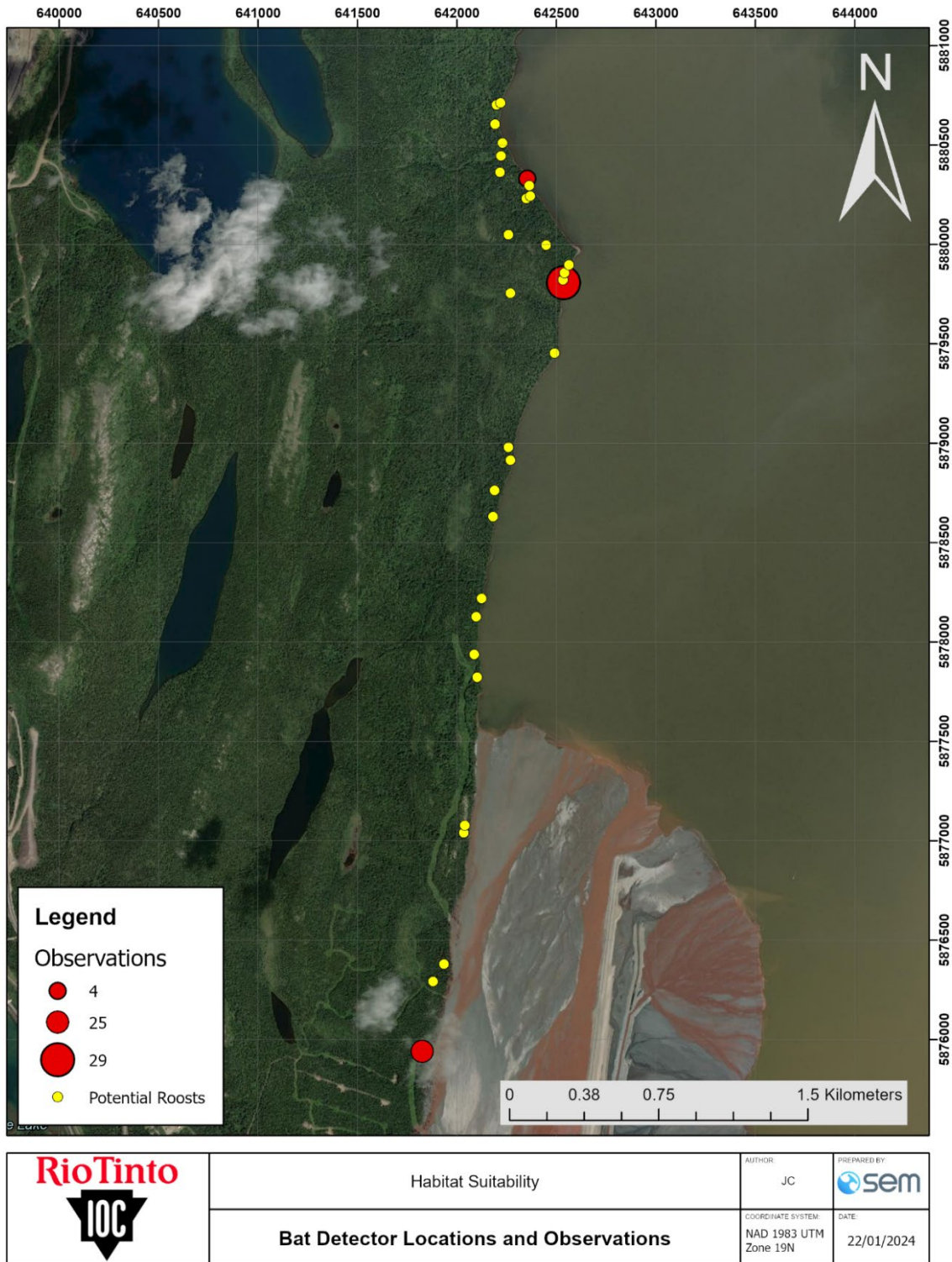


Figure 4.20 Bat Detections and Potential Roosts (snags, caves, rock crevices) in the Study Area.

4.4.2.1 Bat Habitat Identification

During the terrestrial surveys conducted by SEM personnel along the Study Area, suitable bat habitat was monitored to identify key features of the terrestrial ecotypes that would support bats at some point in their life cycle, particularly little brown, and Northern myotis as the most dominant species previously observed in IOC. Standing dead or dying trees with hollow spaces, curled bark, elevated bark, old, hollowed nest holes, and other spaces where bats can roost are known to enhance the habitat and support more bats in a particular habitat (ECCC 2015). Mature forests often have a higher abundance of these trees and in the Study Area the Closed Spruce ecotype is associated with an abundance of large mature trees. In areas that contain a higher proportion of mixedwood conditions (i.e., large birch trees growing amongst mature coniferous), large white birch snags occur (Figure 4.21). The bark of these species rolls when it dies or dries out which allow elevated spaces of bark from the trunk of the tree where bats can roost. Woodpecker species often nest in these trees and create open spaces into the trunk which can also allow suitable roosting conditions for bats. Male daytime roosts, or even maternity roosts can occur in these snags and the identification of these throughout the Study Area combined with the detection data helped inform the use of the ecotypes by bats. Rock faces also have gaps within rock that may be used as roosts for bats and therefore any areas of potential rock roosts or cave potential were identified as well.

Figure 4.20 indicates the potential roost sites identified throughout the Study Area and the detector locations with indications of the bat counts per each site. While similar habitats were selected across the three detector zones, the two detectors (1 and 3) placed near highest abundance of potential roost sites near mature closed forest had a notable increase in bat detections indicating more suitable sites for foraging or possibly increased numbers of detections based on the presence of bats nearby associated with this more suitable habitat with more abundant roost sites and other suitable bat habitat features. It was also noted that Northern myotis were detected more frequently in the area nearby to mature closed coniferous forest in the south while little brown myotis were observed most frequently in the more northern portion of the Study Area on Detector 3 where suitable snags, and foraging habitat (open coniferous forest) existed nearby aligning with the preferences of this species (ECCC 2014). West of Detector 3 open spruce ecotype can be observed running several hundred meters south, west, and north of the detector while the detector is adjacent to Snags, suitable roosting trees in a more mature patch of closed spruce/mixed wood forest type. In comparison to the ecotype surrounding Detector 1 which suits the foraging behavior of Northern myotis more closely, ecotypes surrounding Detector 3 suit the foraging behavior of little brown myotis. Bat Detector 3 in the northern Study Area is situated along a low-lying treed wetland (too small in resolution to be identified by the ELC) which leads westward toward Lorraine Lake, a known area of high bat abundance for IOC. With a combination of foraging sites (lakes and wetland) and snags it was expected that bat detections would be elevated here but mixedwood forests and shrubland continuing north from this point indicate a reduction in suitable mature coniferous forests, open or closed, potentially

resulting in the reductions of detections here. See the below map of bat detector detections and suitable bat roosting trees/habitat in the Study Area.



Figure 4.21 White Birch Bat SNAG Roost Potential for Bats in Northern Zone of the Study Area.

4.5 Amphibians

Dedicated amphibian surveys were not conducted for Western Hillside, though habitats suitable for amphibians including Anurans (Frogs and Toads), and Caudata (Salamanders) were observed and highlighted in the habitat study. During terrestrial surveys, SEM personnel surveyed shorelines of streams encountered and water-filled area of bogs and forests to observe any amphibians along the transects but

zero (0) were observed. In addition to the wetlands and closed canopy moist forest ecotypes documented by habitat assessment and ELC development, SEM also observed suitable vernal pools at coordinates 642189.34 m E, 5878762.43 m N. These pools could serve as spawning habitat.

4.6 Species at Risk

4.6.1 Avifauna SAR and SCC

Of the SAR and SCC possible for the Study Area, only Bank Swallow was observed during avifauna surveys. This species burrows into sandy or clay banks with slopes over 70 degrees and are found commonly on the tailings revegetation area where suitable banks form from the erosion of tailings. The Study Area provides no breeding habitat for this species, though the lake provides foraging habitat for flying insects. Wetlands in the Western Hillside area may provide some foraging habitat as well.

Another SCC observed elsewhere in Labrador West by SEM personnel during other studies was American Kestrel (*Falco sparverius*) during nest surveys in nearby sites in 2023. Their preferred habitat is not represented within the boundaries of Western Hillside. The potential for other raptors nesting in the area does exist with Osprey being observed circling overhead near the central region of the Study Area during breeding season. Efforts were made to identify a nest in large black spruce (the tallest trees in the area) though they were not observed. The brief encounter with the Osprey and lack of continuous observation either visual or auditory may suggest that the nest was further West of the Study Area. An RPAS survey could be conducted in 2024 to ensure that no raptor nests are present in the Western Hillside Study Area.

4.6.2 Mammal SAR

All three bat species detections and results were discussed in the mammal section above. All three species detected are protected under federal and provincial SAR regulations; Little brown bat, and Northern myotis are listed Endangered under NL ESA 2021 and as Endangered under SARA in 2013. In 2023, Hoary bat were listed as Endangered under SARA and are a migratory species known to occur in Labrador West. In previous bat monitoring at IOC for the BCS, SEM recorded this species in areas of similar foraging habitat (i.e., lacustrine habitat). It is likely the species uses larger waterbodies as stopovers on migration to forage. Bat roost surveys would be recommended to determine the potential use of any of the potential roost sites.

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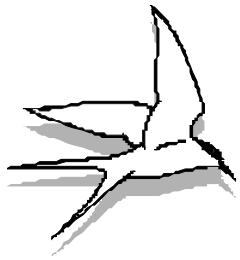
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Appendix A

S-rank Definitions



Part I. Conservation Data Centre Subnational Rarity Ranks

Biological diversity or biodiversity can be described at a number of levels, from molecules to ecosystems. Biodiversity is a combination of species diversity (the variety of species), genetic diversity (the genetic variability among individuals of that species), and ecological diversity (the variety of ecosystems/habitats in which they live). Conservation Data Centres (CDCs), as part of The NatureServe* international network, track biodiversity at two levels: species and ecological communities. Species and ecological communities are referred to as **elements** of biodiversity. Elements are ranked in each jurisdiction (province or state) and at global and national levels in order to help prioritize conservation efforts.

NatureServe and all CDCs (called Heritage Programs in the US) use a standardized element ranking system that has evolved over some 30 years, with input from hundreds of scientists, managers and conservationists. The following material describes this element ranking system at the subnational (S) or provincial level and explains how ranks are assigned for species elements of biodiversity. (The community ranking process is slightly different.)

* Formerly known as The Nature Conservancy (TNC)

Definitions of Provincial (subnational) ranks - SRANKS

- S1 Critically Imperiled**—Critically imperiled in the jurisdiction because of extreme rarity or because of some factor(s) such as very steep declines making it especially vulnerable to extirpation from the jurisdiction.
- S2 Imperiled**—Imperiled in the jurisdiction because of rarity due to very restricted range, very few populations, steep declines, or other factors making it very vulnerable to extirpation from jurisdiction.
- S3 Vulnerable**—Vulnerable in the jurisdiction due to a restricted range, relatively few populations, recent and widespread declines, or other factors making it vulnerable to extirpation.
- S4 Apparently Secure**—Uncommon but not rare; some cause for long-term concern due to declines or other factors.
- S5 Secure**—Common, widespread, and abundant in the jurisdiction.
- SX Presumed Extirpated**—Species or ecosystem is believed to be extirpated from the jurisdiction (i.e., nation or state/province). Not located despite intensive searches of historical sites and other appropriate habitat, and virtually no likelihood that it will be rediscovered.

- SH Possibly Extirpated**— Known from only historical records but still some hope of rediscovery. There is evidence that the species or ecosystem may no longer be present in the jurisdiction, but not enough to state this with certainty. Examples of such evidence include (1) that a species has not been documented in approximately 20-40 years despite some searching or some evidence of significant habitat loss or degradation; (2) that a species or ecosystem has been searched for unsuccessfully, but not thoroughly enough to presume that it is no longer present in the jurisdiction.
- S#S# Range Rank** — A numeric range rank (e.g., S2S3 or S1S3) is used to indicate any range of uncertainty about the status of the species or ecosystem. Ranges cannot skip more than two ranks (e.g., SU is used rather than S1S4).
- SU Unrankable**—Currently unrankable due to lack of information or due to substantially conflicting information about status or trends.
- SNR Unranked**—National or subnational conservation status not yet assessed.
- SNA Not Applicable** —A conservation status rank is not applicable because the species or ecosystem is not a suitable target for conservation activities.

Not applicable cases:

Hybrid – Element represents an interspecific hybrid without conservation value. (Note that hybrids may be assigned a numeric rank if they do have a conservation value.)

Exotic Origin – Element is not native to the nation or subnation.

Accidental/Nonregular – Element is not regularly found in the nation or subnation, in other words, infrequent and outside of normal range.

Not Confidently Present – Element’s presence in the nation or subnation has been reported, but the report is unconfirmed or doubtful; Element has been falsely reported, and may or may not potentially occur; Element may potentially occur (e.g., habitat is suitable); Element was never present in the nation or subnation despite presence in surrounding areas.

No Definable Occurrences – Element is native and appears regularly but lacks practical conservation concern in the subnation because it is transient or occurs in a dispersed, unpredictable manner.

Synonym – Element reported as occurring in the nation or subnation, but the national or provincial data center does not recognize this taxon; therefore the Element is not assigned a national or subnational rank.

Rank Qualifier

- S#?** **Inexact Numeric Rank**—Denotes inexact numeric rank. This designation should not be used with any of the variant national or subnational conservation status ranks or NX, SX, NH, or SH.

Breeding Status Qualifiers⁴

- B Breeding**—Conservation status refers to the breeding population of the species in the nation or state/province.
- N Nonbreeding**—Conservation status refers to the non-breeding population of the species in the nation or state/province.
- M Migrant**—Migrant species occurring regularly on migration at particular staging areas or concentration spots where the species might warrant conservation attention. Conservation status refers to the aggregating transient population of the species in the nation or state/province.

⁴ 4A breeding status is only used for species that have distinct breeding and/or non-breeding populations in the nation or state/province. A breeding-status S-rank can be coupled with its complementary non-breeding-status S-rank if the species also winters in the nation or state/province. In addition, a breeding-status S-rank can also be coupled with a migrant-status S-rank if, on migration, the species occurs regularly at particular staging areas or concentration spots where it might warrant conservation attention. Multiple conservation status ranks (typically two, or rarely three) are separated by commas (e.g., S2B,S3N or SHN,S4B,S1M).

Part II. The Ranking Process

To rank species elements, 8-10 different biological criteria are assessed for each species. The ten factors considered in assigning status ranks are described below.

Ranking Matrix Eight ranking criteria and value of letter scores for each criterion.

MATRIX SCORE									
CRITERIA	A	B	C	D	E	F	G	H	I
Population size	1-50	50-250	250-1000	1000-2500	2500-10000	10000-100000	100000-1000000	>1000000	
Range Extent	<100km ²	100-250km ²	250-1000km ²	1000-5000km ²	5000-20000 km ²	20000-200000 km ²	200000 – 2500000 km ²		
Short-term Trend	Decline >90%	Decline of 80-90%	Decline of 70-80%	Decline of 50-70%	Decline of 30-50%	Decline of 10-30%	Relatively Stable (<10% change)	Increase of 10-25%	Increase of >25%
Long-term Trend	Decline >90%	Decline of 80-90%	Decline of 70-80%	Decline of 50-70%	Decline of 30-50%	Decline of 10-30%	Relatively Stable (<10% change)	Increase of 10-25%	Increase of >25%
Area of Occupancy	<0.4km ²	0.4-4km ²	4-20km ²	20-100km ²	100-500km ²	500-2000km ²	2000-20000km ²	>20000 km ²	
Number of Element Occurrences (EOs)	0-5	6-20	21-100	>100					

Number of EOs with Good Viability	No occurrences with excellent or good viability or ecological integrity	Very few (1-3) occurrences with excellent or good viability or ecological integrity	Few (4-12) occurrences with excellent or good viability or ecological integrity	Some (13-40) occurrences with excellent or good viability or ecological integrity	Many (41-125) occurrences with excellent or good viability or ecological integrity	Very Many (>125) occurrences with excellent or good viability or ecological integrity			
Environmental Specificity	Very Narrow	Narrow	Moderate	Broad					
Threat Scope	Pervasive (71-100%)	Large (31-70%)	Restricted (11-30%)	Small (1-10%)					
Threat Severity	Pervasive (71-100%)	Large (31-70%)	Restricted (11-30%)	Small (1-10%)					

1. Population Size

Population size is the estimated current total population of the species which is naturally occurring and wild within the area of interest (globe, nation, or subnation), and that is of reproductive age or stage (at an appropriate time of the year), including mature but currently non-reproducing individuals, which should be included in counts or estimates. Abundance is measured in different ways depending on the biology of the species. For animal populations it is usually measured by the number of individuals, for plants it may be measured by the area occupied by a distinct population, and for aquatic invertebrates it may be measured by the stream length that the species occupies:

Z = Zero, no individuals believed extant (i.e., species presumed extinct)

A = 1–50 individuals

B = 50–250 individuals

C = 250–1,000 individuals

D = 1,000–2,500 individuals

E = 2,500–10,000 individuals

F = 10,000–100,000 individuals

G = 100,000–1,000,000 individuals

H = >1,000,000 individuals

U = Unknown

Null = Factor not assessed

*A value range (e.g., DE) can also be used to indicate uncertainty.
(DE would indicate between 1000 – 10000 individuals).

2. Range Extent

This denotes the approximate range of the species as a percentage of the province's area. It is defined as the current area contained within the shortest continuous imaginary boundary which can be drawn to encompass all the known, inferred or projected sites of occurrence, but, *excluding* significant areas where the species does not occur due to unsuitable habitat. Thus the estimate of range for a species exhibiting a linear use of coastal forests or riverine habitats would not consider tracts of unsuitable habitat in the interior of the polygon.

Z = Zero (no occurrences believed extant; species presumed extinct or ecosystem believed eliminated throughout its range)

A = <100 km²

(less than about 40 square miles)

B = 100–250 km²

(about 40–100 square miles)

C = 250–1,000 km²

(100–400 square miles)

D = 1,000–5,000 km²

(400–2,000 square miles)

E = 5,000–20,000 km²

(2,000–8,000 square miles)

F = 20,000–200,000 km²

(8,000–80,000 square miles)

G = 200,000–2,500,000 km²

(80,000–1,000,000 square miles)

H = >2,500,000 km²

(greater than 1,000,000 square miles)

3. Short-term Trend

The rating code that best describes the observed, estimated, inferred, or suspected degree of change in population size, extent of occurrence (range extent), area of occupancy, number of occurrences, and/or number of occurrences or percent area with good viability or ecological integrity over the short term, whichever most significantly affects the conservation status assessment in the area of interest (globe, nation, or subnation). Consider short-term historical trend within ten years or three generations (for long-lived taxa), whichever is the longer (up to a maximum of 100 years), or, for communities and systems, typically 30 years, depending on the characteristics of the type.

The trend may be recent or current, and the trend may or may not be known to be continuing. Trends may be smooth, irregular, or sporadic. Fluctuations will not normally count as trends, but an observed change should not be considered as merely a fluctuation rather than a trend unless there is evidence for this. Conservation Status Assessments: Factors for Assessing Extinction Risk 25

In considering trends, do not consider newly discovered but presumably long existing occurrences, nor newly discovered individuals in previously poorly known areas.

Also, consider fragmentation of previously larger occurrences into a greater number of smaller occurrences to represent a decreasing area of occupancy as well as decreasing

number of good occurrences or populations.

- A = Decline of >90%**
- B = Decline of 80–90%**
- C = Decline of 70–80%**
- D = Decline of 50–70%**
- E = Decline of 30–50%**
- F = Decline of 10–30%**
- G = Relatively Stable ($\leq 10\%$ change)**
- H = Increase of 10–25%**
- I = Increase of >25%**
- U = Short-term trend unknown**
- Null = Factor not assessed**

4. Long-term Trend

The rating code that best describes the observed, estimated, inferred, or suspected degree of change in population size, extent of occurrence (range extent), area of occupancy, number of occurrences, and/or number of occurrences or percent area with good viability or ecological integrity over the long term (ca. 200 years) in the area of interest (globe, nation, or subnation).

- A = Decline of >90%**
- B = Decline of 80–90%**
- C = Decline of 70–80%**
- D = Decline of 50–70%**
- E = Decline of 30–50%**
- F = Decline of 10–30%**
- G = Relatively Stable ($\leq 10\%$ change)**
- H = Increase of 10–25%**
- I = Increase of >25%**
- U = Long-term trend unknown**
- Null = Factor not assessed**

5. Area of Occupancy

Area of occupancy for taxa can be defined as (modified from the International Union for the Conservation of Nature 2001):

“...the area within its ‘extent of occurrence’, which is occupied by a taxon or ecosystem type, excluding cases of vagrancy. The measure reflects the fact that a taxon or type will not usually occur throughout the area of its extent of occurrence, which may contain unsuitable or unoccupied habitats. In some cases, (e.g., irreplaceable colonial nesting sites, crucial feeding sites for migratory taxa) the area of occupancy is the smallest area essential at any stage to the survival of existing populations of a taxon. The size of the area of occupancy will be a function of the scale at which it is measured, and should be at a scale appropriate to relevant biological or ecological aspects of the taxon or type, the nature of threats and the available data.”

- A** = <0.4km²
- B** = 0.4-4
- C** = 4-20 km²
- D** = 20-100 km²
- E** = 100-500 km²
- F** = 500-2000 km²
- G** = 2000-20000 km²
- H** = >20000 km²

5b. Linear Distance of Occupancy

Ecosystems that occur as linear strips. They are often ecotonal between terrestrial and aquatic ecosystems. In undisturbed conditions, typical occurrences range in linear distance from 0.5 to 100 km.

- A** = <4km²
- B** = 4-40
- C** = 40-200 km²
- D** = 200-1000 km²
- E** = 1000-5000 km²
- F** = 5000-20000 km²
- G** = 20000-200000 km²
- H** = >200000 km²

6. Number of Element Occurrences (EOs)

An “element occurrence” is the mapping unit of CDC methodology. It is generally defined as an area of land or water on which an “element of biodiversity” (plant and animal species or natural community) is or was present. It is a physical location important to the conservation of a species or community, an area worth preserving to insure the survival of a community or species at risk. For a species it is generally the habitat occupied by a local population, for a community it is the area containing a stand or patch. What constitutes an occurrence also varies between species (e.g. hibernacula, den sites, breeding ponds where adults, egg masses and/or larvae have been identified, breeding colonies, etc.). Some species can have more than one type of occurrence, for example breeding and wintering occurrences.

A single letter code (below) represents the number of estimated occurrences believed extant for the species in the province. When a species’ distribution is extremely limited and there are very few site occurrences, it is very susceptible to any number of ecological disturbances, both predictable and unpredictable. This criteria is therefore an important factor influencing SRANK when the number of occurrences is few. If the letter code for this field is A or B, the species usually qualifies for a rank of S1 or S2.

- A** = 0 - 5 occurrences
- B** = 6 - 20 occurrences
- C** = 21 - 100 occurrences
- D** = 101+ occurrences

7. Number of EOs with Good Viability

For species, an occurrence with at least good (i.e., excellent-to-good) viability exhibits favorable characteristics with respect to population size and/or quality and quantity of occupied habitat; and, if current conditions prevail, the occurrence is likely to persist for the foreseeable future (i.e., at least 20–30 years) in its current condition or better. See Hammerson et al. (2008) for more details. For ecosystems, an occurrence has excellent-to-good ecological integrity when it exhibits favorable characteristics with respect to reference conditions for structure, composition, and function, operating within the bounds of natural or historic disturbance regimes, and is of exemplary size (Faber-Langendoen et al. 2008). One would expect only minor to moderate alterations to these characteristics for an occurrence to maintain good ecological integrity.

For many occurrences, viability or ecological integrity assessments or ranks have been applied by biologists and ecologists throughout the NatureServe network. For species, these Element Occurrence (EO) ranks estimate the probability of persistence of the occurrence. For ecosystems, the rank is a succinct assessment of the degree to which, under current conditions, an occurrence of an ecosystem matches reference conditions for that system, without any presumptions made about future status or persistence. Ranks for species and ecosystems are based on a set of “occurrence rank factors,” namely size (including population size and/or occupied area), abiotic and biotic condition, and landscape context. These factors may be further refined to specific indicators or metrics. The overall ranks range from A = Excellent viability/integrity, to D = Poor viability/integrity

A = No occurrences with excellent or good (assessed as A or B) viability or ecological integrity

B = Very few (1–3) occurrences with excellent or good viability or ecological integrity

C = Few (4–12) occurrences with excellent or good viability or ecological Integrity

D = Some (13–40) occurrences with excellent or good viability or ecological integrity

E = Many (41–125) occurrences with excellent or good viability or ecological integrity

F = Very many (>125) occurrences with excellent or good viability or ecological integrity

U = Unknown number of occurrences with excellent or good viability or ecological integrity

Null = Factor not assessed

8. Environmental Specificity

Environmental Specificity is the degree to which a species or ecosystem depends on a relatively scarce set of habitats, substrates, food types, or other abiotic and/or biotic factors within the overall range. Relatively narrow requirements are thought to increase the vulnerability of a species or ecosystem. This factor is most important when the number of occurrences, and the range extent or area of occupancy, are largely unknown.

A = Very Narrow. Specialist or ecosystem with key requirements scarce. For

species, specific habitat(s), substrate(s), food type(s), hosts, breeding/non-breeding microhabitats, or other abiotic and/or biotic factor(s) are used or required by the species or ecosystem in the area of interest, with these habitat(s) and/or other requirements furthermore being scarce within the generalized range of the species or ecosystem within the area of interest, and the population (or the number of breeding attempts) expected to decline significantly if any of these key requirements become unavailable. For ecosystems, environmental requirements are both narrow and scarce (e.g., calcareous seepage fens).

- B =** Narrow. Specialist or ecosystem with key requirements common. Specific habitat(s) or other abiotic and/or biotic factors (see above) are used or required by the species or ecosystem, but these key requirements are common and within the generalized range of the species or ecosystem within the area of interest. For ecosystems, environmental requirements are narrow but common (e.g., floodplain forest, alpine tundra).
- C =** Moderate. Generalist or community with some key requirements scarce. Broad-scale or diverse (general) habitat(s) or other abiotic and/or biotic factors are used or required by the species or ecosystem, but some key requirements are scarce in the generalized range of the species or ecosystem within the area of interest. For ecosystems, environmental requirements are broad but scarce (e.g., talus or cliff forests and woodlands, alvars, many rock outcrop communities dependent more on thin, droughty soils per se than specific substrate factors).
- D =** Broad. Generalist or community with all key requirements common. Broad-scale or diverse (general) habitat(s) or abiotic and/or biotic factors are used or required by the species or ecosystem, with all key requirements common in the generalized range of the species or ecosystem in the area of interest. For animals, if the preferred food(s) or breeding/non-breeding microhabitat(s) become unavailable, the species switches to an alternative with no resulting decline in numbers of individuals or number of breeding attempts. For ecosystems, environmental requirements are broad and common (e.g., forests or prairies on glacial till, or forests and meadows on montane slopes).

9. Threat Severity

Within the scope (as defined spatially and temporally in assessing the scope of the Threat), severity is the level of damage to the species or ecosystem from the Threat that can reasonably be expected with continuation of current circumstances and trends (including potential new threats) (Table 7). Note that severity of Threats is assessed within a ten-year or three-generation time frame, whichever is longer (up to 100 years).

For species, severity is usually measured as the degree of reduction of the species' population. Surrogates for adult population size (e.g., area) should be used with caution, as

occupied areas, for example, will have uneven habitat suitability and uneven population density. For ecosystems, severity is typically measured as the degree of degradation or decline in integrity (of one or more key characteristics).

Extreme	Within the scope, the Threat is likely to destroy or eliminate the occurrences of an ecological community, system or species, or reduce the species population by 71–100%
Serious	Within the scope, the Threat is likely to seriously degrade/reduce the effected occurrences or habitat or, for species, to reduce the species population by 31–70%
Moderate	Within the scope, the Threat is likely to moderately degrade/reduce the effected occurrences or habitat or, for species, to reduce the species population by 11–30%
Slight	Within the scope, the Threat is likely to only slightly degrade/reduce the effected occurrences or habitat or, for species, to reduce the species population by 1–10%

10. Threat Scope

Scope is defined herein as the proportion of the species or ecosystem that can reasonably be expected to be affected (that is, subject to one or more stresses) by the Threat within ten years with continuation of current circumstances and trends (Table 6). Current circumstances and trends include both existing as well as potential new threats. The ten-year time frame can be extended for some longer-term threats, such as global warming, that need to be addressed today. For species, scope is measured as the proportion of the species' population in the area of interest (globe, nation, or subnation) affected by the Threat. For ecosystems, scope is measured as the proportion of the occupied area of interest (globe, nation, or subnation) affected by the Threat. If a species or ecosystem is evenly distributed, then the proportion of the population or area affected is equivalent to the proportion of the range extent affected by the Threat; however, if the population or area is patchily distributed, then the proportion differs from that of range extent.

Pervasive	Affects all or most (71–100%) of the total population or occurrences
Large	Affects much (31–70%) of the total population or occurrences
Restricted	Affects some (11–30%) of the total population or occurrences.
Small	Affects a small (1–10%) proportion of the total population or occurrences.

11. Intrinsic Vulnerability

Note that this factor is not used if the Threats status factor has been assessed.

Intrinsic Vulnerability is the observed, inferred, or suspected degree to which characteristics of the species or ecosystem (such as life history or behavior characteristics of species, or likelihood of regeneration or recolonization for ecosystems) make it vulnerable or resilient to natural or anthropogenic stresses or catastrophes. For ecosystems, Intrinsic Vulnerability is most readily assessed using the dominant species and vegetation structure that characterize the ecosystem, but it can also refer to ecological processes that make an ecosystem vulnerable or lack resiliency (e.g., shoreline fens along estuarine and marine coasts subject to rising sea levels).

Since geographically or ecologically disjunct or peripheral occurrences may show additional vulnerabilities not generally characteristic of a species or ecosystem, characteristics of Intrinsic Vulnerability are to be assessed for the species or ecosystem throughout the area of interest, or at least for its better occurrences. Information on population size, number of occurrences, area of occupancy, extent of occurrence, or environmental characteristics that affect resiliency should not be considered when assessing Intrinsic Vulnerability; these are addressed using other status factors.

Note that the Intrinsic Vulnerability characteristics exist independent of human influence, but may make the species or ecosystem more susceptible to disturbance by human activities. The extent and effects of current or projected extrinsic influences themselves should be addressed in the comments field of the Threats status factor.

A = Highly Vulnerable. Species is slow to mature, reproduces infrequently, and/or has low fecundity such that populations are very slow (>20 years

or five generations) to recover from decreases in abundance; or species has low dispersal capability such that extirpated populations are unlikely to become reestablished through natural recolonization (unaided by humans). Ecosystem occurrences are highly susceptible to changes in composition and structure that rarely if ever are reversed through natural processes even over substantial time periods (>100 years).

B = Moderately Vulnerable. Species exhibits moderate age of maturity, frequency of reproduction, and/or fecundity such that populations generally tend to recover from decreases in abundance over a period of several years (on the order of 5–20 years or 2–5 generations); or species has moderate dispersal capability such that extirpated populations generally become reestablished through natural recolonization (unaided by humans). Ecosystem occurrences may be susceptible to changes in composition and structure but tend to recover through natural processes given reasonable time (10–100 years).

C = Not Intrinsicly Vulnerable. Species matures quickly, reproduces frequently, and/or has high fecundity such that populations recover quickly (<5 years or 2 generations) from decreases in abundance; or species has high dispersal capability such that extirpated populations soon become reestablished through natural recolonization (unaided by humans). Ecosystem occurrences are resilient or resistant to irreversible changes in composition and structure and quickly recover (within 10 years).

U = Unknown

Null = Factor not assessed

12. Other Considerations

Other considerations in determining the rank that are not apparent from the letter codes selected for the above criteria. Generally, these considerations will raise rather than lower the rank, e.g., "Never sexually reproduces" or "All occurrences are in areas under development".

References

Master, L., D. Faber-Langendoen, R. Bittman, G. A. Hammerson, B. Heidel, J. Nichols, L. Ramsay, and A. Tomaino. 2009. NatureServe Conservation Status Assessments: Factors for Assessing Extinction Risk. NatureServe, Arlington, VA.

