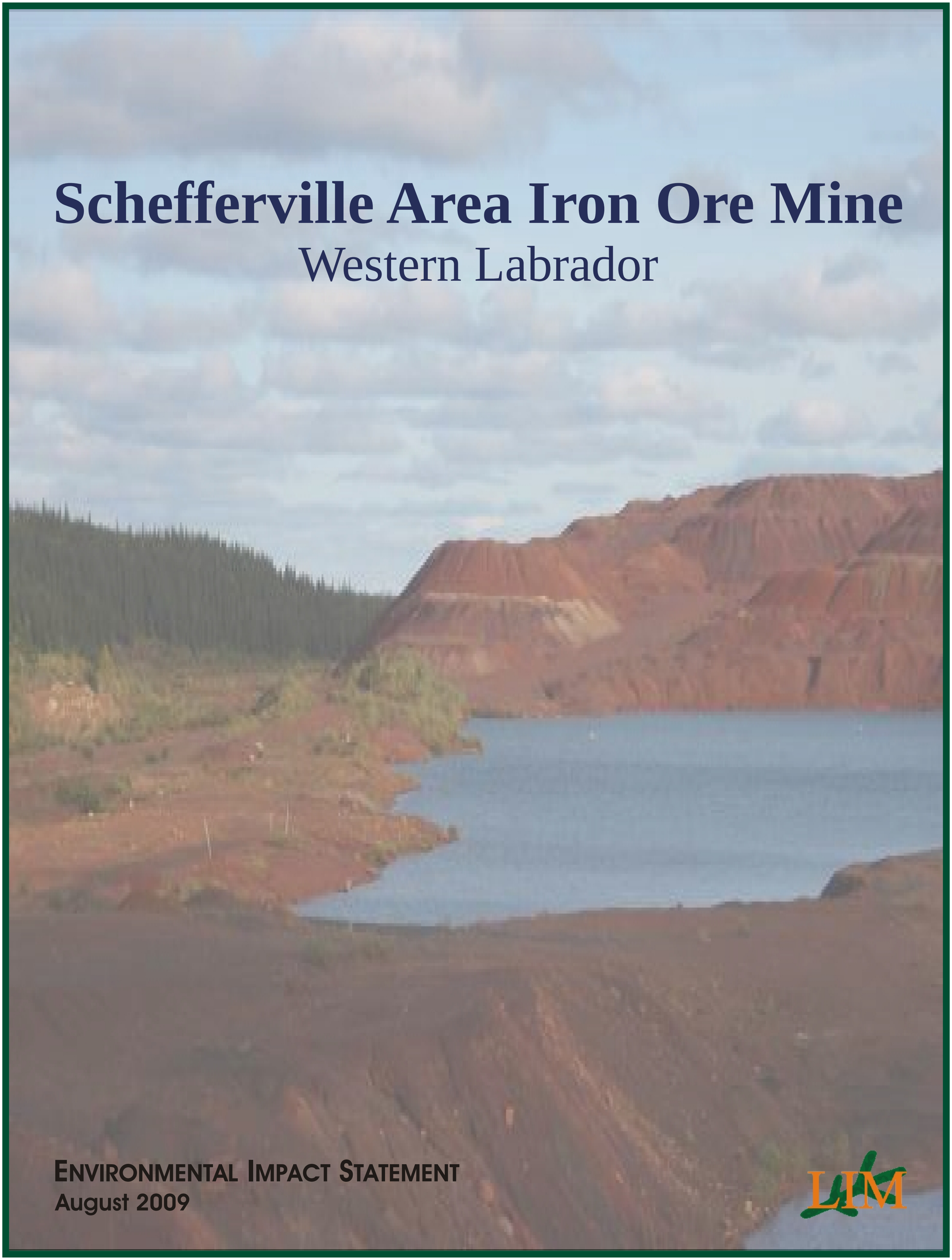


Schefferville Area Iron Ore Mine

Western Labrador

ENVIRONMENTAL IMPACT STATEMENT

August 2009

LIM

REPORT TO

Labrador Iron Mines Limited
220 Bay Street
Suite 700
Toronto ON M5J 2W4

FOR

Schefferville Area Iron Ore Mine
(Western Labrador)

ON

Revised Environmental Impact Statement

August 2009

EXECUTIVE SUMMARY

Introduction

This Environmental Impact Statement (EIS) has been prepared for the proposed Schefferville Area Iron Ore Mine (Western Labrador) (the Project) in accordance with the *Newfoundland and Labrador Environment Protection Act*, *Environmental Assessment Regulations* and the final *EIS Guidelines* issued on December 9, 2008. This EIS presents information about the Project and the results of its environmental assessment. It was submitted to government in December 2008 and in response to review comments issued by the Minister of Environment and Conservation, received in March 2009, has been revised and resubmitted.

The Project to be developed by Labrador Iron Mines Limited (LIM) will involve the reactivation of two iron ore deposits located in Labrador near Schefferville, Québec. Open pit mines will be developed at James North, James South, Redmond 2B and Redmond 5 deposits. The Project will operate under current regulations, environmental protection standards, and industry best practices and will be smaller than the previous IOC operation (1954 to 1982).

The EIS identifies and addresses the potential environmental effects on communities, economy and business, caribou, and fish and fish habitat. The assessment process also considers Project feasibility, the Project's water budget, and potential effects to air quality.

The EIS has been prepared in accordance with Guidelines issued by the Minister of Environment and Conservation (December 9, 2008) to fulfill provincial environmental assessment requirements and will be used by the Minister of Environment and Conservation, in consultation with Cabinet, to determine whether the Project's environmental effects are acceptable and the Project is to proceed.

Highlights of the Project include:

- the mining of 'direct shipping' iron ore deposits in western Labrador in an area of previous iron ore mining;
- mining will be carried out using conventional open pit mining methods, employing drilling and blasting operations;
- additional small excavations that may be required will include borrow pits, quarries and side-hill cuts associated with the construction and maintenance of access roads, mine haulage roads, sumps and settling ponds, and railway spur line construction;
- ore will be beneficiated by crushing, washing and screening at the Silver Yard in Labrador. No chemicals will be used in the beneficiation;
- the beneficiation building will house a primary crusher, tumbling scrubber, secondary crusher, primary screening equipment, secondary screening equipment, filtration equipment, a crane and various chutes, conveyors, and pumps;
- the Project is planned to operate an average of 7 to 8 months per year;
- the beneficiation building and contents will be semi-mobile and modular to fit with the Project's long-term plans;
- other buildings at the Silver Yard include: mine dry, site offices, laboratory, maintenance shed, warehouse facilities, and a camp nearby;

- subsequent to washing and screening, the reject fines will be deposited in Ruth Pit, which will become a settling pond to remove suspended solids;
- a 4.0 km rail spur line, previously operated and abandoned, will be restored, and a siding track will be laid at the Silver Yard;
- the use of a commute work system and seasonal camp accommodations for most Project workers;
- standard and proven environmental protection procedures will be employed throughout construction, operation, and rehabilitation and closure;
- water management will include: sourcing beneficiation water from pit water and groundwater; depositing resulting washwater in Ruth Pit; diverting clean drainage away from active mine areas; and maintaining flow to fish habitat using clean groundwater
- an environmental management plan regarding the potential disturbance to avifauna nest sites during construction will be submitted to Environment Canada;
- a Development Plan and Rehabilitation and Closure Plan will be submitted to Mines Branch prior to Project initiation;
- the site specific Environmental Protection Plan (EPP) will be submitted to the Minister of Environment and Conservation for approval before any construction on the Project begins
- a Benefits Policy and associated Benefits Plan;
- an Impact and Benefits Agreement with the Innu of Labrador has been signed;
- a Women’s Employment Plan has been developed; and,
- operation Plans will be prepared and submitted annually.

Local and Regional benefits include:

- approximately 40 jobs created during construction and approximately 109 during operation;
- 5 years duration of employment;
- between $30 million and $60 million per year in total operating costs, much of which will be accrued to the Province of Newfoundland and Labrador;
- close working with the Innu of Labrador involving them in provision of labour, goods, and services;
- maximum use of qualified mining contractors and other services based elsewhere in the region, such as Labrador City, Wabush and Happy Valley-Goose Bay; and
- LIM is committed to the creation and implementation of employment equity practices to promote recruitment, training, and advancement of qualified visible minorities and women.

Issues Scoping

LIM conducted an extensive issues scoping process in relation to the Project, which included consultation with appropriate regulatory agencies, the public, and Aboriginal groups, in order to identify the potential environmental issues associated with it. The EIS includes consideration of the environmental effects of the proposed Project, including the potential effects of each of its components/phases and any of these predicted environmental effects is also evaluated. Mitigation measures which are technically and economically feasible have been incorporated into Project design and planning and additional VEC-specific mitigation has also been identified and proposed as required and appropriate.

Valued Environmental Components

Valued Environmental Components identified in the Guidelines and discussed in the EIS include Employment and Business, Communities, Fish and Fish Habitat, and Caribou.

Fish and Fish Habitat

The potential effects to fish and fish habitat have been considered and, with diligent application of mitigative and environmental protection measures, the residual and cumulative environmental effects are expected to be not significant under definitions for environmental assessment. LIM will adhere to the following mitigation measures to reduce or eliminate adverse effects on fish and fish habitat:

- vegetated buffer zones;
- sediment and erosion control measures;
- proper wastewater management measures;
- proper solid and liquid waste management measures;
- proper handling of petroleum products (oils, grease, diesel, hydraulic and transmission fluids), which will be stored a minimum of 100 m from any bodies of water and on level terrain and in accordance with applicable regulations;
- implementation of emergency response equipment and training to respond to spills and other unplanned events;
- blasting, when conducted, will be in accordance with applicable provincial and federal regulations to protect surface water features; and
- a no-fishing policy for workers will be implemented to protect local fisheries resources.

Follow-up and monitoring measures that will be applied to ensure compliance with provincial and federal regulations and to verify the impact predictions include:

- water quality monitoring under provincial and federal approvals and regulations;
- Environmental Effects Monitoring (EEM) under provincial and federal approvals and regulations.

Caribou

The Project may affect caribou, which occasionally migrate and/or occupy this area, through changes in habitat availability or effectiveness, changes in movement patterns, and increased mortality through influences affecting predation/poaching/hunting and vehicle collisions. To further document the status of caribou in the Project area, LIM undertook an aerial caribou survey with representatives of the Department of Environment and Conservation Wildlife Division in May 2009, including the documentation of potential caribou habitat, the presence of any caribou or other wildlife within a 50 km radius of the Project area, the collaring of one female caribou, collection of tissue for DNA analysis and ecotype affiliation, if possible, and a collection of measurements. A copy of the supporting document has been submitted to, and reviewed by, the Department of Environment and Conservation Wildlife Division.

In order to mitigate potential effects of the Project on caribou, activities during all phases of the Project will be planned with three main considerations:

- The recently completed caribou survey (May 2009) is considered inconclusive regarding the determination of the ecotype of caribou which were present in the project area. As such, LIM will undertake a caribou mitigation strategy which protects all caribou, including the potential for sedentary caribou to exist, although their presence/absence in the project area is currently unconfirmed. Additional associated survey data, such as outstanding DNA analyses, satellite collar data, and ongoing monitoring are anticipated to be of assistance in the near future in the determination of caribou type. LIM proposes that the mitigation strategy and supporting data be re-assessed at the end of Year 1 of operation for appropriateness and effectiveness including clarification of caribou ecotype;

- In the event that caribou are observed within the Assessment Area or in the vicinity of Project activities, a set of procedures will be incorporated to reduce or eliminate disturbance and encounters with caribou; and
- Any activity that may potentially affect caribou habitat or mortality in some manner will be implemented with appropriate mitigation regardless of whether caribou are actually present.

Specific mitigation measures have been developed for both the woodland and migratory caribou ecotypes, and these mitigation strategies will be implemented in close collaboration with the Provincial Wildlife Division. Details for both mitigation strategies are provided in Section 7.2.5.

Applying the mitigation measures outlined for each caribou ecotype will reduce adverse environmental effects. Thus, residual and cumulative environmental effects on caribou, whether from a migratory herd or a possible woodland herd, are determined to be “not significant”.

Employment and Business

Employment and Business was chosen as a VEC based on public concern that economic benefits accrue to local communities, Labrador and the Province as a whole. This includes benefits to the population and economy as a whole, and to under-represented groups.

It has been determined that the Project will make a contribution to the further economic development of the Province and, in particular, Labrador, by:

- Providing full and fair opportunity and first consideration for the people, employment, businesses and companies of the Province to participate in and benefit from the Project;
- providing local employment and incomes during construction and operation;
- providing local business during construction and operation;
- increasing the capacity and skills of local labour force and businesses; and
- facilitating further mining development by putting in place these new labour and business capabilities and new transportation infrastructure, thereby making existing and new Labrador projects more competitive globally.

These net positive effects will be particularly valued given the recent economic downturn in Labrador West.

No significant adverse residual or cumulative effects are expected on Employment and Business.

LIM will monitor Project employment and expenditures, including the proportions of work going to Labrador, the Innu of Labrador, women and the Province as a whole. This information will be compiled on an annual basis and made available to government upon request. Provisions respecting the employment of women have been specified in the Women’s Employment Plan.

Communities

Communities are another aspect of the socio-economic environment that may be affected by the Project. The communities most likely to be affected are the primary places of residence of the Project labour force: Labrador West, Upper Lake Melville, Schefferville, and Kawawachikamach. The construction, operation, and decommissioning phases of the Project will have negligible adverse short-term direct effects on the communities of Labrador West, Upper Lake Melville, Schefferville, and Kawawachikamach.

The monitoring of demands on community services and infrastructure is the responsibility of the relevant government departments and agencies, as part of their normal planning processes. LIM will assist by liaising with them, as requested, and through the timely provision of information about Project activity and plans.

Conclusion

Significant adverse environmental effects are not predicted in relation to the Project's construction, operation, or decommissioning phases, or as a result of accidental events. The Project is therefore not likely to cause significant adverse environmental effects. A monitoring and follow-up program will be undertaken to assess the accuracy of the effects predictions made in the environmental assessment, and to determine the effectiveness of mitigation measures.

The Project will result in considerable socio-economic benefits accruing to the Province of Newfoundland and in particular Labrador. It will create considerable direct and indirect employment and business opportunities, and contribute substantially to the economy of the local area of Labrador, as well as that of the Province of Newfoundland and Labrador as a whole. LIM is committed to providing full and fair opportunity and first consideration for the people, employment, businesses and companies of the Province to participate in and benefit from the Project.

TABLE OF CONTENTS

LIST OF APPENDICES

LIST OF TABLES

LIST OF FIGURES

1.0 INTRODUCTION

1.1 Project Overview

The Schefferville Area Iron Ore Mine (Western Labrador) (the Project) is being developed by Labrador Iron Mines Limited ("LIM"), which is a wholly owned subsidiary of Labrador Iron Mines Holdings Limited, a public company listed on the Toronto Stock Exchange.

LIM has identified eight separate ore grade deposits located across a 100 km strike length, all in Labrador. The four central deposits are located within 10 km of the location of Silver Yard, Labrador, which is some three km west of Schefferville, Québec.

The Project involves development and mining of 'direct shipping' iron ore deposits in the northwest of western Labrador in an area of previous iron ore mining. High grade hematite iron ore will be mined from a number of identified deposits on sites where similar mining has taken place in the past. Mining will be carried out in a sequential manner using conventional open pit mining methods. When mined, the rock will be beneficiated at a single location in Labrador. The resultant products will include lump ore and sinter fines for direct rail transport to port and shipping to end users in Europe and possibly Asia.

The size of the operation proposed for this Project is small by world-wide iron ore standards and small compared to other iron ore projects carried out elsewhere in the Province and previously in this area. The Project is based on previously developed brownfield sites and this and the small size will ensure that the adverse social and environmental impacts of the Project will be both limited in range and in time.

The Project benefits from and relies upon the significant level of pre-existing infrastructure (open pits, roads, rail beds, etc.) put in place for previous mining operations that were subsequently closed during the 1980s. The existence of these infrastructure facilities, the majority of which are still in sound operational conditions, will ensure that new build facilities, including the camp and semi-portable mobile buildings, will be kept to a minimum with the ensuing reduction in the level of surface and ground water disturbance typically associated with this type of mining operation.

One of the key items of current operational infrastructure is the existing 200 km railroad line between Emeril Junction, Labrador and the town of Schefferville, which has been in continuous use since 1954, carrying iron ore until 1982 and passenger and freight since that time. Only the 4.0 km of track connecting the Silver Yard to the existing rail line requires having track re- laid on an existing bed. As and when required, LIM will be closely involved with others in any necessary upgrade of this track to ensure that the railroad has the capacity and the operational capability to handle all the expected volume of both outbound iron ore as well as inbound freight to meet all end users expectations.

LIM recognizes its responsibilities to a large number of stakeholders particularly those within the Province of Newfoundland and Labrador. Whilst the proximity of the Project location to other parts of Canada outside of the Province will influence aspects of the operational characteristics of the Project, LIM is committed to maximizing the benefits of the Project to the Province and to its peoples consistent with maintaining the financial viability of the Project. LIM also commits to minimizing the impacts of the Project on both the physical and the social environments and will at all times act within or surpass the requirements of the various regulations and guidelines covering these matters. LIM also commits to maintaining an open dialogue with all stakeholders on these matters.

A major component of LIM's commitment will be to ensure that the largest proportion possible of jobs and services are sourced from the communities of Newfoundland and Labrador. LIM has signed an Impact Benefits Agreement (IBA) with the Innu Nation of Labrador. In addition, Memoranda of Understanding have been signed with the Innu Nation of Matimekush-Lac John and the Naskapi Nation of Kawawachikamach and extensive community consultation has been conducted with the nearby communities, as well as communities in western and central Labrador (Labrador City, Wabush, Happy Valley-Goose Bay). These consultations and agreements will ensure a close working relationship with the Innu of Labrador with respect to their involvement in the provision of labour, goods, and services. LIM is also aware of the impacts of the current world-wide economic downturn on communities within the Province, particularly those associated with the resource industries in Labrador West and, in developing the Project, LIM seeks to encourage economic development in this area of Labrador and will provide a full and fair opportunity and first consideration for the people, employment, businesses and companies of the Province to participate in and benefit from the Project.

It is LIM's intention to mine and beneficiate two of the four central deposits, James and Redmond initially. Therefore these two deposits are the subject of this Project and the Environmental Impact Statement (EIS). LIM expects to submit further applications in future years to next develop the Houston and Knob deposits (also part of the central cluster), and then subsequently the more distant deposits.

LIM has selected this phased approach to permit early commencement of production to bring forward the economic benefits of the Project to the Company and to the Province. Secondly, this approach allows LIM to use both the additional knowledge and the financial benefits of the initial phase to permit a thoroughly considered and economically feasible approach to the development of the additional deposits in which LIM holds interests.

Reasoned analysis suggests that attempting to bring all eight deposits located over a 100 km strike distance under a single application would significantly extend the baseline analysis and detailed engineering necessary, with a subsequent increase in the time-frame required, and that in itself would then render the progression to this study phase and hence to a production decision as highly unlikely. LIM considers that this phased approach is consistent with sound economics and good industry practice and is the only viable course of action likely to ensure these deposits are developed for the benefit of all stakeholders.

1.2 The Proponent

The parent company (Labrador Iron Mines Holdings Limited) of the Proponent, Labrador Iron Mines Limited, is an Ontario registered company trading on the TSX Exchange under the symbol of "LIM" and "LIM.WT" and can be contacted at:

Proponent:

Labrador Iron Mines Limited
Suite 700-220 Bay Street
Toronto, Ontario
M5J 2W4
www.labradorironmines.ca

Chairman and Chief Executive Officer: Mr. John Kearney
Director, President and Chief Operating Officer: Mr. Bill Hooley
Phone: (647) 728-4125
Fax: (416) 368-5344

Newfoundland Office: 2 Baird’s Cove
St. John’s, NL
A1C 5M9

Labrador Office: 15 King Crescent
Happy Valley-Goose Bay, NL
A0P 1C0

Environmental Assessment Contacts: Linda Wrong, P. Geo
Vice President, Environment and Permitting
Suite 700-220 Bay Street
Toronto Ontario
M5J-2W4
Telephone: 647-728-4115

1.3 Regulatory Framework

1.3.1 Provincial Environmental Assessment Process

The Project is subject to an environmental assessment that meets the requirements of the Government of Newfoundland and Labrador as outlined under the *Environmental Protection Act*. Following release from the environmental assessment process, the Project will be subject to various environmental approvals and other regulatory requirements.

The Project was registered pursuant to Section 3 of the Newfoundland and Labrador Regulations 54/03, Environmental Assessment Regulations, 2003, under the *Environmental Protection Act*, SNL 2002 Ce-14.2, on May 5, 2008. Following both government and public review, the Minister of Environment and Conservation determined on August 13, 2008 that further environmental assessment (an Environmental Impact Statement (EIS)) was required for the proposed Project. Consistent with Part 10 Environmental Assessment of the *Environmental Protection Act*, the Minister appointed an Environmental Assessment Committee with representation from all relevant provincial and federal government departments and agencies to provide advice on scientific and technical matters related to the proposed undertaking. The Environmental Assessment Committee includes representation from:

- Environmental Assessment Division, Department of Environment and Conservation;
- Water Resources Management Division, Department of Environment and Conservation;
- Pollution Prevention Division, Department of Environment and Conservation;
- Wildlife Division, Department Environment and Conservation;

- Policy Planning and Evaluation Branch, Department of Human Resources, Labour and Employment;
- Strategic Planning Policy Coordination, Department of Natural Resources;
- Policy and Planning, Department of Labrador and Aboriginal Affairs;
- Environmental Protection Branch, Environment Canada; and
- Oceans and Habitat Management Branch, Fisheries and Oceans Canada.

As per Section 53 of the *Environmental Protection Act*, the Environmental Assessment Committee prepared guidelines for the EIS for the Project. These guidelines were also subject to a 40-day public review period, as per Subsection 59(1) of the *Environmental Protection Act*. Public meetings were conducted during this 40 days review period in the communities of Happy Valley-Goose Bay, Labrador City-Wabush and Schefferville. After approval from the Minister of Environment, the guidelines were provided to LIM on December 10, 2008. These guidelines, provided in Appendix A, established the framework for preparing the EIS by outlining the format and information requirements. The EIS was initially submitted to government in December 2008. Regulatory agencies subsequently reviewed the EIS and the Minister of Environment and Conservation requested additional information and clarifications from LIM in March 2009. In response to these comments and requests, this EIS has been revised and resubmitted to government. A Table of Concordance is also provided in Appendix A.

1.3.2 Environmental Authorizations

Following release from the provincial environmental process, the Project will require a number of approvals, permits and authorizations prior to Project initiation. In addition, throughout Project construction and operation, compliance with various standards contained in federal and provincial legislation, regulations and guidelines will be required. LIM will also be required to comply with any other terms and conditions associated with the EIS release. Potential environmental authorizations as they relate specifically to the Project description are discussed in detail in Section 2.4.

1.4 Environmental Impact Statement Purpose

The EIS presents information about the Project and the results of the environmental assessment conducted for the Project. This environmental assessment addresses the potential environmental effects on communities, economy, business, fish and fish habitat, and caribou. The assessment process also considers Project feasibility, the Project’s water budget, and potential effects to air quality.

The EIS fulfills provincial environmental assessment requirements and will be used by the Minister of Environment and Conservation, in consultation with Cabinet, to determine whether the Project’s environmental effects are acceptable.

1.5 Document Organization

Information on the study team and brief descriptions of each team member’s expertise and experience are provided in Appendix B.

The document is organized as follows:

Executive Summary Identifies the Proponent, and provides a synopsis of the Project description, predicted environmental effects, mitigation measures, residual and cumulative environmental effects, and proposed monitoring and follow-up programs. The summary provides an overview of the EIS conclusions and allows the reader to focus immediately on important subjects. Tables of Concordance with the EIS Guidelines and requirements are provided in Appendix A to aid reviewers in ensuring that all requirements have been fulfilled.

Chapter 1 Identifies the Proponent, describes the purpose of the EIS, outlines the regulatory framework for the environmental assessment, and describes the EIS organization.

Chapter 2 Describes all components of the Project including: the Project location and study area; the site history; the purpose of the Project, including rationale and feasibility; alternatives for carrying out the Project; permits, and approvals and authorizations that may be required.

Chapter 3 Includes physical features of the Project; schedule for construction and implementation; details on operation and maintenance; and decommissioning information. The chapter concludes with a discussion of environmental management planning for the Project.

Chapter 4 Describes the existing environment of the Project area including: physical, biological, and socioeconomic. Data availability and gaps, and predicted future environmental conditions in the absence of the Project are also discussed.

Chapter 5 Describes the scope of the assessment, including details on the issue scoping process and the issues and concerns raised during public consultation sessions and other scoping activities. The Valued Environmental Components (VECs), as determined from the EIS Guidelines and the issues scoping exercise, are identified.

Chapter 6 Describes the Aboriginal Consultation that has been conducted to date by LIM, including a listing of issues identified, and where Impact Benefits Agreements or other agreements, such as Memoranda of Understanding have been reached.

Chapter 7 Discusses environmental effects assessment for each VEC, including fish and fish habitat, caribou, employment and business, and communities, and addresses accidental events that could occur.

Chapter 8 Provides information on environmental protection including issues such as VEC-specific mitigation, emergency response/contingency plans, environmental monitoring and follow-up programs, and rehabilitation and environmental protection plans.

Chapter 9 Presents concluding statements regarding the anticipated environmental effects that may result from the Project, a summary of specific mitigation measures and monitoring and follow-up commitments.

Chapter 10 References and personal communications cited in the EIS are provided.

Appendices Supporting materials are provided in the appendices.

1.5.1 Other Related Documentation

A number of documents have been prepared in relation to the Project and previous projects in the area. A bibliography listing of these documents is provided in Appendix C. These documents have either been previously submitted to the Department of Environment and Conservation in relation to previous environmental assessments for the Project, or are available from LIM.

2.0 PROPOSED UNDERTAKING

2.1 The Project

2.1.1 Project Location

The Project is within the Labrador Trough Iron Range. The Project includes the re-activation and development of James North and South, and Redmond 2B and 5 mineral deposits which are located in Western Labrador (Figure 2.1). The James deposits are located approximately one km south of the Silver Yard area. The Redmond deposits are approximately 8 km south of the James deposit. The single beneficiation area, where rock will be crushed and washed will be situated at the Silver Yard area in Labrador. A temporary camp to accommodate workers will be constructed nearby.

The Project has an estimated five-year operational life and is located within an area that has been previously mined and disturbed. The deposits are accessible by existing gravel roads. The James property straddles an existing road to the Redmond property to the south, and continues to the Menihek hydro electric dam, where the road is terminated.

2.1.1.1 Natural Environment

The Project area is situated at the southern edge of the forest tundra (Waterway et al. 1984; Hare 1950; Hustich 1949). The James and Redmond properties contain varied land classes from exposed tundra and exposed bedrock with lichen and scattered trees and shrubs, to low wetland areas (including bogs and fens). Intermediate land classes consist of varied forest types with spruce-moss and spruce-lichen predominating; merchantable timber is not known to occur in the area. Extensive surface disturbance exists on these properties as a result of previous mining. In such areas, alder and other vegetation associated with disturbed areas can occur.

The terrain is comprised of parallel ridges and valleys trending northwest to southeast, with bare rock exposures and barrens. At the James North and James South deposits, approximately 50 percent of the surface area has been disturbed as a result of previous mining activities. The Redmond sites are located to the south of the James' property and extensive past surface disturbance (approximately 90 percent) has occurred, including the presence of flooded abandoned mine pits, a former rail bed, turning yards and stockpiles of mine waste rock and uneconomical ore materials.

2.1.1.2 Existing Site Features

A historical mining pit, the Ruth Pit, will be utilized as a reject fines disposal area for the washwater that originates from the Silver Yard beneficiation area.

There is an existing transmission line that was established during the former operations, and it transmits power from the Menihek Generating Station, now owned by Newfoundland and Labrador Hydro. The regional grid crosses the Redmond property and is located less than 2 km away from the James property along existing roadways.

Existing roads and rail services will be used to access the Project and to transport equipment and materials.

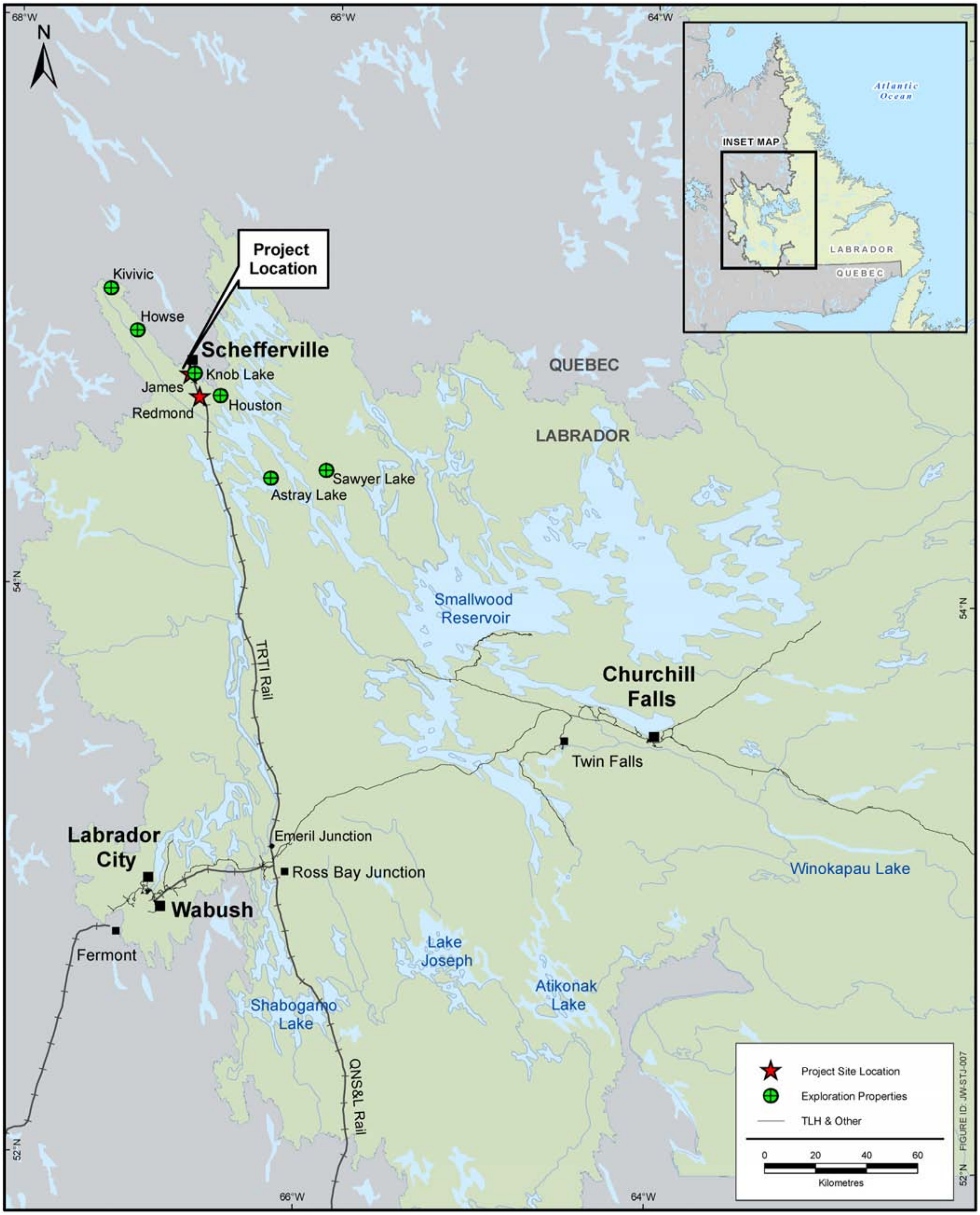


Figure 2.1 Project Location

2.1.2 Site History

Written references to mineral occurrences of the Schefferville area (originally known as Knob Lake) were first included in the diaries of missionary Louis Babel in 1854. Using those references, Albert Peter Low (A.P. Low) of the Canadian Geological Survey (CGS) began detailed mapping of the area in 1892 and continued the work in 1895/96. During that period, Low published a report which highlighted the existence of large iron ore deposits in the area.

Guided by Low's report, the Labrador Mining and Exploration (LME) Company began exploration in the area sometime around 1936. LME was subsequently taken over by Hollinger North Shore Exploration Company (Hollinger), which was later joined by M.A. Hanna Company (M.A. Hanna).

Under the direction of Hollinger and M.A. Hanna, an intensive exploration program was undertaken in the Schefferville area between 1945 and 1949. With the involvement of those two companies and a number of other entities, the Iron Ore Company of Canada (IOC) was officially incorporated in 1949.

During the period between 1950 and 1954, IOC constructed the 568 km rail transportation system between Schefferville and the shipping and receiving port of Sept Iles, Québec, as well as the iron ore processing and maintenance support facilities at the mine site and a power station at Menihek.

Mine workers were originally accommodated in the near-by temporary town of Burnt Creek. Permanent housing and office accommodations were subsequently constructed in the town of Schefferville, following the start of ore production activities. The population of Schefferville subsequently grew to a total of about 4500 persons during the peak mining years. Schefferville mining operations were terminated in November of 1982.

Between 1954 and 1982, mines in the Schefferville area produced in excess of 150 million tons of iron ore for world markets. At the time of closure, an additional resource of approximately 200 million tons of iron ore remained in individual deposits in Labrador, located in proximity to the previously operated mines. These include the James and Redmond deposits on which initial mining or development activities had been undertaken by IOC.

2.1.3 Project Purpose and Rationale

The Project will see the reactivation of two historical mine areas, the James and Redmond properties (the Project), located in Labrador near the Silver Yard area. Although the mine operations will involve the extraction of iron ore, the Project will be smaller than the one that was active from 1954 to 1982 and will operate under current regulations and environmental protection standards and industry best practices.

The purpose of the Project is to satisfy market demand for high-grade direct shipping iron ore products.

The successful start up of LIM's direct shipping iron ore Project will provide positive economic stimulus to the economy of Western and Central Labrador and contribute to long-term economic stability in the area.

In the construction phase, the Project could generate up to 40 jobs, with that number increasing to approximately 109 on an ongoing production basis during operations. The economic impact of such employment and contracting business on the surrounding communities would be positive and lead to the development of other support and service sector jobs in Western and Central Labrador.

Local and regional benefits include:

- construction and operation phase jobs;
- between $30 million and $60 million per year in total operating costs, much of which will be incurred within the Province of Newfoundland and Labrador;
- close working relationship with the Innu of Labrador involving the provision of labour, goods, and services;
- maximum use of qualified mining contractors and other services based elsewhere in the region, such as Labrador City, Wabush and Happy Valley-Goose Bay; and
- commitment by LIM to the creation and implementation of employment equity practices to promote recruitment, training, and advancement of qualified visible minorities and women.

In terms of world-wide mining operations, the Project is modest in size when compared to historical iron ore mining operations in the area, as well as to other existing iron ore mining operations in Labrador. The impact of the Project on these other operations will therefore be equally small. Certainly with the distances involved between LIM's Project and these other mining operations, there will be no direct physical impact.

The most obvious indirect impact will be in the area of availability and employment of suitable personnel. However again, the LIM Project is relatively small and the call on the available pool of skills will be quite limited. In consideration of the current and projected downturn in the economic climate, employment into the LIM Project from throughout Labrador will go some way to mitigating the difficulties being felt in these areas and particularly in Western Labrador.

It is LIM's intention to use contractors to carry out the majority of both the construction and operational aspects of the Project and to source these contractors from within the Province and particularly from within Labrador whenever possible. At present, there appears to be sufficient contracting capacity to meet LIM's requirements without prejudicing the operations of any of the current mining companies. Again the small size of LIM's operations compared to these other operations is a key determinant in this analysis. Additionally, by choosing to use contractors with their noted capability to speedily reduce and expand the size of their operations as circumstances change, LIM is likely to have an even more minimal impact on the future operations of these other companies.

The general supply of services and consumables will also be very limited given both the small size and relative simplicity of the mining and beneficiation processes to be used. Again, it is considered that the addition of the services and consumables into the supply train will have a negligible indirect impact on other end users.

It is therefore concluded that the introduction of the LIM Project will have only a very minor indirect impact on these other operations and will have no impact on their future viability.

As the Project develops, it is expected that LIM will seek and then be granted a number of Mines Leases and Crown Titles on which to carry out the Project. It will be LIM's fundamental intention to develop the mineral resources located within these leases. In those areas wherein the existing Mineral Licenses over which the requested Crown Titles are held by others, it is understood that the mineral license holders' rights retain precedence and, as such, LIM will respect these inherent rights and applicable legislation.

It is possible that some surface use leases will be located over land currently held by others under Mineral Rights Licences. The extent of these surface rights will be limited to the areas required for the efficient operation of the Project and such an arrangement is normal within the Province. Based on a review of regional and local geology, it is not considered that any of these potential areas will be the subject of future exploration and this, in combination with LIM's respect of the rights of Mineral License holders, will therefore not create any direct or indirect impact on the viability of exploration and development activities by other parties.

There will be some direct impact of the Project on the operations of the various railroad facilities that exist in Western Labrador and Québec. Again given the small size of the Project, these are expected to be minimal. This Project, as envisaged within this Study, is expected to generate a maximum of 1.5 million tonnes per annum of iron ore traffic. This compares to some 45 million tonnes per annum that is forecast to be handled through the Port of Sept-Îles, assuming that all announced expansions and new developments do eventually materialize. There appears to be a general measure of knowledge that the capacity of the lower section of this rail transport corridor from Emeril Junction to Sept Isles has a current capacity in the region of 60 million tonnes or as much as 15 million tonnes in excess of this predicted expanded production. The addition of LIM's 1.5 million tonnes per annum into this total production scenario is therefore to be considered as minimal.

The capacity of the upper section of this rail corridor, entirely within the Province, was demonstrated during periods of previous operations, to be in excess of 10 million tons per annum. Currently, there is no iron ore movement on this section and reviews carried out for LIM indicate that the haulage of the forecast Project capacity on this section of the railroad can be readily achieved. It will be necessary to carry out some ongoing upgrades to the rail track to maintain this capacity and these are being addressed with the operators. It is possible that other new mining operations will also wish to use this section of track for iron ore transport. To the best of LIM's knowledge, the confirmation of intent, timing and loadings for these additional operations have not yet been reached. If and when these timings and loadings are confirmed then a review of upgrade work required will be made. Nevertheless, it is predicted that the total volume to be potentially carried on this upper section will be less than that achieved by the previous mining operations in the period 1954 to 1982.

LIM has been holding discussions with railroad and port operators for an extensive period. To date these have resulted in a number of confidential Memoranda of Understanding regarding the supply of such services.

During 2008, LIM reached agreement with the railroad operators TRH and QNSLR, and with port and stevedoring companies, regarding the transport, unloading and storage of its bulk sample products over the railroad lines and port facilities and during 2008 these bulk sample tonnages were transported from the Silver Yard site to port. LIM expects that, subject to completing ongoing commercial negotiations, these arrangements will be extended to cover the periods covered by the Project production scenario.

LIM does note that each of the railroads over which its iron ore products will need to be transported are covered by the application and provisions of the *Canada Transportation Act* 1996, and accordingly the operators are required under the terms of that *Act* to provide a level of service.

LIM continues to be in discussion regarding ongoing port facilities under various Memoranda of Understanding, and expects to conclude successful negotiations with various port operators to provide a sufficient level of stevedoring service in the general Port of Sept-Îles area well before the commencement of commercial production. LIM also expects to extend these agreements to cover the expected life of this Project.

2.2 Environmental Management and Corporate Responsibility Policies

2.2.1 Health & Safety Policy

LIM and its management are committed to conducting operations in a professional manner in pursuit of excellence in business practices and in compliance with all applicable health and safety legislation. LIM has adopted a Health and Safety Policy to express its commitment to its own personnel and its contractor workforce. LIM is further committed to conducting its operations in a manner that delivers maximum health and safety protection of workers as well as the general public.

In support of excellent business practices, LIM will provide positive avenues for dialogue, communication and training and will work in cooperation with employee representatives from health and safety committees, supervisory personnel, workers and contractors to ensure proper understanding and competency to safely and efficiently perform the work. LIM will work in cooperation with government representatives and regulatory agencies on all matters related to health and safety compliance.

Routine monitoring and reporting of health and safety performance will form a key part of LIM stewardship and management systems. Where appropriate and necessary LIM will take proactive corrective action to ensure health and safety objectives are attained in support of the overall corporate plan and related regulatory obligations. LIM will include health and safety performance as an important factor of its management and employee review process and will provide training, resources and staffing so that all employees, contractors and suppliers understand, and are able to conduct their work, in accordance with this Health and Safety Policy.

All LIM executives and their employees and contractors will fulfill their duties and exercise their individual and collective responsibilities in a manner that supports defined health and safety goals and clearly demonstrates compliance with LIM policies, procedures, applicable laws, regulations and industry standards.

2.2.2 Environmental and Social Responsibility Policy

LIM and its management are committed to conducting operations in an environmentally and socially responsible manner. LIM has adopted an Environmental and Social Responsibility Policy to express its commitment to the environment and the local communities in which it works. This commitment to sustainable development is achieved through the undertaking of its programs in a manner which balances environmental, economic, technical, and social issues.

To implement this policy and its commitment to such principles and practices, LIM will apply appropriate pollution prevention principles and environmental risk management practices throughout its activities on its mineral properties.

LIM and its contractors will conduct their work and operate the facilities in compliance with all applicable laws and regulations. In the absence of legislation, LIM will apply professional best management practices to support environmental protection at all sites, minimize risks to human health and the environment, and achieve environmental protection to levels at or above industry standards or best practices. To support the development of responsible environmental laws, policies and regulations, LIM will work cooperatively with the local communities, industry and regulators.

LIM will develop and implement a Rehabilitation and Closure Plan in accordance with the *Newfoundland and Labrador Mining Act* that will advance long-term environmental recovery and provide suitable post-closure land-use incorporating consideration of the long-term vision of local communities. Where possible LIM will encourage economic and educational development in the communities, during Project assessment, development, operation and post-closure and will support initiatives to design and implement operating practices which advance the efficient sourcing and use of materials and energy.

LIM will include environmental performance as an important factor of its management and employee review process and will provide training, resources and staffing so that all employees, contractors and suppliers understand, and are able to conduct their work, in accordance with the Environmental Policy and Social Responsibility. To encourage continual improvement, LIM will conduct routine assessments of the Project to identify areas of non-compliance with the Environmental and Social Responsibility Policy, and create and implement corrective action.

LIM commits to the establishment of effective communications with employees, regulators, stakeholders and communities to address environmental and social concerns in a timely and effective manner.

2.2.3 Benefits Policy

LIM has established a Labrador Iron Mines Limited Newfoundland and Labrador Benefits Policy that will apply to LIM and to all Project contractors and subcontractors, and has developed a Benefits Plan (Appendix D) to implement the Benefits Policy. Labrador Iron Mines understands the importance of the Project to the Province of Newfoundland and Labrador and in line with the principles described in this policy will provide full and fair opportunity and first consideration for the people, businesses and companies of the Province to secure employment and to participate in and benefit from the business opportunities associated with the Project.

Specifically, LIM is committed to:

- the delivery of associated benefits, including employment, education, training and business and economic development to the Province and in particular to Labrador on a full and fair opportunity and first consideration basis;
- the encouragement and assistance of residents of the Province, and in particular of Labrador, to receive the education and training necessary to maximize their opportunities for employment, retention and advancement on the Project;
- the procurement of goods and services from within the Province and, in particular from Labrador, and provincial suppliers will be provided full and fair opportunity and first consideration for the supply of goods and commercial services to the Project on a competitive basis;
- the implementation of policies and practices in connection with the procurement of goods and services for the project that enhance economic and business opportunities in Labrador, including the identification and support of industry businesses that would generate long-term economic benefits to Labrador; and

- the provision of timely Project-related information to encourage the participation of all potential employees, businesses and contractors in the economic opportunities of the Project.

In addition LIM will also comply with the undertakings, commitments and obligations of the Impact Benefits Agreement (IBA) entered into with the Innu Nation of Labrador, and with the provisions of LIM's Women's Employment Plan (Appendix D).

2.3 Alternatives

The Project is located in a previously disturbed area and was conceived based on the use of infrastructure developed during the historical IOC operations. As these considerations formed the basis for the Project initiation and design, it is recognized that there is no preferred alternative to the overall Project and therefore there will be no detailed alternatives analysis. However, within the Project, one aspect for which alternatives were available and evaluated was for the reject fines storage options.

2.3.1 Reject Fines Storage Area

The mined ore will be taken to the Silver Yard area for beneficiation, which involves the crushing, screening and washing of the rock, and which does not involve the use of any chemicals. The resulting washwater consists of water and fine rock material (reject fines) and, mineralogically, this material is the same as the surrounding rocks. As presented in LIM's Registration Document, dated April 28th, 2008, the reject fines will be produced at an estimated rate of 21 percent of feed. As presented in the Registration document, the preferred option involved the deposition of these reject fines into nearby historically mined pits until such time as the new mine pits are decommissioned. The four original options previously presented in the registration document included:

- an open pit at the Ruth site;
- an open pit at the Wishart Site;
- a small on-land facility to the north of the James North area in a previously excavated valley; and
- open pits at the Redmond site.

Since the Registration document was submitted, LIM undertook additional environmental and engineering studies, including the gill netting of the identified historical pits to assess for the presence or absence of fish and fish habitat. These studies were undertaken further in consideration of extensive communications with DFO. Upon completion of this work and preparation and submission of the resulting reports, DFO reviewed this information and, in an e-mail dated September 25, 2008 stated "Based upon the results, Habitat Management has determined that the historic pits, specifically Redmond Pit 1, Redmond Pit 2, Wishart Pit, and Ruth Pit, do not constitute productive fish habitat that supports, or potentially supports, a commercial, recreational or aboriginal fishery" (Appendix E).

Although preliminary consideration was given for the deposition of the reject fines to the potential use of an on land v-shaped valley, located to the north of the James North deposit, this option was discontinued based on the:

- potentially higher risk posed by the requirement for a dam on the open side of the valley;
- position of this valley at an up gradient location relative to where workers would be mining at the James North pit; and

- requirement for additional water management in an on land area.

Hydrological studies conducted by WESA of the Project area, including Ruth Pit (Section 4.1.4), confirm that Ruth Pit has the capacity to meet the water demands required for the reject fines deposition for the life of the mine operation. Based on this information, in combination with the determination from DFO, and in consideration that the Ruth Pit is an existing man-made feature, LIM concluded that the deposition of the reject fines at this location presented the least potential for environmental impacts.

2.4 Regulatory Approval Requirements

Following release from the provincial environmental assessment processes, the Project can be expected to require a number of approvals, permits and authorizations prior to Project initiation. In addition, throughout Project construction and operation, compliance with various standards contained in federal and provincial legislation, regulations and guidelines will be required. The Project will also be required to comply with any other terms and conditions associated with the EIS release.

A list of potential regulatory approvals and compliance standards that may be required for the Project is provided in Table 2.1. All appropriate permits, authorizations and approvals will be obtained for the Project. Where appropriate, authorizations will be obtained by individual contractors.

Table 2.1 Environmental Authorizations that May be Required for the Schefferville Area Iron Ore Mine

Permit, Approval or Authorization Activity	Issuing Agency
Federal (under review)	
• Authorization for Works Affecting Fish Habitat, **or** • Letter of Advice regarding Protection of Fish Habitat	Fisheries and Oceans Canada
Provincial	
• Release from environment assessment process • Approval under *Rail Service Act* Govt. of NL	DOEC – Environmental Assessment Division
• Permit to Occupy Crown Land	DOEC – Crown Lands Division
• Certificate of Environmental Approval to Alter a Body of Water - Culvert Installation - Fording - Pipe Crossing/Water Intake (reject fines deposition) - Stream Modification or Diversion - Other works within 15 m of a body of water (site drainage, dewater pits, settling ponds) • Certificate of Approval for Water Supply System • Water Use License - Beneficiation wash water	DOEC – Water Resources Management Division
• Certificate of Approval for Construction and Operation • Industrial Processing Works • Approval of MMER Emergency Response Plan • Approval of Waste Management Plan • Approval of Environmental Contingency Plan (Emergency Spill Response) • Approval of Environmental Protection Plan	DOEC – Pollution Prevention Division
• Permit to Control Nuisance Animals	DOEC – Wildlife Division
• Pesticide Operators License	DOEC – Pesticides Control Section

Permit, Approval or Authorization Activity	Issuing Agency
• Blasters Safety Certificate • Magazine License • Certificate of Approval for a Sewage/Septic System • Approval for Storage & Handling Gasoline and Associated Products • Temporary Fuel Cache • Fuel Tank Registration • Approval for Used Oil Storage Tank System (Oil/Water Separator) • Fire, Life and Safety Program • Certificate of Approval for a Waste Management System • Food Establishment License	Government Service Centre (GSC)
• Approval of Development Plan, Closure Plan, and Financial Security • Mining Lease • Surface Rights Lease • Quarry Development Permit	DNR – Mineral Lands Division
• Operating Permit to Carry out an Industrial Operation During Forest Fire Season on Crown Land • Permit to Cut Crown Timber • Permit to Burn	DNR – Forest Resources
• Approval for Operation of Lunchroom/Washroom Facilities	DH – Public Health Inspector

3.0 PROJECT DESCRIPTION

Mining excavations will occur at James North, James South, Redmond 2B and Redmond 5 deposits. The following section describes major project elements and activities that are the subject of this EIS. Beneficiation will take place at the Silver Yard area and a 4.0 km rail spur will be re-established along the existing railbed in Labrador.

3.1 Project Features

The primary features of the Project are the open pits, the beneficiation site at the area known as Silver Yard, the railway spur line re-establishment, a project camp, and the access roads. Other features will include laydown areas and waste rock disposal sites. The Project features are shown on Figure 3.1.

3.1.1 Mineral Licenses

Two Mineral Rights Licenses in 71 claim units issued by the Government of Newfoundland and Labrador registered in the names of Labrador Iron Mines Limited are applicable to this Project. Details of licenses associated with the James and Redmond Deposits are provided in Table 3.1 and 3.2 and Figures 3.2 and 3.3. In addition, a surface lease will be applied for prior to the start of construction for the Silver Yard area.

LIM holds title to these Mineral Rights Licenses subject to the terms of an Agreement dated September 15, 2005 and as subsequently amended between Fonteneau Resources Ltd. and Energold Minerals Ltd. and LIM. These licenses are located in west Labrador covering approximately 1,775 hectares. The Project location and the location of the properties are shown on Figure 2.1.

The proposed development is to be executed in the mineral licenses registered to LIM and/or covered under the above mentioned Agreement, as well as some small areas of adjacent lands where the mineral licenses are registered to a third party, New Millennium Capital Corp. (NML). NML has acknowledged that these jointly held deposits will most likely be mined in accordance with the LIM mining schedule (see NML News Release 08-05, February 5, 2008, Appendix F). LIM is in discussions to negotiate some mutually satisfactory agreement with NML regarding the mining on the NML licenses and anticipates that agreement will be successfully concluded and, as such, the proposed development area covers this larger area.

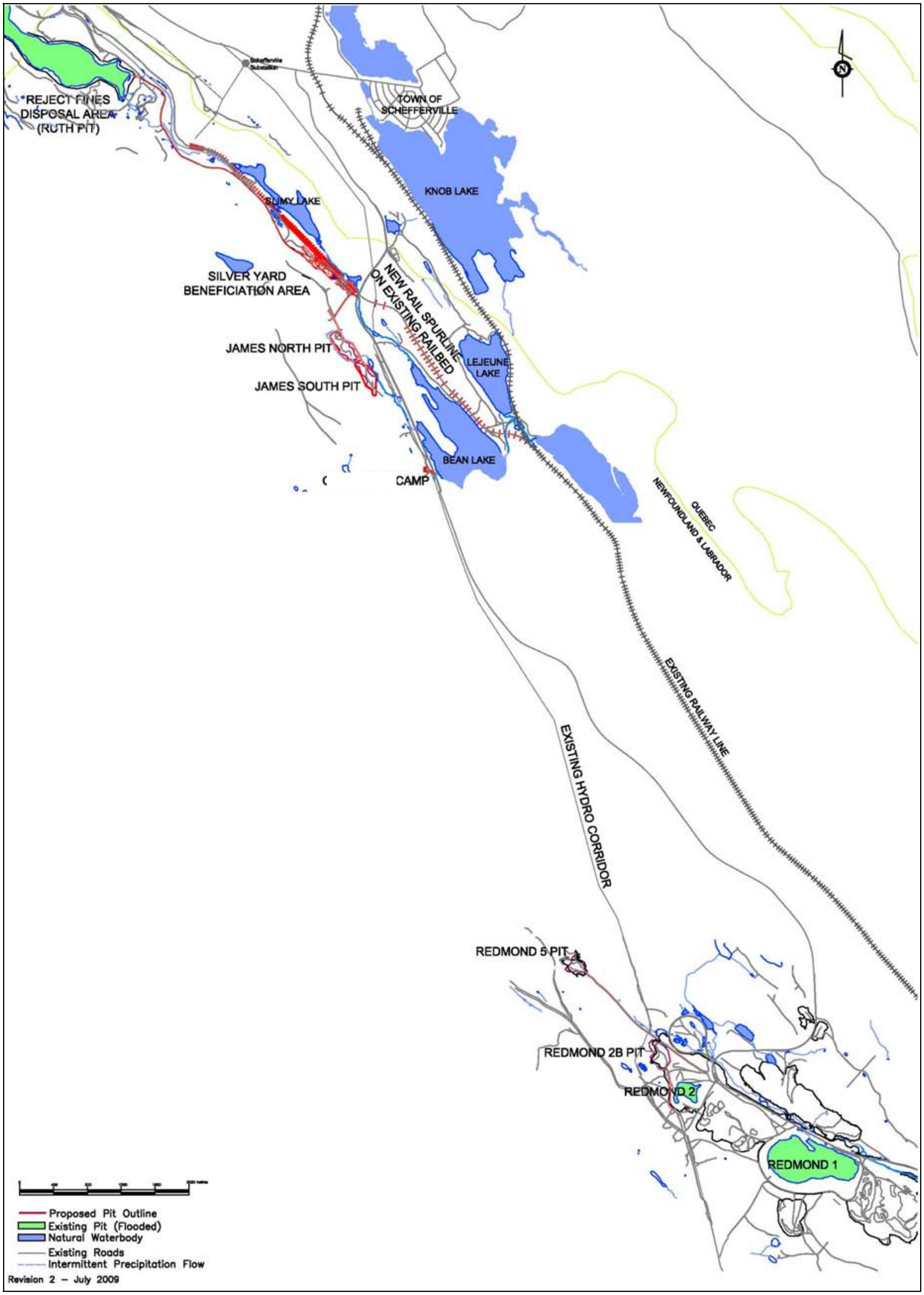


Figure 3.1 Project Features

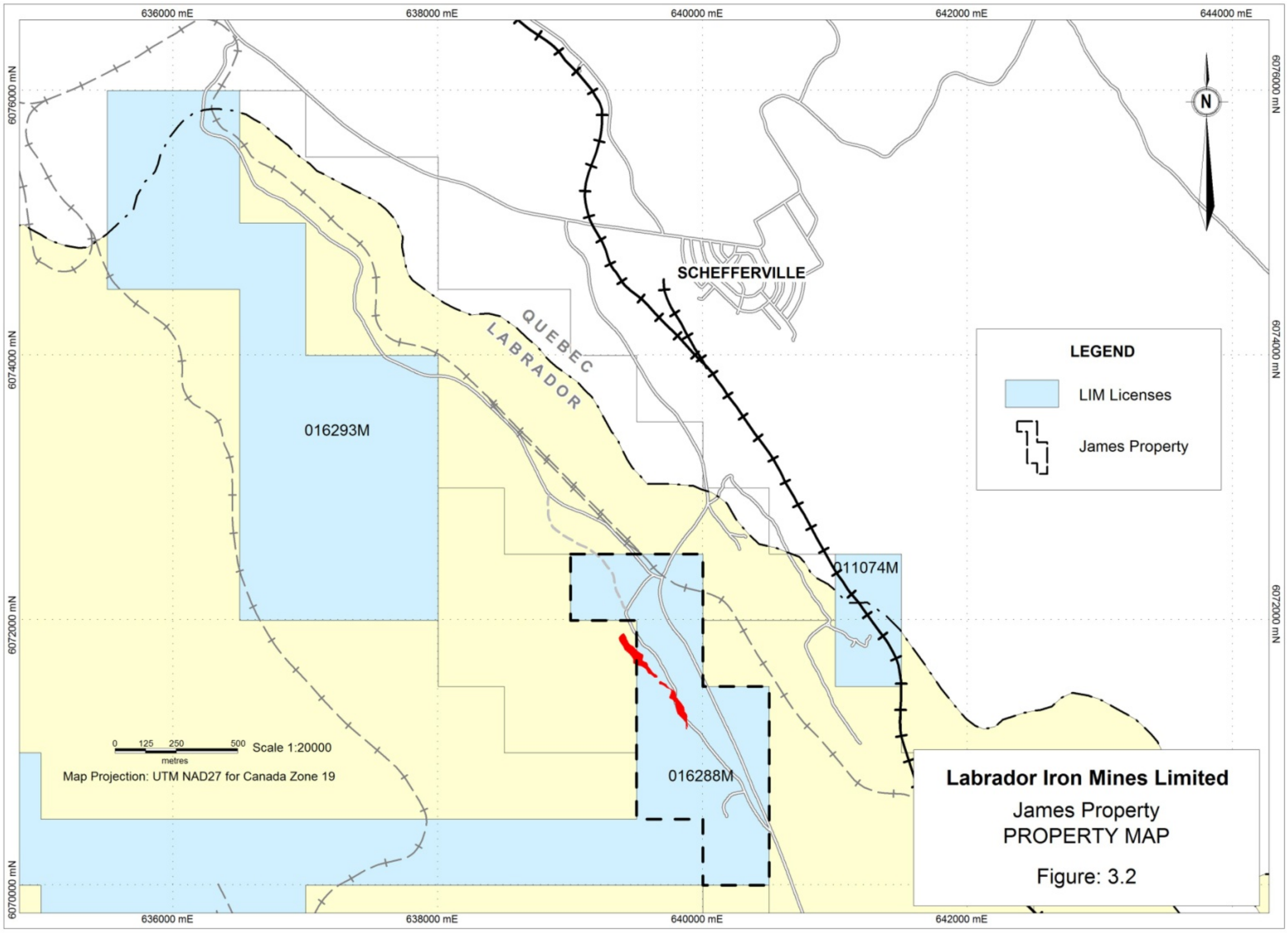


Figure 3.2 Mineral Licenses, James Property

3.1.1.1 James Deposit

The James deposit is located in the NE portion of the license 016288M; which covers an area of 6.75km^2. The license is held by Labrador Iron Mines Limited (Table 3.1). The James ore body is partially covered by the license 016288M, while the north-west end is covered by the license 010593M held by New Millennium Capital Corp. The James property delimited by the dashed line in Figure 3.2 was defined by licenses 010039M and 011231M prior grouping completed on June 1, 2009.

Table 3.1 James Property License

License No.	Holder	Issued	Claims	Extension (km^2)	Comments
016288M	Labrador Iron Mines Limited	Apr 12, 2004	27	6.75	This license replaces 011231M, 010039M, 012890M, 014497M and 014746M as of June 1, 2009
Total			**27**	**6.75**	

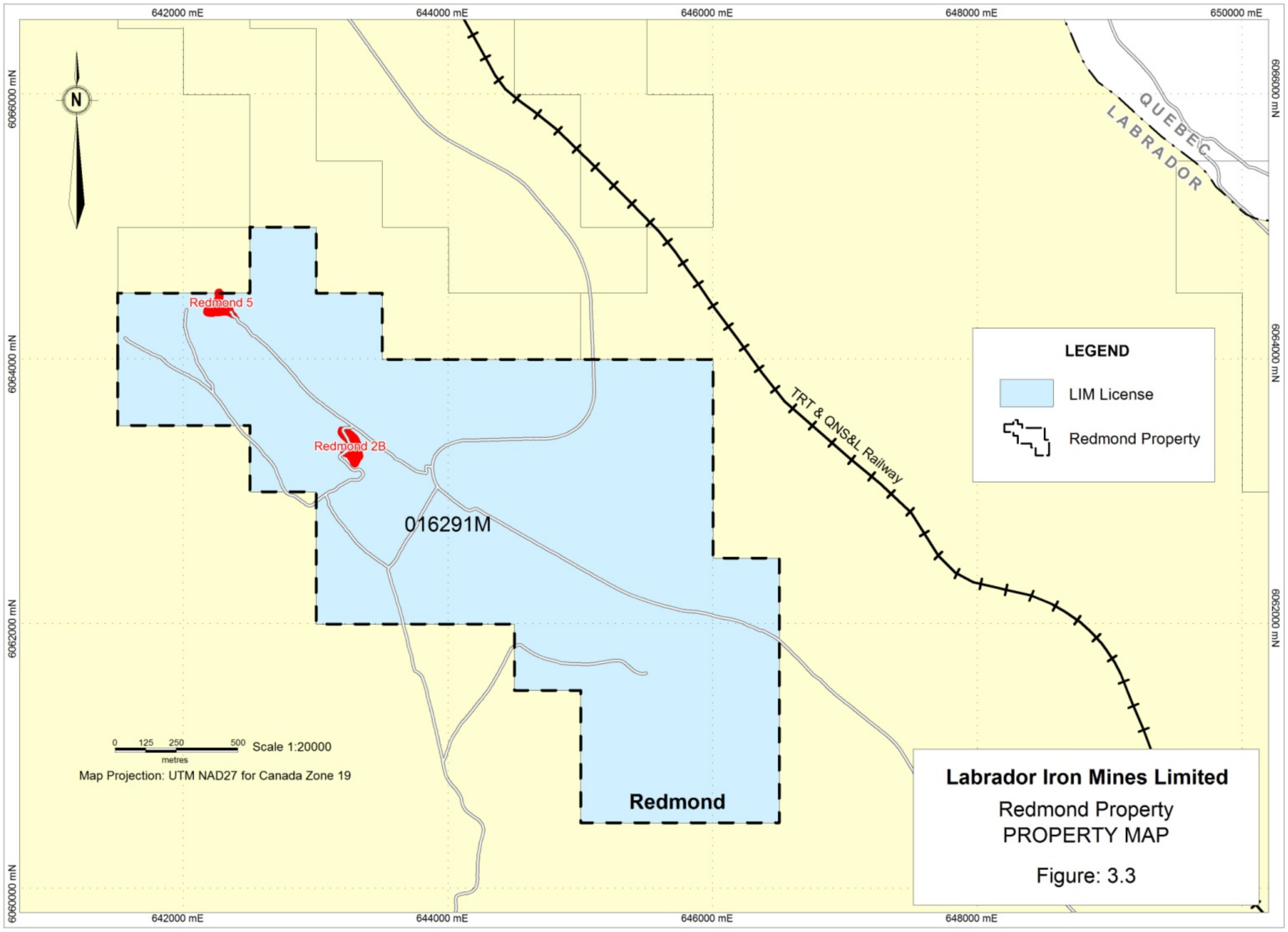


Figure 3.3 Mineral Licenses, Redmond Property

3.1.1.2 Redmond Deposits

The Redmond property comprises one license in 11.0 km^2 held by Labrador Iron Mines Limited (Table 3.2). The ore bodies considered by LIM for exploitation are Redmond 2B and Redmond 5 and both are covered by the license 016291M; however a small portion of the Redmond 5 ore body is covered by the license 013405M held by New Millennium Capital Corp.

Table 3.2 Redmond Property License

Licence No.	Holder	Issued	Claims	Extension (km^2)	Comments
016291M	Labrador Iron Mines Limited	Aug 25, 2005	44	11.0	This license replaces 011201M, 014495M, 014510M, 014512M, 014747M, 014748M and 014749M as of June 1, 2009
		Total	**44**	**11.0**	

3.1.1.3 Engineering Studies

Subsequent to the confirmation exploration program, an engineering study will be prepared. The study will examine the volume and value of the resources, production methods and costs, and the transport of the iron ore for shipment to markets.

Environmental baseline studies have been conducted and are summarized in this EIS. Discussions with rail transport companies and port operators are also being conducted.

3.1.2 Mine and Borrow Pits

3.1.2.1 James and Redmond Mines

Mining will occur at James North, James South, Redmond 2B and Redmond 5 deposits, where approximately 5.8 million tonnes of iron ore resources have been shown in historic documents. In addition to ore, approximately 5 million tonnes of overburden and waste rock will be excavated and disposed or stockpiled over the life of the individual properties. Excavation and transport to the beneficiation area will be done using conventional truck and excavator methods.

The pit designs for the referenced deposits will have overall pit wall angles that will range from 34^o in overburden to 55^o in competent rock. The face angles will range from 40^o in overburden to 70^o in competent rock. These angles are based on dewatered/depressurized pit walls and controlled blasting techniques. The excavations will be mined in 10m benches.

The pit haulage roads will be designed at 8 percent grade. All haul roads at the mine sites will be engineered and built to permit the safe travel of all vehicles and in accordance with provincial regulations (CNLR 1145/96). The running surface width of proposed haul roads will be designed to conform to current industry standards.

All pits will occur within the economic boundaries of the referenced deposits. Other minor excavations may be necessary and are discussed in the following sections.

3.1.2.2 Waste Rock Disposal

Waste rock storage areas and low-grade ore stockpiles will be required to support the recovery of saleable product to customers of lump ore and sinter fines ore. These storage areas and stockpiles will be located in close proximity to individual mine entrances/exits and/or the proposed beneficiation facility in order to optimize haulage distances and potential future stockpile recovery costs. In all cases, waste removal and stockpiling decisions will be made on the basis of environmental protection considerations, overall mining costs, iron ore marketability and the total quantity of material to be moved to access and produce the final products.

Other factors influencing the proposed location of waste rock storage areas include:

- location of ore bodies and potential exploration targets;
- topography to minimize storage area footprint;
- water drainage and proximity to watercourses; and,
- visual exposure to public roads and housing/ cottages.

Where applicable, waste rock storage areas will be built up in lifts to limit the overall dumping height. While this will increase haul distance, it will stabilize the waste rock and minimize the risk of the storage area edge slumping.

Due to the very low probability of the presence of sulphide minerals in the waste rock and uneconomic mineralized zones (Section 4.1.3), waste rock storage sites should not need to be contoured or capped with clay to control any acidic runoff.

The proposed locations for the necessary waste rock storage and low-grade ore stockpiles are indicated on the respective mine drawings (Figure 3.4 and Figure 3.5). The waste rock disposal plan for the James mining area includes an option of storing the waste rock in an existing V-shaped valley and to a site east of the James North pit and south of the James South pit. The footprint for the waste rock storage and low-grade stockpiles at the James North and South sites requires an area of approximately 11.8 ha and 7.8 ha respectively. The slopes of the waste rock storage areas and stockpiles will be 1.5:1 and the average height for the quoted footprint is 15 m. In-pit disposal will be utilized wherever feasible.

The waste rock disposal plan for the Redmond deposits includes a combination of the use of the existing mined-out Redmond 2 pit, on-land stockpile area, and in-pit disposal wherever feasible. This will reduce the requirement for additional disturbance due to waste rock storage. There may be some new disturbance required for low-grade stockpiles. The use of existing stockpiles will be investigated and if shown to be economical will be the preferred method.

Waste rock and overburden will be stockpiled and contoured in a manner that conforms to provincial guidelines and regulations. These materials will be managed to limit the possibility of suspended solids being introduced into site drainage or adjacent waterbodies. Overburden will be used during site reclamation to support vegetation.

3.1.2.3 Minor Excavations and Borrow Pits

Additional minor excavations may be required to support ongoing mining activities. These excavations will include small borrow pits, quarries and side-hill cuts associated with the construction and maintenance of access roads, mine haulage roads, sumps and settling ponds, and railway spur line construction.

In recognition of regulatory requirements, any new excavations outside of approved mining leases for James North, James South, Redmond 2B and Redmond 5 deposits, will be subject to Newfoundland and Labrador regulatory and licensing processes, prior to the commencement of field activity. Where possible, LIM will attempt to make use of previously excavated quarries and borrow pits that were excavated in the past by IOC in order to prevent new ground disturbances. A number of such small pits exist along the road to the north of Silver Yard area and to the south of Silver Yard area near the previously mined area of Redmond (Figure 3.6).

Due to local climatic conditions in the proposed mining area, accumulations of water from natural rainfall and snowmelt will create a need for the excavation and/or construction of runoff water containment and sedimentation control structures. Such structures will insure that necessary discharge of accumulated surface water will meet current environmental standards.

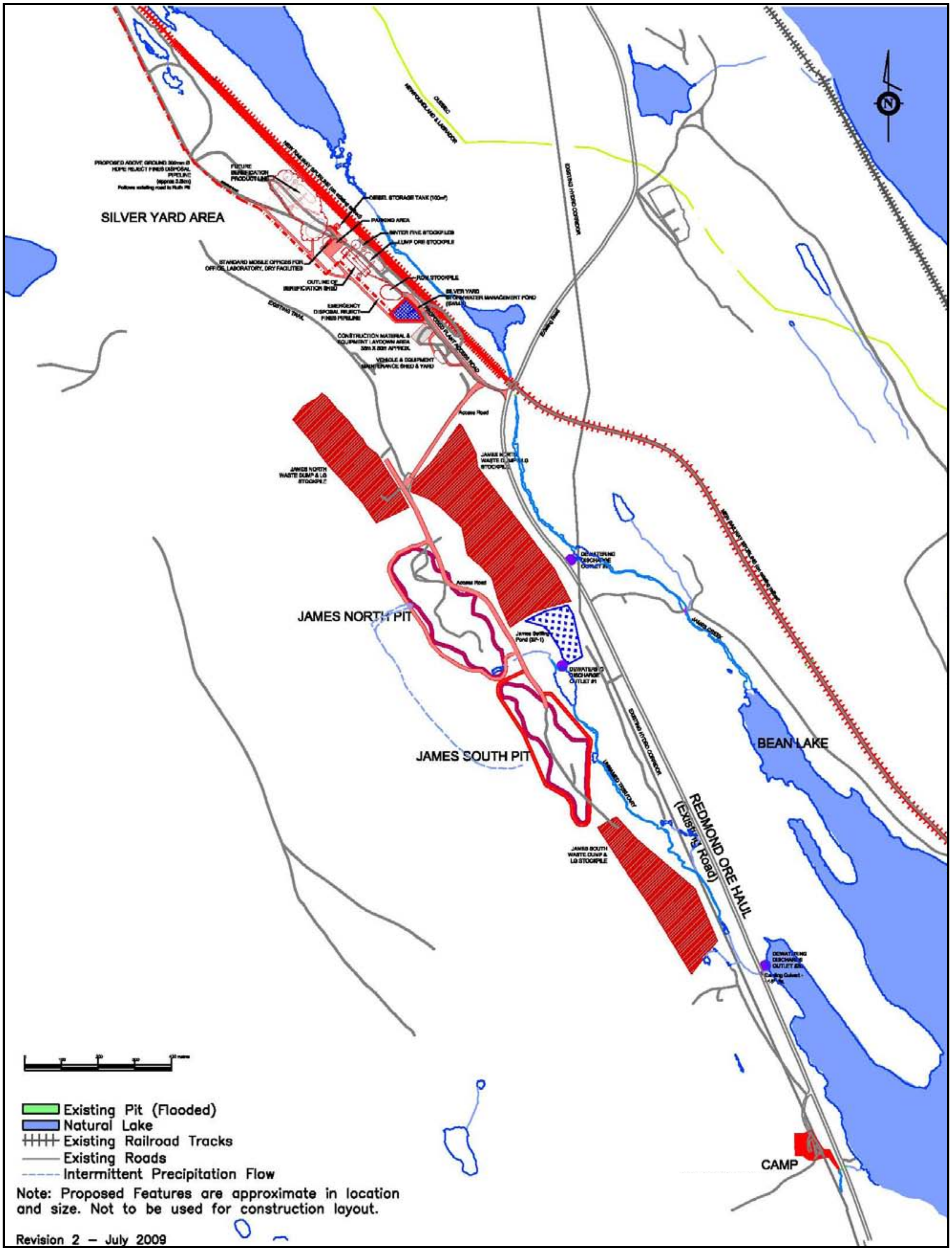
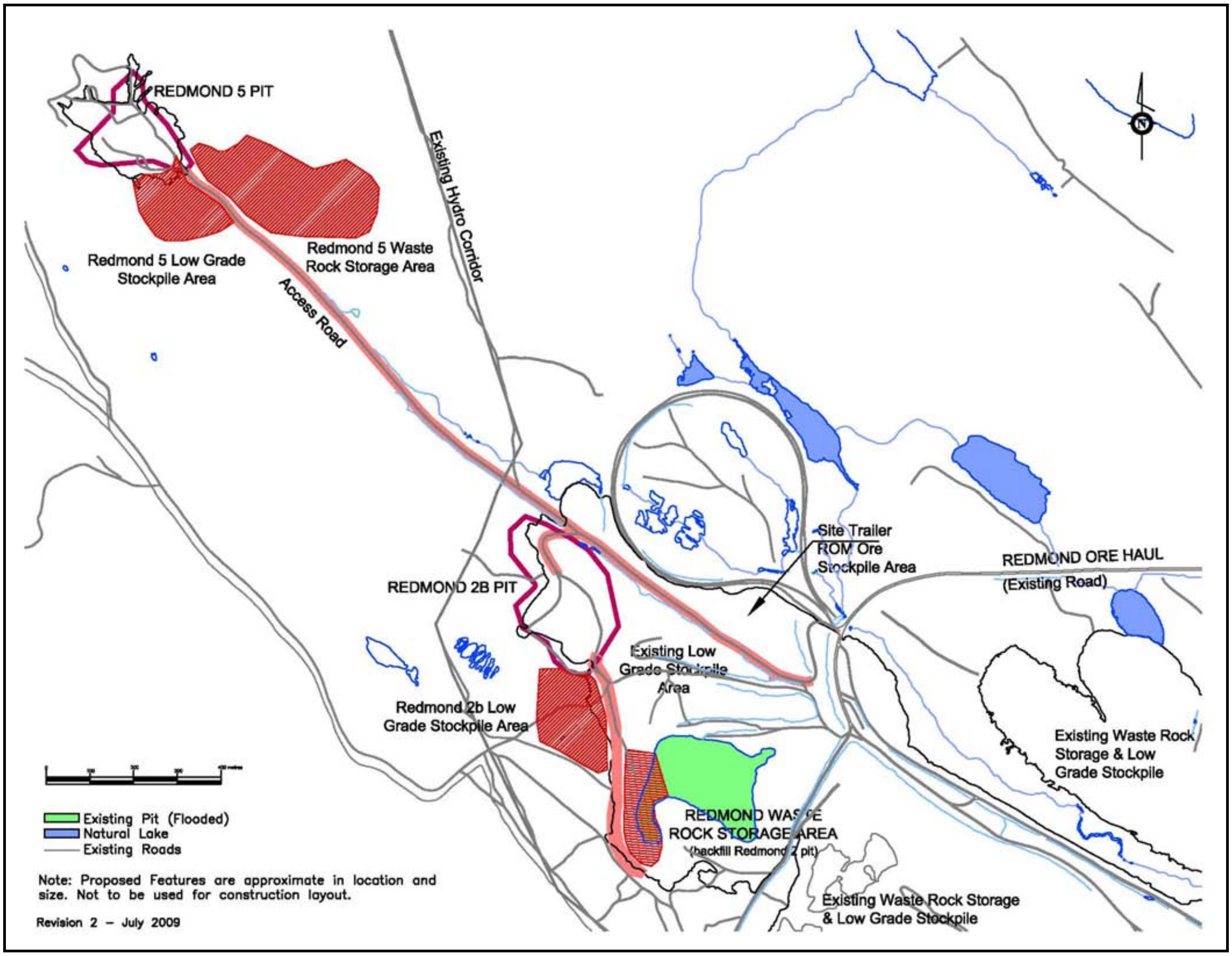


Figure 3.4 James and Silver Yard Infrastructure



Note: Proposed Features are approximate in location and size. Not to be used for construction layout.

Revision 2 – July 2009

Figure 3.5 Redmond Infrastructure

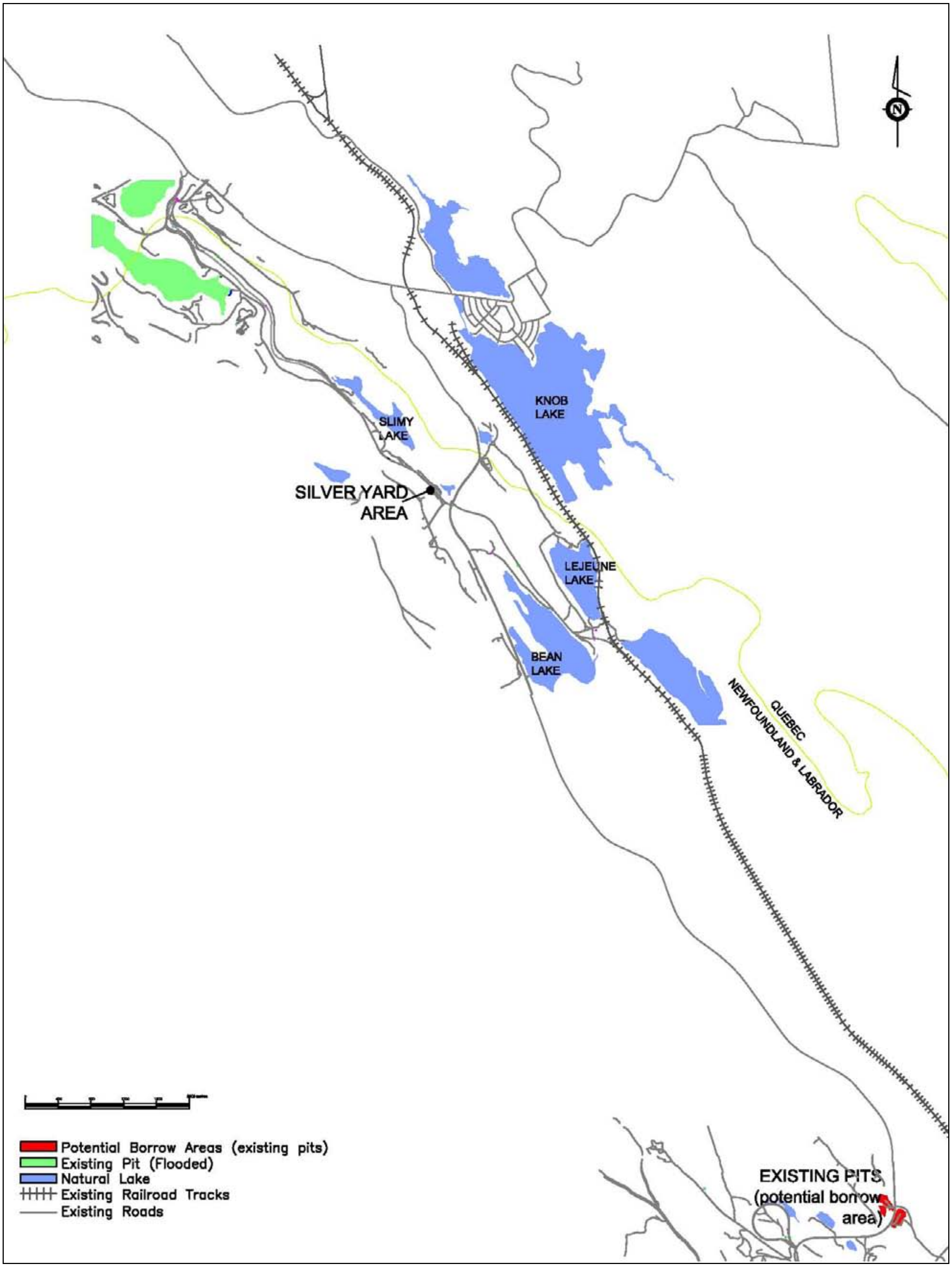


Figure 3.6 Existing Pits (Potential Borrow Areas)

Contractors may require borrow material for the construction of the spur line. The total number of borrow pits and amount of borrow material required for the Project has not been determined, as the quantity of material required depends on detailed design. However, as there are existing borrow pits in the nearby area, it is unlikely that additional borrow pits will need to be developed.

Vegetation will be cleared from the area and organic material stockpiled for use in site rehabilitation. Provincial environmental legislation and regulations will be applied during borrow area development, as well as a progressive restoration plan for the site, prior to decommissioning. Specific details on establishing, using and rehabilitating borrow pits will be outlined in the EPP.

3.1.3 Mine Infrastructure

All iron ore production from the James and Redmond properties will be beneficiated at the Silver Yard Area. Figure 3.4 illustrates the proposed infrastructure at the Silver Yard Beneficiation Area and includes the following:

- Beneficiation Area, which includes the Beneficiation Building, Primary Mobile Crushing Plant, various conveyors, Product Stockpiles;
- Water Supply Tank and Pump building module;
- Electrical building module, mobile diesel generators, and transformer;
- Diesel storage tanks and fuelling dispensing station for mobile equipment;
- Vehicle and Equipment Maintenance Shed;
- Standard mobile offices;
- Parking area;
- Raw Ore Stockpile Area;
- Stockyard and railcar loading area;
- Reject fines disposal pipeline;
- Stormwater Management Pond (SWM-1); and
- Security fencing and/or signage.

The infrastructure at the James Mining Area includes the following and is illustrated in Figure 3.4:

- James North Pit and associated haulage roads;
- James South Pit and associated haulage roads;
- James Low Grade and Waste Rock stockpile areas;
- James Settling Pond facility (SP-1)

The infrastructure at the Redmond Mining Area includes the following and is illustrated in Figure 3.5:

- Redmond 2b Pit and associated haulage roads;
- Redmond 5 Pit and associated haulage roads;
- Redmond 2b Low Grade Stockpile;
- Redmond 5 Low Grade Stockpile;

- Redmond Raw Ore Stockpile Area; and
- Redmond Site office trailer.

3.1.3.1 Beneficiation Buildings and Process

The building and contents will be semi mobile and modular to fit with the Project's long term plans. The beneficiation buildings will house the equipment needed for the beneficiation process. These include tumbling scrubber, secondary crushing equipment, primary screening equipment, secondary screening equipment, crane and various chutes, conveyors, and pumps. The beneficiation plant is designed to operate on average 7 to 8 months per year. This process description is illustrated in Figure 3.7. Details of the process flow and equipment is provided in Appendix G.

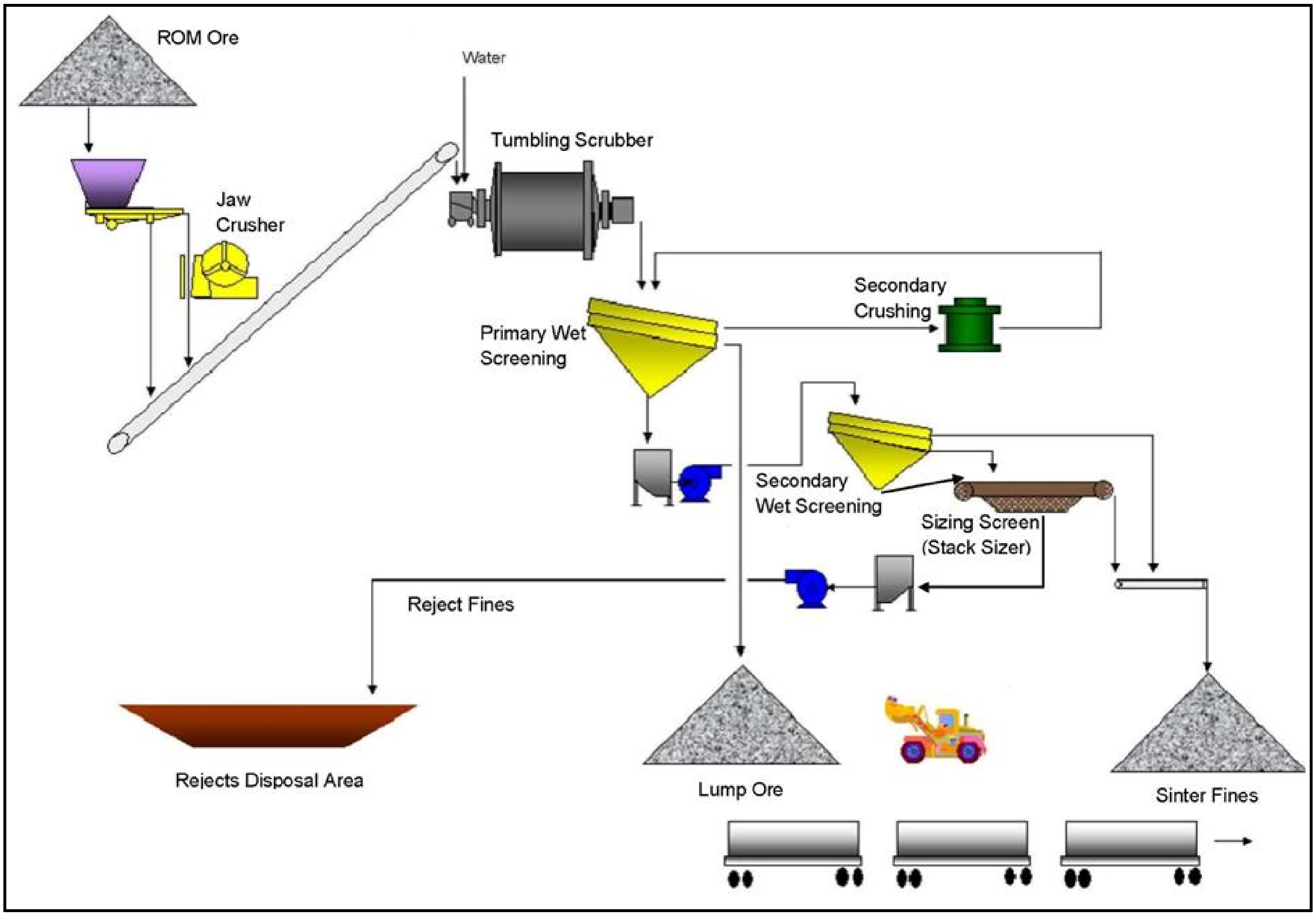


Figure 3.7 Overall Beneficiation Process Flow Diagram

Other buildings at the Beneficiation area include: mine dry, site offices and analysis laboratory, which will be standard mobile trailers/modular units; maintenance shed, which will be a sprung type structure; and warehouse facilities, which will be housed within containers.

3.1.3.2 Other Infrastructure

The other infrastructure that will be located at the Silver Yard Area include fuel storage tanks, mobile diesel generators, transformer, laydown areas, and process water pump building.

3.1.3.3 Fuel Storage

Fuel storage in Newfoundland and Labrador is regulated by the Storage and Handling of Gasoline and Associated Products Regulations, 2003. A Certificate of Approval for a fuel storage system must be obtained from the Department of Government Services and Lands. Fuel caches in remote areas of Newfoundland and Labrador should abide by the Environmental Guidelines for Fuel Cache Operations as stipulated by the Department of Environment and Labour.

Transportation, storage, and use of fuels at the Project site will be conducted in compliance with all relevant laws, standards and regulations. Before transporting or storing fuel at the Project site, contracted fuel suppliers will be required to provide a copy of a fuel spill contingency plan acceptable to LIM. LIM and its contractors are required to ensure that fuel and other hazardous materials are handled by persons who are trained and qualified in handling these materials, in accordance with government laws and regulations.

A 100 m^3 Diesel Oil Storage Tank and Diesel Vehicle Refueling Tank Truck will be used for fuel supply on site. The diesel fuel will be transported by rail to Silver Yard prior to being transferred to the above ground storage tank. The storage tank is of single wall design with a retention lined dike. The tank foundation is to be made of compacted sand and includes a geomembrane that covers the entire dike area. The dike retention volume will be able to retain at least 110 percent of the tank volume. The diesel vehicle refuelling tank truck will carry the diesel from the bulk storage tank to the equipment diesel day tanks. Any water rejected from the tanks will be directed into a closed circuit oil/water separator. The effluents from the oil/water separator will be disposed of as per environmental standards. The oil/water separator will require approval by Government Services Canada (GSC). Used and collected oil will be delivered to a licensed used oil collector.

These storage tanks will be designed according to API 650. Large storage tanks will be provided with one manhole on the side wall near the bottom level. One additional manhole will be provided on the roof of the tank for closed tanks. Drums of fuel oil, if required at the site, will be tightly sealed to prevent corrosion and rust and will be placed within appropriate secondary containment.

3.1.3.4 Electrical Power Supply

The Menihek Power Plant, owned and operated by Newfoundland and Labrador Hydro, is located 32 km southeast from Silver Yard and is the only provider of electric power to the area. The plant was built to support iron ore mining and services in Schefferville. The plant contains two 5 MW Westinghouse generators and one 12 MW unit. The main substation is close to Silver Yard lowering the voltage of distribution to Schefferville town.

The existing transmission corridor runs across and adjacent to the Redmond and James properties as well as the Silver Yard area. Refer to Figure 3.1 for locations. The expected peak demand load from the beneficiation process is currently estimated at 1500kW and total connected load is 3000kW. The expected peak demand load from the dewatering is currently estimated at 2000kW and total connected load is 3000kW.

The initial phase of the Electrical Supply Plan will have power generated by up to four mobile diesel generators located at Silver Yard. These generators will be continuous duty, 750 kW, 60 Hz, and 600 V and placed on concrete pads. A mobile generator will also be required at the field trailer at Redmond. Up to four additional 900kW mobile generators will be located nearby the dewatering wells at the

James site. An aerial transmission line at 4160V will distribute the power to each pump at the James Site. Local starters will control each individual pump.

As soon as it is possible, the second phase of the Electrical Supply Plan will be initiated. This phase involves drawing hydro-electric power from the existing regional power grid. A substation will be required and it is expected to be located near the Silver Yard area.

3.1.3.5 Water Supply

The Project's proposed water supply plan is shown in Figure 3.8. The figure shows existing and proposed flow rates.

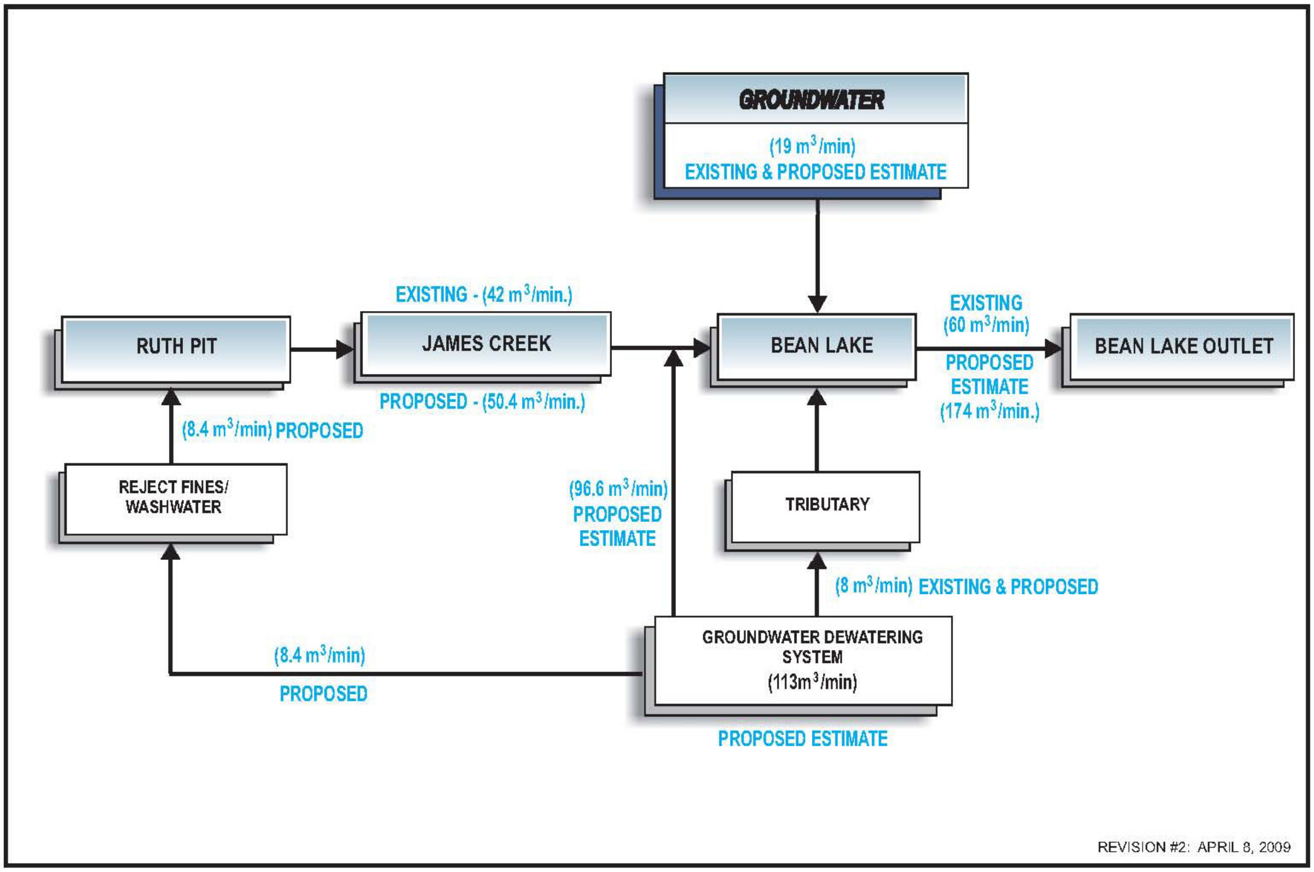


Figure 3.8 Preliminary Water Balance

Potable Water

Potable water will be required at the beneficiation building, various site office trailers at Silver Yard, and at the site trailer at Redmond. Initially, it is anticipated that potable water will be tanked to the site and/or bottled water will be transported to the Project. The water will be stored in the potable water distribution system. It is also recognized that existing ground water testing has shown that the water may be of suitable quality upon completion of well development and so it is possible that groundwater may be considered at some point in the future. If so, testing and use of groundwater for potable water use will be taken in accordance with applicable regulations and permit requirements. Testing of the potable water quality will be conducted regularly in accordance with provincial requirements. Potable water at the Redmond site trailer will be provided by bottled water.

Wash Water

Water for use in the beneficiation process will be sourced locally from within the Project area. Groundwater sourced from the dewatering system and not used to supplement the flow in the unnamed tributary may be diverted to the Process Water Tank at a current estimated flow rate of up to 8.4 m^3/min (2,187,000 m^3/year).

Although there will be some water loss in the washing process due to absorption by the ore, it is not possible to quantify this loss. Therefore, as a conservative measure it is assumed that all the used wash water will be pumped to Ruth Pit. Therefore, the estimated rate of wash water is 8.4 cu.m./min and the rate of flow to Ruth Pit is estimated at 8.4 cu.m./min.

The wash water will be transported to Ruth Pit by an aboveground pipeline that will follow an existing gravel road from the Sliver Yard Area to Ruth Pit. The location of the discharge end of the wash water fines pipeline into Ruth Pit will be chosen to maximize the retention time of the water in Ruth Pit. Given the size of Ruth Pit, it is anticipated that some storage will occur depending on seasonal and environmental conditions, etc.; however, using a conservative approach, it is assumed that the additional discharge of water from Ruth Pit will be equal to the discharge rate of wash water into Ruth Pit.

Further details of the impacts of the proposed flows on James Creek and Bean Lake are presented under Section 4 and Section 7.

Fire Water Supply

The fire protection systems design is based on good engineering practice, using National Fire Protection Association (NFPA) standards, IBC and IFC to provide appropriate life and loss protection. The fire protection system is based on the understanding that the beneficiation shed structures and lining are non-combustible and are providing easy exit on all sides.

The scope of fire protection involves: conveyors and material handling, beneficiation shed, utilities, and administrative, laboratory and dry facility trailers. The equipment and buildings will be protected by portable fire extinguishers.

Silver Yard Stormwater Management Pond (SWM-1)

The Silver Yard Stormwater Pond (SWM-1) will serve three functions:

- The primary function of the Pond will be to collect and treat stormwater from the beneficiation plant area.
- The secondary function of the Pond will be to receive the flush of water from the regular maintenance of the pumping/pipeline system. In order to complete regular Plant and/or pipeline maintenance (approximately once a week), the reject fines discharge pipeline to Ruth Pit will be flushed with clean water to push all reject fines wash water in the system to Ruth Pit. Once the pipeline is flushed and contains only clear water, the water will either be left in the pipe (typical for Plant maintenance under warm ambient temperatures) or the water will be released from the pipeline (as required for pump and pipeline maintenance or plant maintenance during freezing ambient conditions). The pipeline cannot be pumped dry; therefore, in order to clear the pipeline of water, it must be released to drain via gravity. The lowpoint on the line is the Silver Yard Stormwater Pond and this clean water will be released into this pond prior to discharge to the environment. Discharge to the SWM-1 will consist of clear water and will not require significant retention time in the pond.

- The third function of the pond will be to receive the emergency discharge from the pipeline during a power or pumping failure. The Beneficiation Plant will be interrupted during this event and therefore the volume of effluent discharge to the pond should only be the volume of effluent in the pipeline. In this case, the effluent discharged into the pond will be the same quality as the effluent being deposited in Ruth Pit except that due to the decrease in pumping pressure and therefore pipeline velocities, some larger fines particles will settle in the pipeline and not be discharged with the effluent.

In a general risk analysis, the probability of pipeline/pumping malfunction is typically low. In the case of the Silver Yard- Ruth Pit pipeline, the risk of malfunction is associated with freezing conditions and with the continuity of pumping operations. Therefore, there is no backup pipeline proposed for the Project. The pumping system will include a backup pump and backup power source. In the case of failure of either, the operation of the Beneficiation Plant will be interrupted and the pipeline will be automatically drained to the Silver Yard Stormwater Pond.

The Silver Yard stormwater pond will be designed as a multi-cell settling system to treat each of these effluent flows, to accommodate the varying effluent flows, and to ensure that release of the water/effluent to the environment (James Creek and the unnamed tributary) will meet the discharge requirements under the Certificates of Approval and MMER. This multi-cell design will also ensure maximum retention time and allow pond maintenance operations (removal and disposal of reject fines) to be carried out while the pond is still being used. Pumping the emergency discharge back to Ruth Pit is technically and economically impractical.

A detailed design of Silver Yard Stormwater Pond, which will integrate all effluent treatment requirements hydraulic design and controls to ensure discharge water quality to James Creek in compliance with all regulatory requirements, will be provided at the permitting stage (Development Plan as required under the *Newfoundland and Labrador Mining Act* and reviewed by Water Resources).

3.1.4 Supporting Infrastructure

It is not anticipated that any permanent structures will be erected for the mining and beneficiation operations at the Silver Yard area, although some temporary stores and workshops will be established. As this will be a beneficiation site, a workshop and warehouse will be established, as well as a small fuelling station nearby. A portable office and lunchroom facility will also be set up, which will include services such as washrooms and a first aid room. All of the buildings, including foundations if required, will be removed upon completion of operations. General services and infrastructures will be shared with the contractor.

3.1.4.1 Laboratory

It is planned to establish an on-site mobile laboratory in a portable modular building at the Silver Yard area. The laboratory will include a sample preparation section with a drier, crushers, screens, pulverisers and rifle splitters and an analytical lab section for daily ore control and exploration samples analysis. It is anticipated that the analytical methods used will be fusion (lithium metaborate) followed by XRF spectrometry.

3.1.4.2 Workshop

A maintenance/workshop shed (sprung type structure on concrete pad) and maintenance yard will be provided to conduct routine maintenance and non-major repairs for the mine and beneficiation operations. The building will be equipped with the necessary tools and equipment to maintain the mobile fleet. It is expected that the workshop would be equipped with compressed air and related tools, tire changing equipment, and hydraulic hose preparation. A closed-circuit wash bay and oil-water separator will be developed within the concrete-floored Maintenance Building and collected material will be pumped out on a routine basis for disposal by a licensed and experienced contractor at an approved facility. There will be no discharge of this into the surrounding environment. Solvents may be used for parts cleaning and if so, will be properly stored and disposed of in accordance with applicable regulations.

It is anticipated that onsite storage of small retail-size quantities of hydraulic oils and other materials may be required for the limited mine vehicle/equipment maintenance. In addition, diesel storage associated with local or emergency back-up power generation may be required. Petroleum/oil/lubricant (POL) transport, storage, use and disposal will be conducted in accordance with applicable legislation and all workers will be trained in the appropriate Environmental, Health & Safety (EHS) approach to working with these materials. Spill kits will be available at key locations on site and workers will be trained in their use and other emergency response procedures.

It is anticipated that major repairs would be conducted elsewhere at the contractor's discretion.

3.1.4.3 Warehouse

The warehouse will contain critical components for the vibrating screens and ware parts for crushers and conveyors. The contractor may want to store tires, filters, retail quantities of lubricants/oils and brake parts for trucks and drill steel, bits and parts for drill rigs.

3.1.4.4 Explosives Storage and Mixing Facilities

Iron ore extraction will be conducted by a Labrador-based mining contractor. Mining methods will be left to the Contractor's discretion. Mechanical methods will be used, where possible, to break up the rock. The contractor may also require the occasional use of explosives. The contractor will be responsible for complying with the required permit and/or approvals under the Natural Resources Canada Explosive Regulatory Division. The Contractor will ensure that blasting will follow all provincial regulations, including the Occupational Health and Safety Regulation, under the *Newfoundland and Labrador Occupational Health and Safety Act* 1165 and the Mine Safety of Workers under Newfoundland and Labrador Regulation 1145/96. The Contractor will hire experienced/licensed blasters.

3.1.4.5 Communication

All mining equipment and mine vehicles will be equipped with two-way radio system. This radio system will be available within the beneficiation building, maintenance building, and offices. A transmitter/receiver station including antenna tower and housing for radio communication equipment may be required. The location of the tower would be selected to optimize communication transmissions between the James – Redmond – Silver Yard sites.

Telephone and internet services would be provided through satellite services.

3.1.4.6 Camp

Camp accommodations will be constructed for workers at a previously developed former ski hill lodge location in Labrador. The camp will have an overall footprint of approximately 7,000 sq. m. and will be located on the site of a former ski hill and lodge (Figure 3.9, Also referred to in Air Quality sections as “Cabin 1”). The site for the camp was previously cleared and developed for facilities associated with the ski hill, and an abandoned ski lodge (also referred to as “Cabin 1”) remains on the site. Camp structures will consist of mobile to semi-mobile pre-fabricated modular trailers and will accommodate approximately 60 workers seasonally, from approximately April to November on an annual basis. The construction and operation of the camp will utilize NL workers, materials, goods, and services where possible.

The proposed dormitories will be comprised of single rooms and will include an adequate number of rooms for the number of people on-site at any given time. Men and women’s accommodations will be separate and the women’s accommodations will be situated near the Women’s Sanitary and Dry Trailers. The camp will include a kitchen (with catering), dining room, laundry facilities, and a recreation area. The recreation facilities may include such features as a pool table, television lounge, exercise equipment, and access to outdoor recreation. The camp will also have wireless internet and telecommunications access.

Initially, up to two diesel generators (125 and 175 kw) will be used as a temporary power source for the camp until electricity can be connected from the nearby grid. Grid access is nearby and no significant construction is anticipated to facilitate the grid connection. Minimal quantities of generator fuel will be temporarily stored in a double-walled storage tank in accordance with applicable regulations until the permanent grid connection is in place (Figure 3.9).

Gensets, installed outdoors (including trailer mounted), will be equipped with noise attenuating enclosures providing a combustion exhaust muffler, air supply silencer(s) and air exhaust silencer(s).

Water requirements for the seasonally operated camp are anticipated to be supplied from a nearby groundwater well. Sanitary waste at the camp will be collected and treated using a domestic wastewater treatment system that uses a Rotating Biological Contactor (RBC) form of aeration. This system produces minimal sludge, which will be removed at an estimated rate of once per operating season and disposed of at an NL-approved facility by a licensed contractor. Surface water drainage, consisting of site drainage and the RBC system, will be contained and directed to a settling pond downgradient of the camp. Proposed locations of these features are shown in Figure 3.9.

Any domestic waste will be collected on-site and delivered to an experienced Labrador-based contractor and placed in a landfill facility in Labrador West, in accordance with applicable regulations. Food storage and handling will be conducted in accordance with applicable regulations and any organic waste generated will be stored in animal-proof containers prior to offsite disposal in NL. Where and when possible, a Reduction, Reuse and Recycling policy, will be implemented to minimize waste generation at the camp.

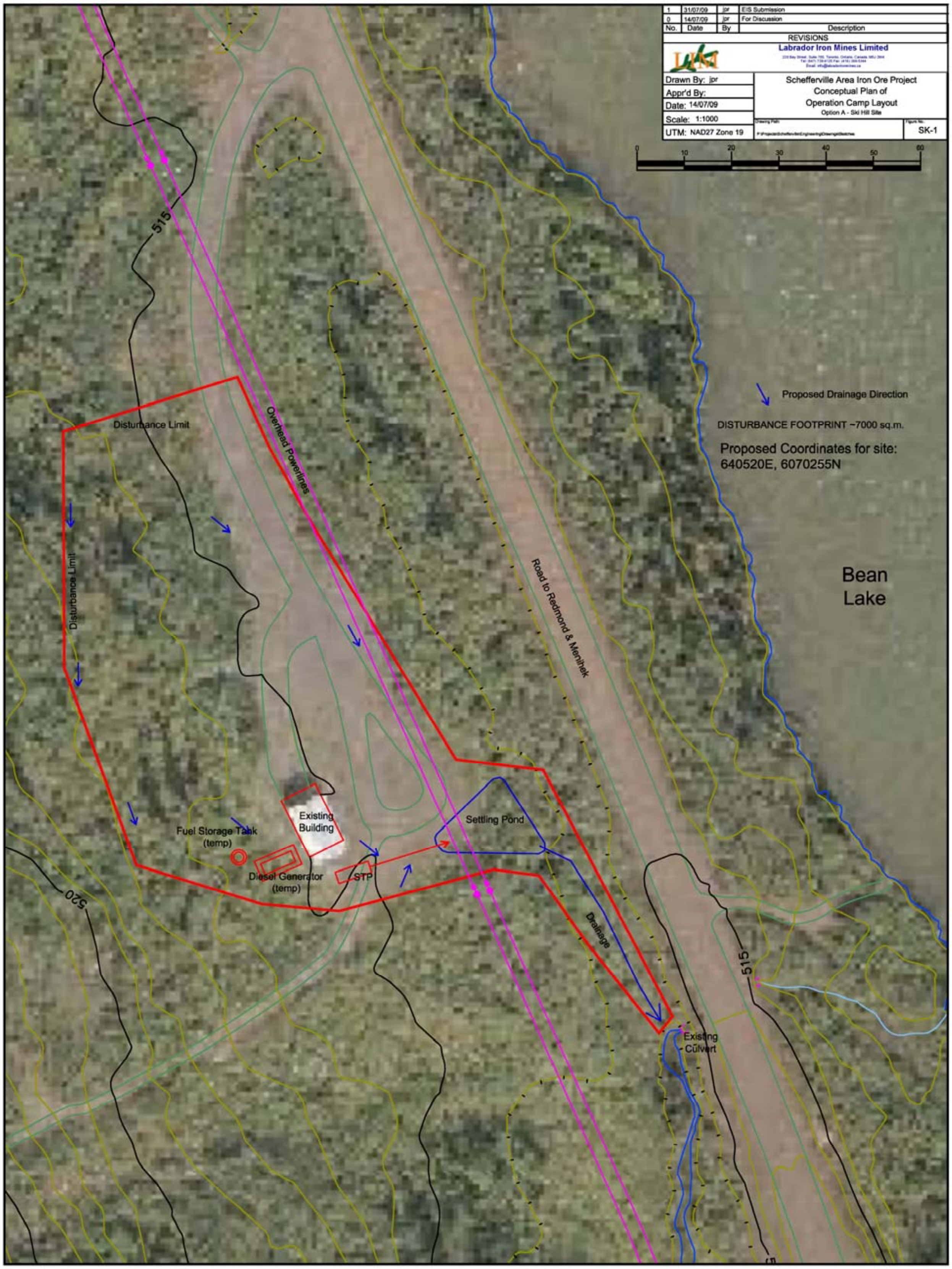


Figure 3.9 Camp

3.1.4.7 Site Access

Primary access to the James mineral deposit is by an existing gravel road which is located approximately one km southwest of the Silver Yard area. The James property straddles an existing road connecting Silver Yard with the Redmond property, and continues to the Menihek hydroelectric dam, where the road is terminated. The existing roads are in reasonable condition and may require brushing to improve visibility and grading to establish road surface.

The access roads will require proper signage. The signage will include posted speed limits, stop signs at intersections, and caution signs about the co-use of mine and public traffic. Adequate numbers of signs will be posted in all local languages.

Within the pit designs, the access roads will be limited to only mine personnel. The haulage roads will be designed and built to permit the safe travel of all of the vehicles in regular service by following accepted industry standards and following Section 27 of the Mines Safety of Workers Regulations.

Although all of LIM's properties are located in the Province of Newfoundland and Labrador, they will utilize, to some extent, present connecting roads and possibly some of the services available from the town of Schefferville and the surrounding communities.

3.1.4.8 Lighting

All buildings will include sufficient perimeter lighting with outdoor fixtures. Exterior lighting will be timer or photocell controlled. Lighting will also be provided at doorways and overhead doors. There will be no street lighting on any access roads. Portable lighting plants and lights on mobile equipment will be used within the pit areas to illuminate working areas.

3.1.4.9 Railway Infrastructure

In order to deliver product, LIM must transport by rail, approximately 568 km to the port of Sept Îles for further shipping by marine transport. LIM will operate a short spur line linking the Silver Yard with the existing rail system. The existing rail system includes:

- a 208 km link from Schefferville to Emeril Junction (near Ross Bay Junction) that is owned and operated by Tshiuetin Rail Transportation Inc.(TSH), a company jointly owned the Innu Nation of Matimekush-Lac John, the Naskapi Nation of Kawawachikamach, and the Innu Takuaikan Uashat mak Mani-Utenam;
- the 360 kilometres of rail from Ross Bay Junction to Sept Îles that is operated by Québec North Shore and Lab Railway (QNS&L) a wholly owned subsidiary of the Iron Ore Company of Canada (IOC); and
- at Sept Îles, the rail link from Arnaud Junction to Pointe-Noire that is operated by Arnaud Railways, (AR), a wholly owned subsidiary of Wabush Mines.

A new Labrador Iron Mines Holdings Limited subsidiary company, LabRail, has been incorporated under the laws of Canada which could operate the railway at the mine site and coordinate LIM's rail transportation to the marine terminal in Sept Îles. Initially, LabRail could own or lease and operate the rail loading facilities and all associated rail infrastructure, rolling stock and power.

Arrangements will need to be entered into with other railroad companies regarding access and transport requirements over the various rights of way between Silver Yard and the Port. It is possible that these arrangements could also include other potential commercial and mining operations wishing to utilize some or the entire transport route. This rail facility will be available for use by other companies and will improve the commercial viability along and in close proximity to it. LabRail will cooperate in any future mineral development by others in the facility use and, if necessary, in the realignment of the line.

Existing and proposed railway infrastructure is detailed in Figures 3.10 and 3.11.

3.1.4.10 Infrastructure

A 4.0 km spur line previously operated and abandoned by IOC will be restored for use by LabRail. Including sidings to the spur line, 7,800 m of new track will be laid. The infrastructure components include:

- ballast - the existing railbed and most of the necessary ballast are already in place and some grading and levelling will be done in preparation to the laying the track. Some additional ballast will be required;
- culverts - all necessary culverts are in place and require no immediate maintenance;
- ties;
- rails;
- turnouts and switches;
- bumping posts and derail; and
- other track material (OTM) - spikes, rail anchors, tie plates and joint bars, track bolts, nuts and spring washers.

The new track and associated infrastructure will be installed in conformance with the latest edition of the American Railway Engineering and maintenance-of-way Association (AREMA) recommended practices.

There may also be a split platform static railway scale and scale house, to weigh the loaded ore cars.

3.1.4.11 Rolling Stock

LabRail will operate with sufficient power units and rolling stock to meet the operational needs of the Project. The numbers of locomotives and ore cars will be initially determined on the start-up operations (i.e., the first year production level), and by the outcome of ongoing negotiations on railway operation). Locomotives will be SD40-2 type diesel locomotives or similar and the rolling stock will be 40-foot gondola iron ore cars with a nominal capacity of 93 tonnes of ore.

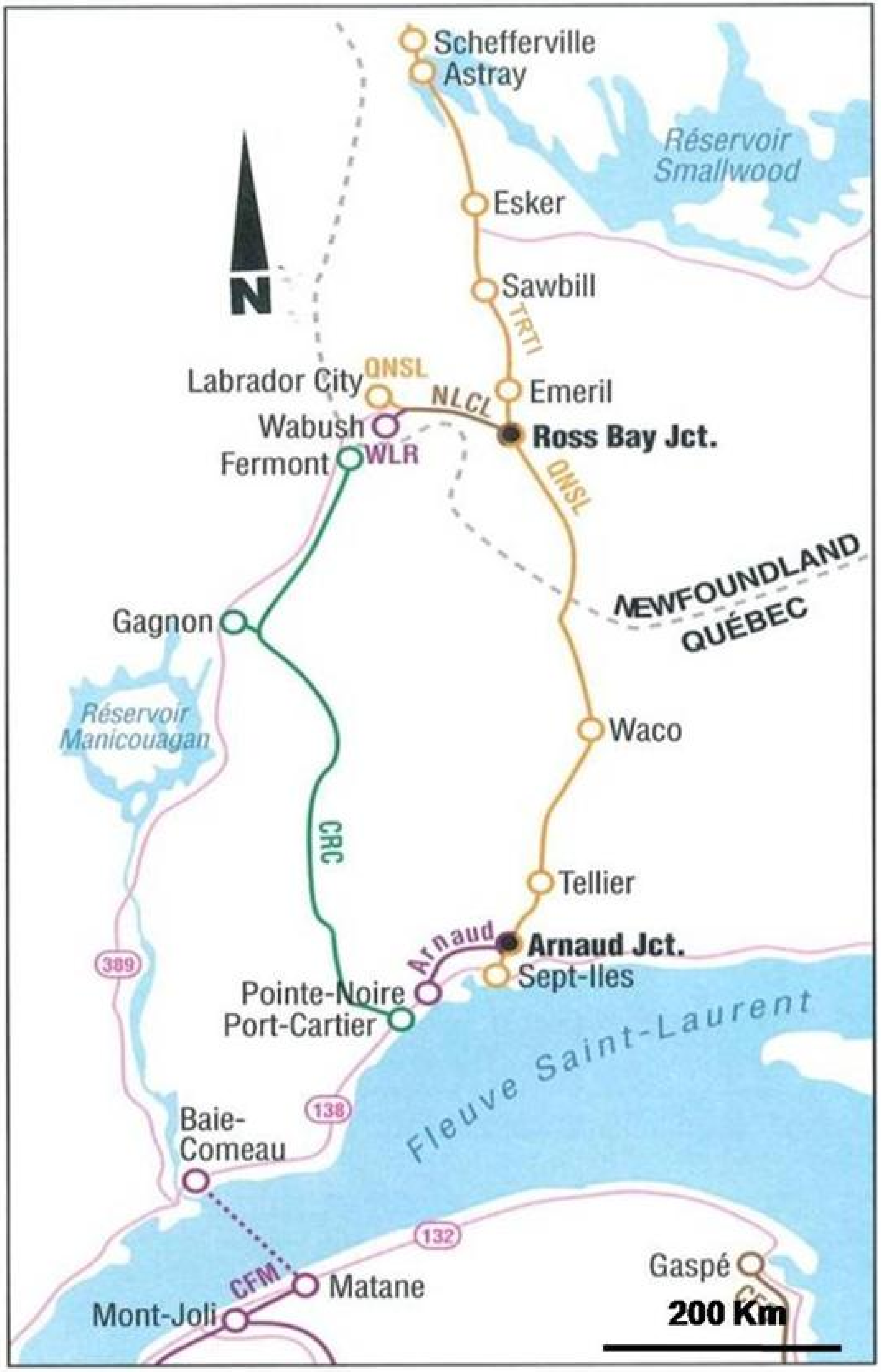
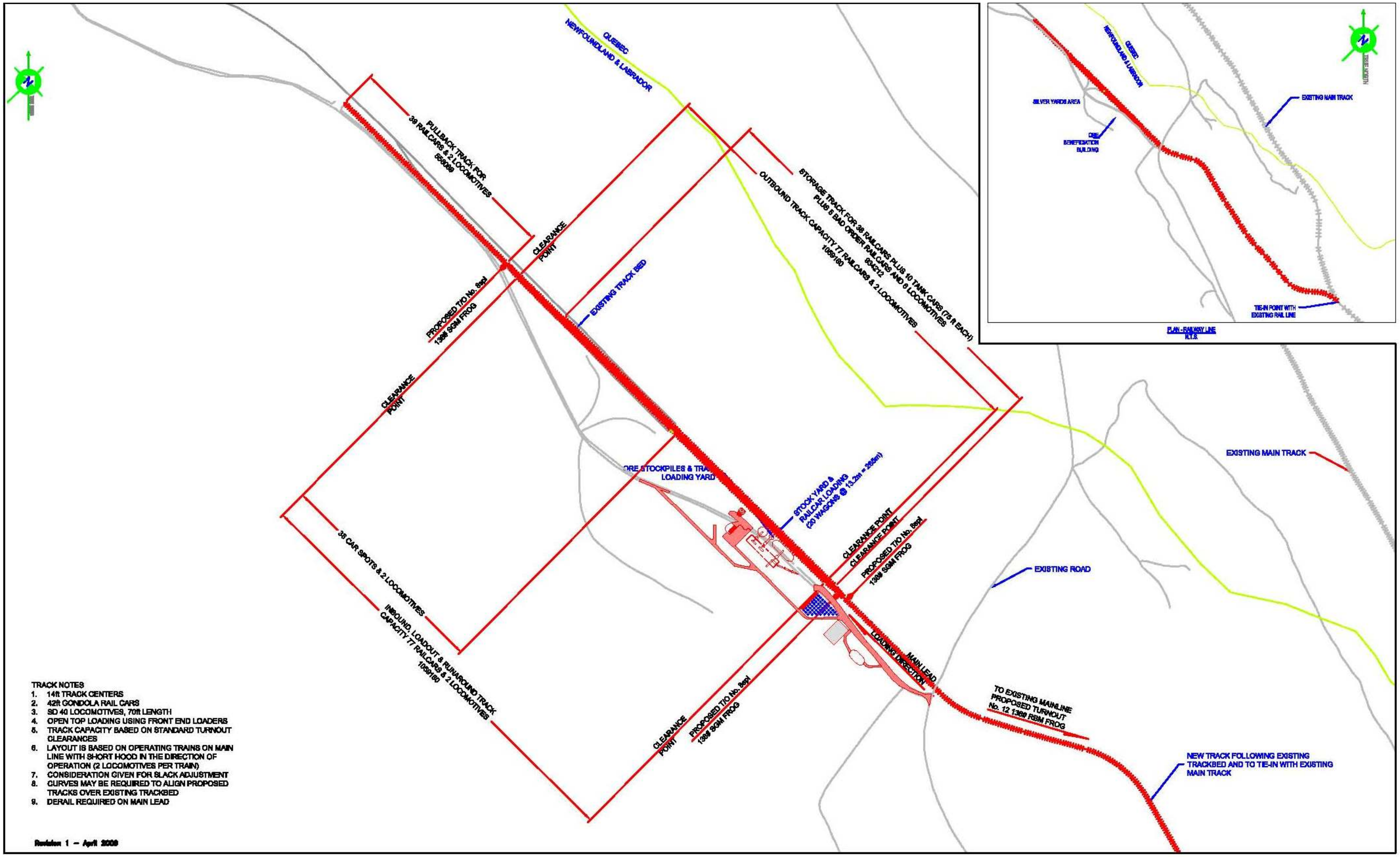


Figure 3.10 Existing Railway Infrastructure



TRACK NOTES
1. 14ft TRACK CENTERS
2. 42ft GONDOLA RAIL CARS
3. SD 40 LOCOMOTIVES, 70ft LENGTH
4. OPEN TOP LOADING USING FRONT END LOADERS
5. TRACK CAPACITY BASED ON STANDARD TURNOUT CLEARANCES
6. LAYOUT IS BASED ON OPERATING TRAINS ON MAIN LINE WITH SHORT HOOD IN THE DIRECTION OF OPERATION (2 LOCOMOTIVES PER TRAIN)
7. CONSIDERATION GIVEN FOR SLACK ADJUSTMENT
8. CURVES MAY BE REQUIRED TO ALIGN PROPOSED TRACKS OVER EXISTING TRACKBED
9. DERAIL REQUIRED ON MAIN LEAD

Revision 1 – April 2009

Figure 3.11 Proposed Railway Infrastructure

3.1.4.12 Storage, Loading, and Shipping

After beneficiation, saleable products will be stockpiled at the Silver Yard site and loaded into ore cars with a front end loader. The loaded cars will be hauled by LabRail to the main line and then hauled to Emeril Junction. The cars will be hauled from Emeril Junction to Sept Iles by QNS&L.

The initial operation of the Project is scheduled to produce 1,500,000 tonnes of ore in the first year through a haulage season of approximately 7 to 8 months per year.

3.1.4.13 Regulatory Framework

LabRail will operate entirely within Labrador and as such will be regulated under the provincial *Rail Service Act* 1993. The regulatory provision of this act is that the railway construction and operation must be approved by the Lieutenant-Governor in Council (Cabinet). Cabinet would then assign additional regulatory function to one or more government departments such as the Department of Transportation and Works.

As LabRail will only operate within the Province of Newfoundland and Labrador, it will therefore not, at least initially, be required to be designated as a Common Carrier under the provisions of the *Canada Transportation Act* 1996. Nevertheless LabRail will agree that it will operate as if it were a common carrier for the purposes of ensuring that other potential users of LabRail track and facilities will be granted a suitable level of service.

3.1.5 Surface Water Management

3.1.5.1 James North and James South Deposits

There are two surface water features within the James North and James South properties:

- James Creek flows along the eastern edge of the sites; and
- An unnamed tributary which originates from a spring situated between the James North and James South mine pits areas flows southeast into Bean Lake. The spring is located approximately 30 m west of the existing road crossing.

Surface water features of relevance on and in the immediate vicinity of the James Property include Bean Lake (east of site), James Creek (which flows from east of Ruth Pit to Bean Lake), and several springs that originate on the James property and form an unnamed tributary that flows southeast from the site to Bean Lake. Details regarding flows and water balances for these features are presented in Section 4.1.4. The locations of the two springs at the James deposit (James North and James South Springs) are such that they will likely be affected by pit dewatering, and since they are the source of water for the unnamed tributary, it is also likely that the unnamed tributary will be affected unless mitigation measures are put in place. A mitigation strategy to deal with this is outlined in detail in Sections 4.1.4 and 7.3, but in summary, it will involve diverting a portion of the pit groundwater dewatering water (after settling) to the unnamed tributary to make up for the water lost from the springs. The source of the springs is groundwater and the source of the pit dewatering water will be groundwater, therefore, the mitigation strategy involves using the same source of water as is currently supplying the tributary.

Surface water collected in in-pit sumps within the James North and James South pits will be pumped to the nearby James Settling Pond area and managed separately from the groundwater dewatering system water at Settling Pond Area SP1. It is currently anticipated that this area would include two settling ponds, one for the pit water management and one for groundwater dewatering management. The ponds will be engineered to ensure that in-pit dewatering and well dewatering effluent will be of suitable quality for discharge to the environment.

Further details of water management at the James North and James South properties are provided under Section 3.3.5.

3.1.5.2 Redmond Deposit

The Redmond deposit area contains isolated ponds and pits, primarily created from past mine workings. There are currently flooded abandoned mine pits on-site. There are natural small waterbodies present and a small stream is located approximately 5 km from the proposed mine operation. The stream flows in a southeasterly direction through existing abandoned ore stock piles towards Redmond Lake.

The main surface water features in the vicinity of the proposed Redmond 2B pit are a wetland/pond area located north of the proposed pit which serves as a source for a stream that runs southeast past the north side of Redmond 1 Pit and ultimately discharges into Redmond Lake. Details regarding flows in this stream are presented in Section 4.1.4. A groundwater discharge appears to be the main source of water discharging from the wetland at the headwater of this stream.

Other surface water features of note include the now flooded Redmond 1 and Redmond 2 pits, located southeast of the proposed Redmond 2B pit. The groundwater water table at Redmond 2 is approximately 25 m below ground surface in the proposed Redmond 2B pit area. Therefore, pit dewatering may be required after the first year of mining to lower the water table in the immediate vicinity of the pit to allow mining to occur to the base depth of the proposed pit. Further discussion of the Redmond dewatering program is presented in Sections 4.1.4 and 7.3.

Surface water collected from pit dewatering activities within the Redmond 2b and 5 pits will be pumped to the existing Redmond 2 pit. Further details of the water management activities for the Redmond 2b and Redmond 5 pits are presented under Section 3.3.5.

3.1.5.3 Silver Yard

The surface drainage water from the catchment area of the beneficiation plant will be diverted to the Silver Yard Stormwater Management Pond (SWM-1), before release into the environment. The reject fines disposal pipeline and beneficiation plant emergency drainage is also located at that pond. Details of the SWM-1 pond were presented earlier under Section 3.1.3.5.

3.1.6 Clearance and Condemnation Work

Investigations of the old IOC stockpiles have shown that preferred stockpile locations were near pits and loadout areas which were underlain by rocks that were not part of the Sokoman Iron Formation. If there was no such convenient location then stockpiles would be placed on top of the iron formation, if it were to be found uneconomic (by their standards).

3.1.6.1 Redmond 2b

Geological mapping indicates that there is a band of Wishart quartzite running northwest to southeast on the west side of the Redmond 2B deposit and this was supported in the drill holes from LIM's 2008 drill program. The area to the west would be small, with the Menihek power lines being approximately 150 m away. This western location would offer an area that is approximately 150 x 200 m.

The area to the north would be quite small, being hemmed in by the pit itself, the Menihek power lines and the Redmond 5 access road.

There is an existing waste rock storage pile immediately to the east of the deposit that could also be considered for stockpiling. This area is underlain by rock units other than the Iron Formation.

An existing waste rock and low-grade ore stockpile is located between the Redmond 2b deposit and the existing Redmond 2 pit. Drill holes from LIM's 2008 drill program indicate that these stockpiles are located on top of Wishart Quartzite (waste). This pile could be enlarged.

The area immediately to the west of this low-grade stockpile (and still between the 2 and 2B deposits) is an area that should be considered for future exploration and not covered over. The potential for exploration in this area was deduced from the apparent ore material in the NW wall of the Redmond 2 pit.

In addition, the mined out Redmond 2 pit could be backfilled with waste rock.

3.1.6.2 Redmond 5

The geology map shows that there is a barren northwest to southeast trending band of Wishart quartzite immediately to the east of the deposit and additional mapping will be conducted in order to determine its coverage.

There is a broad band of Iron Formation to the west of the Redmond 5 deposit which is still open for exploration and could have some potential for economic mineralization.

3.1.6.3 James North

The proposed James North waste rock storage area appears to be on top of uneconomic Fleming Formation (chert breccias), Denault Formation (dolomite) and Wishart formation (quartzite) all of which have been mapped immediately to the east of the proposed pit. This information is from IOC Geology Maps and Wardles 1982 Geology Map of the area. In addition to the geological mapping, IOC 1:40 feet scale cross sections covering the proposed area supports the uneconomic or absence of mineralization and suggests a suitable place for stockpiling. Mapping and possibly trenching/drilling could further expand this area to the north.

3.1.6.4 James South

The proposed area for the James South waste rock storage area is underlain by the Sokoman Iron Formation, which within this area is considered to be uneconomical, and is southeast along strike of the James Deposit.

There is an area south of the proposed James South pit that has a potential economic interest and as such has been avoided in the footprint for the James South Waste Rock Storage and Low-grade Stockpile area.

3.1.7 Waste Management

The objectives of waste management are to prevent, minimize, and mitigate the impact of the waste materials on the environment. The plan is to control the on-site management and final disposal of wastes during the construction and operation phases. Where and when possible, a Reduction, Reuse and Recycling policy, will be implemented to minimize waste generation.

3.1.7.1 Wastewater and Sewage

Wastewater and sewage collection will be required at the Silver Yard area, at the Redmond site, and at the work camp. At the Redmond site, washroom facilities will be provided within a mobile trailer unit. Wastewater and sewage will be handled by holding tanks and transported to the Silver Yard wastewater treatment module.

As indicated in Section 3.1.4.6, sanitary waste at the camp will be collected and treated using a domestic wastewater treatment system that employs biological oxidation of wasterwater using a rotating biological contactor (RBC) form of aeration. This system produces minimal sludge, which will be removed at an estimated rate of once per operating season and disposed of at an NL-approved facility by a licensed contractor.

At the Silver Yard area, wastewater and sewage will be handled and treated by a similar system as that proposed for the camp. Grey water is sterilized before its final discharge at the outlet of the wastewater treatment module. It is proposed that sterilization of grey water will be by means of UV disinfection in the waste water’s last section of the treatment system. After sterilization, this water will be transferred to Ruth Pit.

During the construction phase and until the sewage treatment is operational, wastewater and sewage will be collected in holding tanks, emptied by vacuum truck and disposed of at a licensed facility. All management will be conducted in accordance with applicable regulations.

3.1.7.2 Domestic and Solid Waste Disposal

There is no on-site landfill proposed for the Project. It is planned that garbage and litter will be collected on-site and delivered to an experienced Labrador-based contractor and placed in a landfill facility in Labrador West, in accordance with applicable regulations. Any food or organic garbage onsite will be held in animal-proof containers to prevent attracting bear, birds, and other wildlife.

No wastes will be deposited in or near watercourses or wetlands. A recycling program is being considered for the area and LIM will support and participate in this initiative, where possible.

3.1.7.3 Hazardous Waste

It is not expected that the mine will generate large quantities of hazardous waste. Should any hazardous wastes be generated, they will be stored, transported, and disposed of according to federal and provincial waste disposal regulations.

LIM will require contractors to follow provincial waste diversion regulations or policies, including provincial programs for beverage containers, tires and waste oil and other petroleum products. Discarded tires will be handled according to the requirements of the provincial tire recycling program established by the Waste Management Regulations and used oil will be collected for recycling or reuse according to the Used Oil Control Regulations. In addition, any scrap metals will be taken to a scrap metal recycling operation.

3.1.7.4 Beneficiation Plant Waste Effluent

The production of the “direct shipping” ore requires only a simple process of crushing, screening, and washing. Effluent originating from the beneficiation area will contain rock fines but will have no chemical constituents. Current mine plans anticipate that the washwater will be directed into existing mine pits to settle out solids. For the properties addressed in this study, the existing pit to which the washwater will be directed is the existing Ruth Pit.

Although the Ruth Pit outflow is the start of James Creek, environmental baseline information, including a preliminary aquatic habitat assessment, confirms that the abandoned pit has no surface connectivity to existing fish habitat. The outlet at Ruth Pit is a submerged culvert that is located in the southwest portion of the pit. Historical pit wall rock debris has partially blocked the pit-side end of the culvert, and the pit water level is approximately 2 m above the top of the culvert. Water still flows through the culvert but more by infiltration rather than surface level flow due to the blockage. However, the discharge end of the culvert is perched approximately 1 m above the James Creek inlet, therefore, fish cannot enter Ruth Pit from James Creek because the culvert is perched and is blocked by coarse rock.

Further to recent discussions with regulators (DFO, February 2008), the 2008 baseline program has provided additional confirmation that the existing pits do not contain self-sustaining fish communities.

LIM is evaluating the existing outlet structure at Ruth Pit and it is anticipated that upgrades to this structure may be required at some point in the future. The details of the upgrades will be developed with the overall detailed design stage of the Project, and final design will be provided as part of the Development Plan and permitting stage. LIM acknowledges that permitting for any upgrades, if required, will be subject to Section 48 of the *Water Resources Act* and that monitoring will be required.

3.1.7.5 Waste Rock

Waste rock will be hauled from the pit and disposed of outside the pit limits at a sufficient distance from the active pit limits, rivers and lakes. The location of the waste rock storage areas has been selected to provide sufficient capacity as close as practical to the source of waste, and on moderate slopes to minimize the risks of failures. Precipitation infiltration and site drainage during construction may result in run-off water containing suspended solids. As a result, stockpile construction and mine design will include prevention and mitigation strategies for control and treatment of the suspended solids, as required (e.g., ditch blocks, filter cloths, settling ponds, etc).

Any off-grade product from the beneficiation process will be hauled to a nearby stockpile location.

3.2 Construction

Construction will comply with all applicable standards and regulations, environmental protection guidelines and regulations. A series of environmental protection measures will also be implemented in accordance with the potential Project effects identified through the environmental assessment process (Chapter 7). An Environmental Protection Plan (EPP) will be prepared for each construction phase. An outline of an EPP is contained within this document.

The Contractor's field engineer will ensure that all construction activities comply with the EPP and all regulations, permits, approvals and authorizations. An Environmental Coordinator will provide technical support to the Contractor's field engineer, as well as perform environmental inspections and liaise with regulatory agencies.

3.2.1 Project Schedule

Subject to approval, construction is scheduled to start in 2009. The Project areas are already partially pre-stripped and a limited amount of iron ore product could be readily developed for shipment on a limited basis using the existing railway (Section 3.1.4.9).

The Estimated Production schedule is shown in the following Table 3.3.

Table 3.3 Estimated Production Schedule

	Tonnes of Product by Year				
Deposit Area	**2010**	**2011**	**2012**	**2013**	**2014**
James	1,000,000	1,000,000	1,000,000	750,000	500,000
Redmond	500,000	500,000	250,000	250,000	100,000
Total	1,500,000	1,500,000	1,250,000	1,000,000	600,000

The life of the Project is five years. A Project schedule is shown in Figure 3.12.

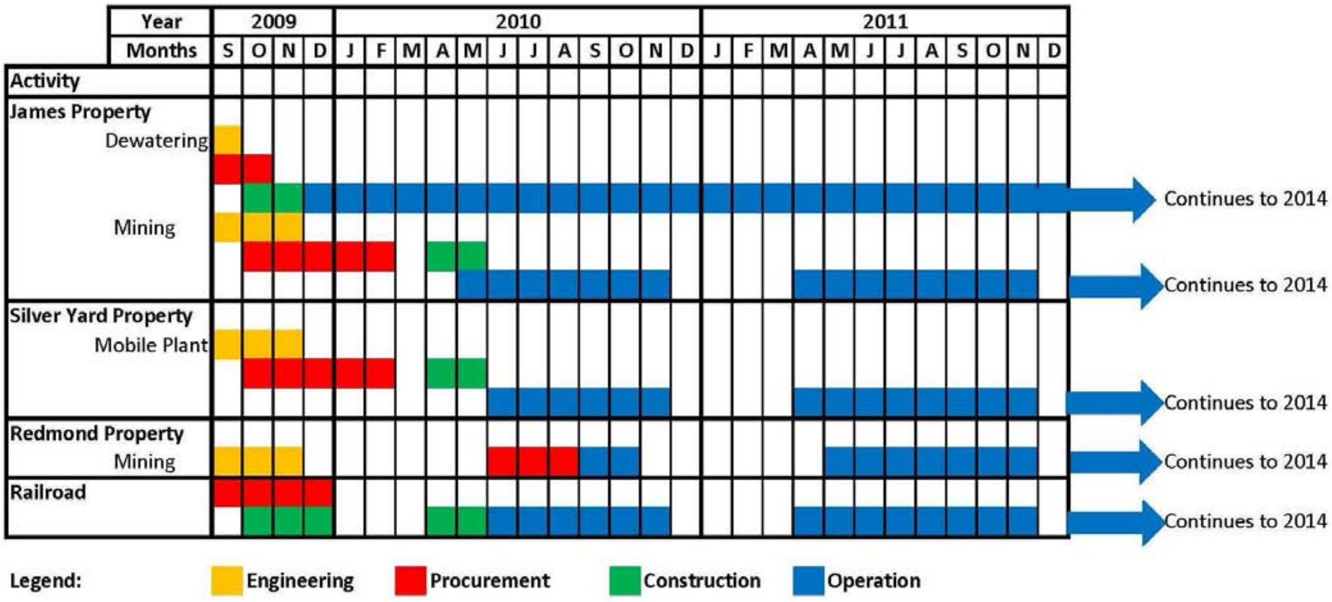


Figure 3.12 Project Schedule

3.2.2 Site Preparation

3.2.2.1 Clearing

Trees and shrubs will be cleared with chain saws or other hand-held equipment. Mechanical clearing methods may be used in areas where terrain disturbance will not cause topsoil loss or sedimentation of watercourses and waterbodies.

Vegetation clearing (e.g., trees and shrubs) will be required in advance of some access road construction, building construction, pit development, and other site preparation activities. Refer to Figures 3.13 and 3.14 for extent of area. Current environmental studies have not identified the presence of merchantable timber within the areas of clearing. Prior to site clearing, migratory bird nests will be identified and appropriate buffers applied. Any trees that are large enough will be salvaged and cut for firewood and/or put through a chipper. Available organic material will be used to help revegetate areas in the future. The remaining trees will be burnt or mulched.

All work will be carried out following all applicable government legislation including the *Forestry Act* and *Cutting of Timber Regulations*.

3.2.2.2 Grubbing and Debris Disposal

Grubbing of the organic vegetation mat and/or the upper soil horizons will be limited to that necessary to meet the Project engineering requirements. Topsoil and organic materials will be stockpiled and used in site rehabilitation.

A minimum 15 m buffer zone of undisturbed natural vegetation will be maintained between watercourses and areas of grubbing activity. If specific site conditions require modification to the buffer zone, this will be undertaken in consultation with the DFO Area Habitat Biologist. Any work within the 15 m buffer of a water body showing on a 1:50,000 scale map will also need a permit from the Department of Environment and Conservation, Water Resources Management Division.

Following release from the environmental assessment process, and once all the required government permits have been received, the construction phase would be initialized. General construction will employ best practices, incorporating and following the guidelines provided in “Environmental Guidelines for Construction and Mineral Exploration Companies” and LIM’s site and task-specific EPP.

3.2.2.3 Pre-Stripping

Grubbing of the organic vegetation and/or the upper soil horizons will be kept to the minimum but is necessary within the Project footprint. Erosion control techniques and devices will be used to stabilize easily eroded areas. Topsoil and overburden will be stored in separate stockpiles for later use in reclamation activities.

Any unsuitable material will be placed in an approved stockpile area. Runoff of sediment-laden water during grubbing will be minimized by using measures such as settling ponds, ditch blocks, interception ditches and filter fabrics. Erosion control measures such as rip-rap, filter fabrics, drainage channels, and gravel or wood chip mulches will be implemented, as appropriate, in areas prone to soil loss. Erosion and Sediment Control measures will be installed in accordance with manufacturer’s recommendations. These features may include, but are not limited to, silt fencing, sediment control ponds, and gabion blankets. All work will be in accordance with the “Environmental Guidelines for Construction and Mineral Exploration Companies” and LIM’s site and task-specific EPP.

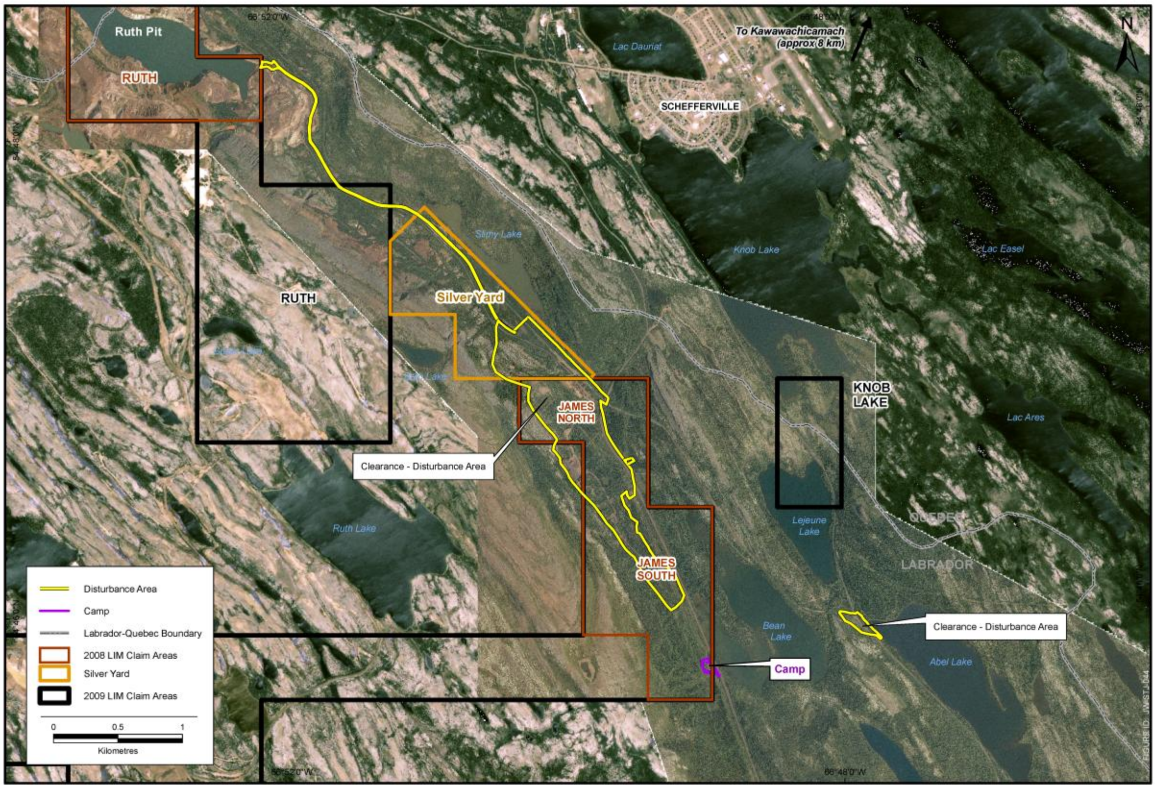


Figure 3.13 Extent of Vegetation Clearing, James

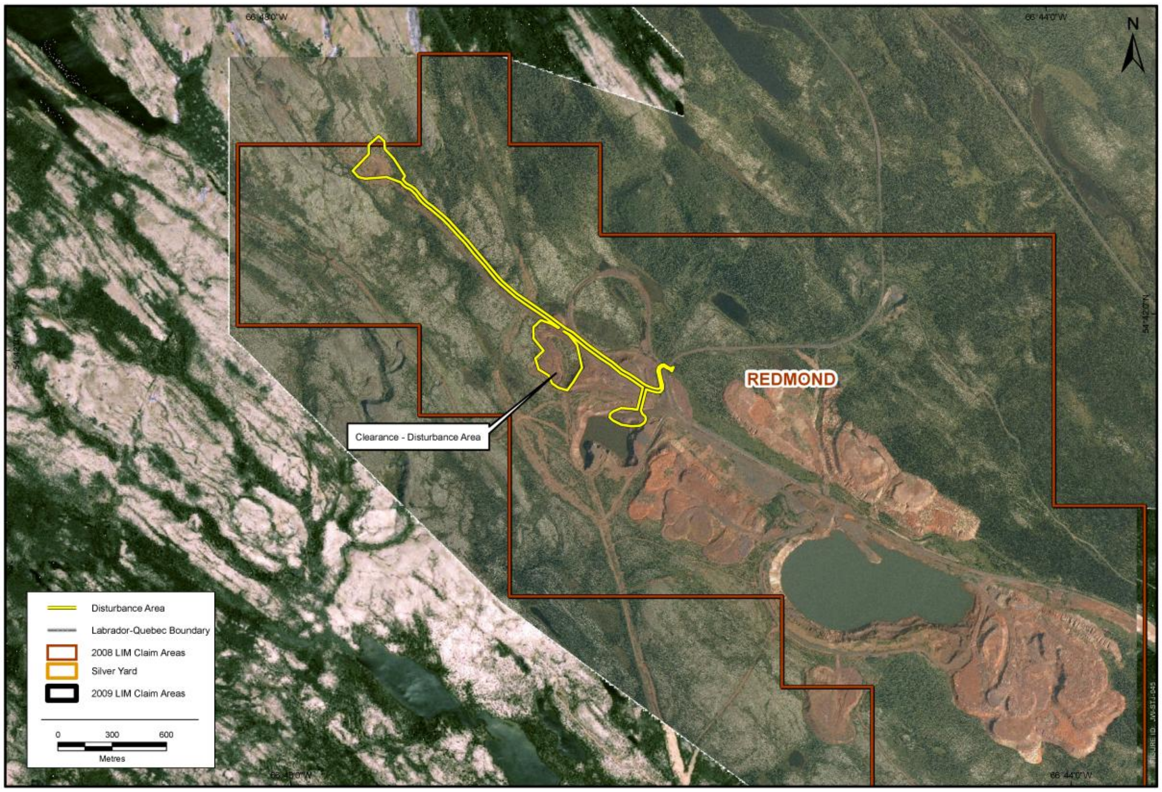


Figure 3.14 Extent of Vegetation Clearing, Redmond

3.2.2.4 Site Preparation Activities for Beneficiation Plant and Railroad Facilities at Silver Yard

The Silver Yard area is the location of the railway marshalling yard previously operated by IOC. With minor exceptions, the original railway subgrade and track ballast remains in place although the steel tracks were removed sometime after IOC terminated its mining operations in 1982. The LIM beneficiation plant will be located in the Silver Yard area and related disturbance of the natural environment will be managed to limit the overall size of the facilities footprint. Structures will include the beneficiation building itself, along with related support infrastructure such as finished product stockpiles, run-of-mine ore stockpiles, laydown yards, office facilities, plant access roads, the railroad marshalling yards and associated ore car loading facilities. Further details of the infrastructure are provided in Section 3.1.4.

Excavated volumes have been utilized to backfill areas required for ore stockpile pads, the rail car loading area, site access roads, etc. When cut and fill volumes are balanced, a total of only 15,000 cubic meters will need to be borrowed (from James deposit area). That is, there will be no net surplus of excavated material from the Silver Yard site preparation.

Topsoil material salvaged from the Silver Yard site preparation will be stockpiled around the site for future reclamation purposes. These areas will be seeded to provide stability to the stockpile.

The James Property requires clearing and grubbing within the waste rock storage and low-grade stockpile footprints and pit footprints. The Redmond Property requires minimal clearing and grubbing within the possible low-grade stockpile and waste rock dump storage footprints. No clearing and grubbing is required for the waste rock dump storage option. Stripping within the pit footprints has already been done by IOC during previous mining operations. Suitable reclamation material from the clearing and grubbing will be stockpiled in strategic locations for future reclamation purposes.

3.2.3 Construction Infrastructure and Activities

Construction within the Project area will involve the following activities:

- transporting equipment, construction materials and related supplies to construction sites, including transporting, storing and handling hazardous materials, fuels, lubricants and explosives;
- establishing and operating laydown areas;
- excavating, including disposing of excess waste rock and overburden
- establishing and operating borrow pits, including identifying sources of borrow material;
- railway construction;
- activities in and around watercourses;
- erection of buildings for wash plant, maintenance shop, and other buildings (offices, lab, camp, etc.). Note that these buildings will be of temporary/portable structure complying with appropriate building codes, etc.; and
- site rehabilitation and environmental monitoring.

Power supply during the construction phase will be by diesel generators and will be supplied by the contractors conducting the work.

It is anticipated that there will be no blasting required for any of the construction activities.

There are no upgrades planned for the haul road to Redmond, with the exception of minor maintenance. Material will sourced from the James and Redmond waste rock.

During the construction phase, excavations will occur in the following areas: primary crusher, settling and stormwater management pond. The expected vehicle types during construction include dozers, graders, rear-dump trucks, hydraulic shovels, boom trucks, and pick-up trucks. The expected hours for equipment use during construction range from 300 hours to 2,000 hours.

Construction activities are expected to be conducted on both day shift and night shifts.

3.2.3.1 Construction Yard Areas

A construction trailer yard has been provided for in the site layout design. The yard covers an area of approximately 75 m x 50 m. The yard will include a number of standard mobile trailers and a gravel parking area for 50 vehicles. Adjacent to this yard will be a construction material and equipment lay down yard. The lay down yard will be approximately 75 m x 50 m. These yards are more than 50 m from any natural waterbody. These yards will remain after construction and be used as additional lay down areas for the operational phase.

3.2.3.2 Truck Routes

Road traffic during construction will include deliveries of material from the nearby train station. Materials will include steel, concrete, and equipment. Vehicles and equipment will follow established routes when travelling to or from the site. All entrances and exits to the site will be designed so that incoming and outgoing vehicles may merge safely with other traffic, and oversized modules will be provided with escorts as required. A traffic control plan will be created for the Project. Hazardous materials will be transported and stored as required by the supplier's Material Safety Data Sheets (MSDS).

3.2.3.3 Sources of Aggregate

The aggregate required for the concrete will be sourced locally. All other aggregates required for the construction will be taken from the excavation material on-site or from waste rock at the mine.

The waste rock from the James and Redmond sites will generally be acceptable for use in road building and maintenance. The onsite mobile crushing plant would be used to create acceptable crushed material.

As indicated in Section 3.1.3, there are existing excavations in close proximity to the Project that are identified as sources of acceptable material.

3.2.4 Pit Dewatering

3.2.4.1 James Property

The water drawn from the proposed dewatering wells around the James pit is estimated to be discharged at a rate up to 113 m^3/min (SNC 2008). This flow rate is based on early calculations and limited data and is considered to be very conservative. Currently, it is proposed to have dual filters at the dewatering pump outlets with one dual filter per two pumps. These filters will treat the groundwater by removing the sediment prior to discharging to the natural environment. A settling pond (Settling Pond Area SP1) will also be constructed to provide additional settling/retention time, as required.

A small quantity of water will be discharged to the unnamed tributary and the remaining majority of water will be directed to the Silver Yard for use in the beneficiation process, discharged to Bean Lake, and/or via James Creek. The preferred location for the large quantity outlet will be designed during the detailed design phase.

The settled (removal of suspended solids by settling/filtering) pit dewatering water, which will be discharged to the south portion of James Creek near where the creek discharges into Bean Lake. Measures will be put in place to minimize any potential erosion or hydraulic effects from this discharge. The stream bed is rocky in this area so erosion is not likely, however the flow will be discharged over a diffuser bed before entering the creek as an additional erosion control measure.

Further discussions on dewatering activities are presented in Section 3.3.5.

3.2.4.2 Redmond Property

Pit dewatering water from the Redmond 2B and 5 pits will be pumped to the historical Redmond 2 pit for suspended solids settling. Note that Redmond 2 Pit is not connected by surface flow to any outside water bodies and it is planned to maintain this hydraulic isolation during operations. Dewatering rates for Redmond 2B and 5 have not been determined yet. Additional design details, including but not limited to dewatering rates, retention times, flow rates, and hydraulic controls, will be provided at the permitting stage.

Further discussions on dewatering activities are presented in Section 3.3.5.

3.2.5 Housing and Transportation

The great majority of operations workers will commute to and from the mine site on a rotational basis, alternating between periods of work, during which they will live in LIM provided camp accommodations and periods living in their home communities. The camp will include a kitchen (with catering), dining room, laundry facilities, and a recreation area. The recreation facilities may include such features as a pool table, television lounge, exercise equipment, and access to outdoor recreation. The camp will also have wireless internet and telecommunications access. An estimated 60 workers are anticipated to use the camp at any one time from approximately April to November on an annual basis during operations. Workers will be transported to and from the work site by buses/vans/pickup trucks.

3.2.6 Predicted Construction Emissions

As discussed in Section 3.2, construction activities at the site will include railway track installation, railbed grubbing, the clearing/grubbing for site services area, and the erection of buildings. All construction activities would occur in the short-term and potential emissions would be generated from tail pipe emissions from vehicles and combustion emissions from diesel generators (i.e., combustion emissions such as nitrogen oxides (NO_X), carbon monoxide (CO), and sulphur dioxide (SO_2)), and from fugitive dust (i.e., particulate matter (PM)) due to earth moving activities and vehicle traffic.

Heavy construction activities at the site will include erecting the crushing facility, the placement of the required generators and tanks, and the installation of conveying systems and rail lines. Emissions during construction are expected to occur intermittently over the duration of the construction period as opposed to emissions during operation, which will occur continuously. Also, the amount of fugitive dust emitted due to operational activities (crushing, ore loading/unloading, conveying, and stockpile erosion) will be greater than those observed during construction activities. Therefore, the maximum emissions during operation provide a conservative envelope for those occurring during construction.

Fugitive dust emissions during construction can occur due to land clearing, ground excavation, and equipment traffic on site.

Generally, fugitive dust emissions are:

- proportional to the disturbed land area and the level of construction activity;
- limited to periods of the day and week when the construction activities take place; and,
- vary substantially from day to day with varying meteorological conditions.

Fugitive dust emissions during construction are expected to be localized in extent, limited in duration, and smaller in magnitude than those occurring during operation. Fugitive dust emissions can be minimized by considering mitigation measures such as dust suppressants (e.g., water) on vehicle haul routes, tire washes, operational controls, and other control measures such as landscaping screens.

Emissions due to fossil fuel combustion are also expected to occur during construction in the beneficiation area through the use of diesel generators and as tail pipe emissions from on-site traffic. As is the case for the fugitive dust releases, emissions including NO_X, CO, PM, and SO_2 are expected to be localized in extent, smaller in magnitude, and will occur for shorter durations than the potential emissions during operation. Further details on emissions occurring during construction are provided in Appendix H

3.2.7 Site Rehabilitation and Monitoring

LIM is committed to progressive site rehabilitation during the construction and operation phases of the Project. Progressive rehabilitation is defined as rehabilitation completed, where possible or practical, throughout the mine development, construction and operation stages, prior to closure. This includes activities that contribute to the rehabilitation effort that would otherwise be carried out at mine closure.

All aspects of mine development including mine design, infrastructure location and design, and operations planning have and will be conducted with full consideration of available progressive rehabilitation opportunities and closure rehabilitation requirements. Baseline environmental studies conducted prior to site construction works will continue, or be refined as required, through the mine development and construction stage. The Project has been planned and designed to minimize the disturbed area of the site, to incorporate areas disturbed by previous mining activities where possible, and to minimize the environmental impact prior to mine operations.

A comprehensive environmental monitoring program will be conducted as part of the mine development and this data will be utilized to evaluate the progressive rehabilitation program on an ongoing basis.

3.2.8 Employment

Occupations during the construction phase, including NOC-2006 codes, are presented in Table 3.4. Certain management positions will be required throughout construction. Others will only be required on-site for limited periods (between about 2 days and 4 weeks on site). Given the small numbers of trades-persons involved, it may be difficult to employ apprentices for some trades in the journeyperson to apprentice ratios determined in accordance with the provincial general conditions concerning apprenticeship. However, LIM will strive to maintain the journeyperson to apprentice rations where possible.

Detailed information on project employment is provided in the NL Benefits Plan, which was developed in consultation with Natural Resources and other departments (Appendix D).

Table 3.4 Construction Phase Employment

Position	Number	NOC
Site Manager	1	0711
Clerk	1	1441
Lead Foreman	1	0721
Surveyor	1	2254
Equipment Operator – heavy	4	7421
Equipment Operator – light	3	7421
Truck Drivers	3	7411
Labourers-specialized	2	7611
Labourers	6	7612
Carpenter	2	7215
Welders	2	7265
Electricians	1	7241
Electrical Helper	1	7611
Crane Operator	1	7371
Boilermakers	1	7262
Ironworkers - steel reinforcement	1	7264
Ironworkers - steel reinforcement-helper	1	7611
Cement Finisher	2	7282
Structural Steel Workers	2	7263
Structural Steel Worker – apprentice	1	7611
Pipe Fitters	2	7252
Pipe Fitter-helper	1	7611
Total - Construction	**40**	

3.2.9 Goods and Services

The construction phase of the Project will see the procurement of goods and services, most of which are available in Newfoundland and Labrador. They include:

- earthworks;
- site construction;
- buildings construction;
- camp supply;
- plant construction;
- mine preliminary works and overburden stripping;
- fuel and refuelling services;
- welding and machining goods and services;
- land surveying;
- catering services

- vehicle rental;
- blasting;
- pipe-laying;
- road construction;
- electrical and mechanical contracting;
- miscellaneous tools and small equipment;
- heavy equipment rental (cranes, excavators, loaders);
- independent environmental monitoring; and
- air transportation.

LIM will ensure that construction management, engineering, procurement and project service activities for the construction phase of the Project shall, to the greatest extent possible, be carried out in the Province. LIM recognizes the existence of significant construction, fabrication and assembly infrastructure within the Province and will encourage utilization of such infrastructure. Specifically, LIM will require that potential contractors bid work on the basis of utilizing qualified, competitive provincial suppliers of construction, fabrication and assembly services, where available. All major construction and supply contracts will be advertised within the Province and potential provincial based contractors and suppliers will be given every opportunity to provide competitive quotations.

3.2.10 Newfoundland and Labrador Benefits Strategy

As is detailed in its Benefits Policy (Section 2.2.3), LIM understands the importance of the Project to the people of the Province of Newfoundland and Labrador and is committed to the delivery of associated benefits, including education, training, and economic development, to the existing communities in Labrador. LIM is also committed to the principles of local procurement of supplies and services.

Consistent with this Policy, LIM will ensure residents of and companies based in the Province receive full and fair opportunity and first consideration for employment and business respectively, where practically and commercially achievable on a competitive basis and in accordance with the IBA entered into with the Innu Nation of Labrador.

In implementing the Benefits Plan, LIM will:

- Communicate all material Project labour, contracts, goods and services requirements on its website and in newspapers in the Province, and especially in Labrador, and require its contractors to comply with this policy;
- Establish targets for Project employment and for goods and services procurement, for both project construction and mine operations. The targets will represent minimum levels of participation by residents of the Province in Project employment and for business opportunities for Newfoundland and Labrador companies in Project activity and the Company commits to achieve or exceed these targets. Residents of Newfoundland and Labrador, at point of hire,, will be determined according to the principles established in *The Elections Act*, SNL 1992, CE-3.1 as being “ordinarily resident.”
- Include a copy of this Benefits Plan in all Project calls for expressions of interest, requests for proposals or contracts, and require that its contractors do the same.

- Require that prospective contractors indicate in bids how they would address the requirements of this Plan.
- Monitor Project employment and the supply of goods and services and, on a quarterly basis, prepare concise reports assessing actual outcomes relative to the Benefits targets.
- Provide copies of the above-noted quarterly employment and business reports to the Department of Human Resources, Labour and Employment and to the Department of Natural Resources in a timely manner, and be available to discuss these reports, including LIM's level of success in meeting targets, and appropriate responses.
- Review and, as necessary, revise LIM's benefits procedures and initiatives to ensure that LIM's commitments under this Benefits Plan, including the attainment of minimum targets, have been achieved.

Project employment and contracting are discussed in Section 7.4. This section also discusses the nature, scale and duration of employment and business opportunities. Given the small numbers of trades-persons involved, it may be difficult to employ apprentices for some trades in the journeyperson to apprentice ratios determined in accordance with the provincial general conditions concerning apprenticeship. However, LIM will strive to maintain the journeyperson to apprentice rations where possible.

More detailed information on employment the nature of employment opportunities has been incorporated in the NL Benefits Plan (Appendix D), developed in consultation with Natural Resources and other departments. This includes plans for liaising with relevant groups and agencies, criteria for ensuring full and fair access to Project-related opportunities, and descriptions of the timing and nature of employment opportunities that will flow from the Project. A Women's Employment Plan has also been developed in consultation with the Women's Policy Office for submission independent of the EIS, and has also been provided in an appendix to the EIS (Appendix D).

3.3 Operation and Maintenance

3.3.1 Operation and Maintenance Activities

The operation schedule will likely begin towards the end of April of each year and continue through to mid November, operating 24 hours per day. All operation and maintenance activities will be undertaken through separate contractors.

3.3.1.1 Excavation

The product will initially be excavated at 3,000 t/day per deposit site. It is anticipated that excavation will be conducted with the following types of mobile equipment:

- Komatsu WA600 loader (or equivalent); and,
- Komatsu PC800, PC750, PC400 type excavators (or equivalent).

3.3.1.2 Haulage

James ore and waste will be hauled with Komatsu HD605 type off-highway trucks or equivalent. Redmond waste will be hauled with the same type of truck. Redmond ore will be hauled from the pit by Komatsu HD605 type off-highway trucks (or equivalent) and stockpiled outside the pit. The raw ore will be reclaimed with a wheel loader or shovel and loaded into road trains (currently 45T) and hauled to the beneficiation area.

3.3.1.3 Drilling and Blasting

Drilling will occur for both ore quality control and for blasting purposes. Based on historic experience in the area, the drill pattern size for blasting is expected to be a 7.5 – 9 m square pattern. Blasting at James and Redmond will be episodic as the deposits are softer in nature and may be excavated without much blasting, although provisions for blasting will be available. It is planned that blasting will initially be done with packaged/cartridge type explosives. Table 3.5 depicts the expected equipment types and numbers:

Table 3.5 Equipment Types and Numbers

Equipment Type	Number of Units				
	Year 1	Year 2	Year 3	Year 4	Year 5
Wheel Loader	2	2	2	2	1
Mine Truck (Off-highway)	4	6	6	6	3
Track Dozer	1	2	2	2	1
Motor Grader	1	1	1	1	1
Haulage Truck	0	0	10	15	5
Blaster Truck	1	1	1	1	1
Explosive Truck	1	1	1	1	1
Pick Up Trucks	5	5	5	5	3
Fuel/Lube Truck	1	1	1	1	1
Drill Rig	1	1	1	1	1
Water Truck	1	1	1	1	1

3.3.1.4 Processing

The processing or beneficiation activities were presented in Section 3.3.1.4.

3.3.1.5 Product Export

The finished products of Lump Ore and Sinter Fines ore will be exported to markets likely outside of Canada.

3.3.1.6 Rock Fines Disposal

As presented in detail in earlier sections, the reject fines from the beneficiation process will be directed by pumping to Ruth Pit (see Section 3.1.9).

3.3.1.7 Maintenance Activities

A maintenance shed (sprung type structure on concrete pad) and maintenance yard will be provided to conduct routine maintenance for the mine and beneficiation operations. The building will be equipped with the necessary tools and equipment to maintain the mobile fleet. The building will have a concrete foundation and closed-circuit wash bay and an oil-water separator, which will be emptied by a licensed contractor on a routine basis and managed in accordance with applicable regulations. Small retail quantities of solvents may be used for parts cleaning and if so, will be properly contained, stored and disposed of accordingly. There will be no discharges to the environment.

It is expected that major repairs will be conducted off site at a location left to the Contractor’s discretion.

3.3.2 Predicted Operational Emissions

Potential emissions during operation are expected to be similar to those described in Section 3.2.6 for construction and include the products of combustion, such as NO_X, CO, PM and SO_2, from diesel generators and onsite traffic, and fugitive dust from ore loading/unloading, crushing, and stockpile erosion.

Emission estimates for the Project during operation were developed for all potentially substantive sources using the list of potential sources provided in the EIS Guidelines as a basis. Where emission sources indentified in the guidelines were found to be not substantive or not applicable, emissions were not estimated. All source and emissions estimates were based on preliminary design data for the Project. The potential emission sources during operation can be broadly grouped as either combustion emissions of fugitive dust emissions. Emissions were estimated for numerous non-negligible sources including generators, on-site vehicles, ore loading, ore crushing, stockpile erosion, and on-site conveyor systems.

The following subsections provide a qualitative overview of the anticipated emissions during operation. More details on Project emissions during operation (including, where applicable, detailed estimates and calculation methodology) is provided in Appendix H.

3.3.2.1 Emissions from Beneficiation Facility

Products of Combustion

Diesel generators will be used initially on-site on a continuous basis to provide power for the on-site equipment until the second phase of the electrical power supply is implemented. Emissions from combustion arise from the burning of fuel and are dependent on fuel flow rate, fuel type, combustion equipment and the efficiency of pollution control devices. The primary products from combustion include NO_X, SO_2, CO, and PM, which include both visible and non-visible emissions. Nitrogen oxide formation can be directly related to the high pressures and temperatures observed during the combustion process. Other emissions, including various hydrocarbons, CO, and PM, are primarily the result of incomplete combustion.

Standard techniques were used to estimate emissions which included using design specifications for the generators, along with accompanying emissions factors from the U.S. EPA, to estimate potential emissions due to diesel combustion.

Fugitive Dust

Fugitive dust emissions at the site will occur from several different sources during operation. Potential sources include ore loading/unloading, ore crushing, stockpile erosion and dust from conveyor systems around the site. Potential fugitive dust emissions at the site were estimated using emissions factors from the U.S. EPA AP-42 guidance documents.

Fugitive dust emissions from loading and unloading operations depend on the parameters of the storage pile being disturbed. Emissions due to stockpile wind erosion are highly dependent on local wind speeds and precipitation levels at the site, along with the type of material and its erosion potential. Larger aggregate material will have a tendency to form stable stockpiles, while finer material will erode over time.

Emissions from ore crushing and conveying depend on the amount of material being treated as well as the controls in place. Emissions control from the crushing operation at the site includes the use of a dust control system which will limit emissions from the main beneficiation area. Emissions from conveyors were estimated with no controls; however, covered conveyors may also be used to limit fugitive dust emissions during transport to and from the various storage piles at the site.

On-Site Traffic

Potential emissions from on-site traffic sources may include tail-pipe emissions due to fossil fuel combustion and fugitive dust. Emissions from combustion arise from the burning of fuel and are dependent on fuel flow rate, fuel type, combustion equipment and the efficiency of pollution control devices. The primary products from combustion include NO_X, SO_2, CO, and PM. Fugitive dust emissions due to on-site traffic would be proportional to the amount of property disturbed and the frequency of disturbance. Neither the tail-pipe emissions nor the fugitive dust emissions from on-site traffic are considered substantive compared to the other activities occurring at the facility during operation.

Locomotive Emissions

Combustion emissions are expected from the diesel locomotive used for transporting ore from the beneficiation area. Similar to on-site traffic emissions, emissions from combustion arise from the burning of fuel and are dependent on fuel flow rate, fuel type, and the type of combustion equipment. The primary products from combustion include NO_X, SO_2, CO, and PM.

Due to the infrequent nature of the source at the site (one trip is expected per day), emissions from the locomotives used on-site are not considered substantive compared to the other activities occurring at the facility during operation.

3.3.2.2 Emissions from Ore Hauling from Mine Site to Beneficiation Area

Emissions from the ore hauling activities are similar to the potential emissions due to on-site traffic as discussed above. Potential emissions may include tail-pipe emissions due to fossil fuel combustion and fugitive dust emissions.

Dust emissions would occur along the haul routes between the James or Redmond mine areas and the beneficiation area. These are all existing dirt roads and would be prone to dust emissions from any type of vehicle traffic. When a vehicle travels along an unpaved road, the vehicle’s wheels travelling on the road generate dust which is then lifted and exposed to passing winds.

Emissions due to ore hauling were estimated using standard techniques including equations found in the U.S. EPA’s AP-42 guidance documents. Fugitive dust emission estimates varied from 221 – 325 kg/day for the one km hauling route between the James deposit and the beneficiation area and 2869 – 4225 kg/day for the thirteen km hauling route between the Redmond deposit and the beneficiation area.

Particulate matter emissions from the ore hauling trucks travelling on a small on-property section of roadway (approximately 250 m) were estimated for input into the air dispersion model.

3.3.2.3 Emissions from Mining

Potential emissions due to the mining operations at the James and Redmond deposits include fugitive dust from loading and blasting operations and combustion gases from vehicles.

Fugitive dust emissions from loading operations depend on the condition of the storage piles being disturbed. When freshly processed material is loaded onto a pile, there is a greater potential of fine particulate emissions. Over time, as the pile is weathered, or if the material has high moisture content, potential emissions will be greatly reduced. Other factors influencing fugitive dust emissions during loading and unloading include the frequency of the operation and the local meteorological conditions, including wind speed, humidity, precipitation, and temperature.

The removal of ore and surrounding waste rock involves drilling and blasting. A dust cloud is produced during blasting. Due to the nature of open pit mining, the dust cloud will partially be retained in the pit, although some portion of it will rise out into the local surroundings. However, it should be noted that the elevated levels of particulate matter will be limited in spatial extent and short lived, as the majority of the fugitive dust will settle within a short distance (i.e., contained within the pit).

3.3.3 Operation Discharges

Disposal and treatment of discharges is presented in Sections 3.1.7 and 3.3.5.

3.3.4 Chemical Storage/Management

The beneficiation process does not require the use of any chemicals or reagents. XRF with lithium metaborate as a flux to produce glass disk will be used for Ore Control. Procedures for safe and appropriate handling will be developed using WHMIS and MSDS and in accordance with applicable regulations.

3.3.5 Water Management

3.3.5.1 James North and James South Property

During operations, the water management activities for the James North and James South properties are anticipated to include a combination of perimeter pit dewatering wells and in pit sumps. The water collected from these activities will be pumped to the nearby James Settling Pond area (SP-1) and managed separately. It is currently anticipated that this area would include two settling ponds, one for the pit water management and another for the groundwater dewatering management.

It is anticipated that water collected from the in-pit sumps and/or dewatering wells may require monitoring for such parameters as TSS, ammonia, and metals such as iron, copper, and zinc.

The main source of nitrogen and ammonia in mine waste waters is from nitrogen components in explosives that can be present in mine blast residues. When a blast is completely detonated, there are no blast residues. Therefore, the objective of reducing the amount of ammonia and nitrate levels in the mine waste water from blasting activities would be to implement actions that contribute to the complete detonation of a blast and reduce the amount of undetonated explosives. This can be achieved by:

- Controlling explosive losses through storage, spillage, and handling controls. Bulk ANFO and bulk emulsions can be spilled during storage, transfer, and loading. It is LIM’s plan to initially use packaged explosives (and not bulk explosives) for their periodic blasting requirements. The use of the packaged explosives is expected to reduce the amount of explosive spillage to handling and loading practices.

- Implementing engineered blasting practices that minimize to the extent possible, the amount of blasting material used and residue produced. These practices include, but are not limited to, the drill pattern design, explosive type and load, initiation method, delay timing, stemming heights, stemming material, burden and spacing sizing.

Additional discussion of approaches LIM has reviewed to reduce the potential of ammonia and nitrates in water is presented in Appendix T, *Methods to Control Ammonia and Nitrate Levels in Mine Waste Water*.

A properly designed, operated, and maintained settling pond is considered to represent best practicable technology for treating mine wastewater. The in-pit sumps, which are the first stage of mine waste water collection, could offer an initial pre-settling and retention time depending on the capacity of the sump.

The settling ponds will be engineered to ensure that in-pit dewatering and well dewatering effluent will be of suitable quality for discharge to environment. As a contingency, a temporary pump/pipeline system will be available to convey the effluent from these ponds to the Beneficiation area to be used for washing or it will be pumped to Ruth Pit via the ore wash water pipeline. If the water is used in the beneficiation process then it will reduce the amount of process water required. The wash water pipeline will be designed to accommodate this additional flow if required.

The water drawn from the proposed dewatering wells around the James North and James South pits has been estimated at a discharge rate of up to 113 m^3/min (SNC 2008). This flow rate is based on early calculations and limited data and is considered to be very conservative.

The results of the samples collected from the groundwater monitoring wells and during the pumping tests in 2008 at the James property indicate that the low levels of metals detected in the groundwater samples were associated with the suspended solids, and the filtered metals results were low. Observations made during the groundwater sampling and pumping were that initially the sampled water would be turbid and red but in less than 24 hours the suspended solids in the water tended to settle and the water cleared up. According to a former IOC engineer involved in dewatering operations at nearby historic mining operations, the water from the IOC dewatering wells generally cleared up within a week or so of pumping, after the wells had become well developed. No existing pits will be dewatered prior to mining (D. Hindy, pers. comm..).

Currently, it is proposed to have dual filters at the dewatering pump outlets with one dual filter per two pumps. These filters will treat the groundwater by removing the sediment prior to discharging to the natural environment. Directing the filtered dewatering water to the settling pond at SP1 will also provide additional settling/retention time, as required. Based on surface water quality monitoring results to date it is likely that the water from the perimeter dewatering wells will clear up over time as the wells become highly developed. This will lead to a further improvement in water quality.

From the James Settling Pond area (SP1), the collected and treated water will be discharged to the environment. A small quantity of water will be discharged to the unnamed tributary as part of a mitigation strategy, while the remaining majority of water will be discharged to Bean Lake and/or via James Creek. The preferred location for the large quantity outlet will be designed during the detailed design phase as part of the permitting stage.

The estimated wash water use rate in the beneficiation process is up to approximately 8.4 m^3/min, the source of which could be diverted from the pit dewatering volume. The water required to make up water potentially lost from the springs feeding the unnamed tributary can also be diverted from the pit dewatering volume. The net effect of this is that more water will be sent to Bean Lake (as a result of groundwater pumping) than currently flows into Bean Lake from surface water and groundwater inputs. Sections 4.1.4 and 7.3 provide information on the capability of Bean Lake to accommodate this additional flow without major hydraulic effects.

3.3.5.2 Redmond Property

During operations, water management activities at Redmond 2b and Redmond 5 are anticipated to include a combination of in-pit sumps and perimeter dewatering wells. Pit dewatering from the Redmond 2B and 5 pits will be pumped to the historical Redmond 2 pit for suspended solids settling.

Hydrogeological work conducted in 2008 determined that the depth of ground water is approximately 25 m below ground surface in the pit area at Redmond 2b. Although Redmond 5 pit will likely require some degree of dewatering, based on existing hydrogeological and other baseline data, the extent of the dewatering requirements for this pit are anticipated to be minor compared to other pits because this pit is higher in elevation and there are no surface water bodies nearby. It is expected that the depth to the water table will be relatively deep at this location (approximately 30 to 40 m below ground).

The subsurface hydraulic conditions suggest that dewatering rates should be significantly lower than at James pits. Based on the hydrological and mining details currently known, the historical Redmond 2 pit will be able to accommodate the dewatering water from Redmond 2b and Redmond 5.

Redmond 2 pit, which currently has no surface connectivity to nearby surface water bodies, will therefore be used as a settling pond for pit dewatering from the proposed Redmond 2b and Redmond 5 open pits. It will also be a waste rock storage area for some portion of the waste rock from Redmond 2b and Redmond 5. It is planned to maintain the non-connectivity of Redmond 2 to nearby surface water bodies. In order to maintain this hydraulic isolation at Redmond 2, the water level in Redmond 2 will be monitored during operations and once the water level reaches a pre-determined level, waste rock disposal from the proposed pits into Redmond 2 will cease and be stockpiled in other locations. In this manner, no overflow will occur.

3.3.5.3 Wash Water

Water requirements are modest, with the beneficiation process water (wash water) being drawn from groundwater wells. The water balance flows were estimated from similar process plants. The flows in the water balance are typical for average conditions for a wash plant producing 2 Mtpy of direct shipping product. The reject fines slurry concentration was assumed to be 21 percent by weight. There will be a number of pumps required, which will maintain a distribution of water within the beneficiation process and have enough capacity to allow for surge conditions such as plant start-up or line flushing.

Fresh clear water will be required for gland water use, potable water, fire water and miscellaneous users. Occasionally the process water reservoir may have a deficit of water which will have to be made up of fresh water. However the overall average water balance does not require fresh water for process water make-up. Fresh water will be supplied from similar groundwater wells. Water for dust suppression will come from beneficiation plant fresh water.

3.3.5.4 Sanitary (Non-Potable) Water System

Storage and management/disposal of sanitary wastewater and greywater will be conducted in accordance with applicable legislation. Wastewater and sewage will be handled and treated by biological oxidation of wastewater using a rotating biological contactor as form of aeration. Grey water is sterilized by means of UV disinfection in the waste water's last section of the treatment, before its final discharge at the outlet of the wastewater treatment module. After sterilization, grey water from the beneficiation area will be directed to Ruth Pit. Testing of sterilized water will be conducted routinely to ensure effective operation of the system.

It is estimated that the flow rate from the sanitary water systems at Silver Yard and at the camp will be a combined 17,000 L/day.

3.3.5.5 Potable Water

Potable water will be required at the beneficiation building, various site office trailers at Silver Yard, and at the site trailer at Redmond. Initially potable water will be tanked to the site and/or bottled water will be transported to the Project area. Existing ground water testing has shown that the water is of suitable quality, and therefore, groundwater use for drinking water may be considered at a future date. Testing of the potable water quality will be conducted regularly. Potable water at the Redmond site trailer will be provided by bottled water.

3.3.5.6 Dewatering Water

Dewatering at the James deposit will be conducted using a combination of perimeter dewatering wells and in-pit sumps. The water from the in-pit sumps will be directed to a settling pond separate from the perimeter well water settling pond at the SP1 settling pond area. The Redmond dewatering system is planned to consist of perimeter wells and in-pit sumps which will direct water to an historical pit, Redmond 2, which has undergone confirmation of the absence of permanent fish habitat and which is hydraulically isolated from any nearby surface water features.

Details are presented under Section 3.3.5.1.

3.3.6 Progressive Rehabilitation

Once the mines advance from the development stage to the operational stage, progressive rehabilitation activities can commence. Progressive rehabilitation is defined as rehabilitation completed, where possible or practical, throughout the mine operation stage, prior to closure. This includes activities that contribute to the rehabilitation effort that would otherwise be carried out at mine closure. Progressive rehabilitation opportunities identified for this Project include:

- Rehabilitation of any construction-related buildings and laydown areas;
- Rehabilitation of the Waste Rock Storage stockpiles;
- Development and implementation of an integrated Waste Management Plan;
- Rehabilitation, if required, of exploration drilling sites;
- Re-vegetation studies; and
- Some backfilling of selected existing open pit areas left by previous mining operations.

A comprehensive environmental monitoring program will be conducted as part of the mining operations and this data will be utilized to evaluate the progressive rehabilitation program on an ongoing basis. Additional studies, such as revegetation trials, will be conducted over the operational phase of the mine which will be integrated into ongoing progressive rehabilitation activities and will be used in the development of the final closure rehabilitation design.

Part of the rehabilitation and closure activities conducted during mine operations will include scheduled review and updates of the Rehabilitation and Closure Plan, as required. These scheduled reviews will incorporate any new or revised data gained from operating experience, progressive rehabilitation activities, environmental monitoring, and rehabilitation-related operational studies.

3.3.7 Employment

The Project operation phase employment by occupation, including NOC-2006 code, is presented in Table 3.6. It is expected that most workers will generally be employed on a four weeks on and two week off schedule. With the exception of the owner management positions, which will be full-time office positions, these personnel will be employed on a full-time seasonal basis.

Table 3.6 Operation Phase Employment

Positions	Number	NOC Code
Mine Operations		
Mine Operation Foreman	1	8221
Foreman	3	8221
Drill Operator	3	7372
Blaster	2	7372
Blaster Helper	1	8411
Loader Operator	3	7421
Haulage Truck Operator	9	7411
Dozer Operator	3	7421
Grader Operator	3	7421
Sampler	3	8614
Subtotal	31	
Mine Engineering		
Mine Engineer	2	2143
Mine Technician	1	2212
Surveyor	2	2254
Draftsman CAD	1	2253
Subtotal	6	
Beneficiation Operation		
Plant Manager	1	0721
Process Technician	1	2243
Chemical Technician (Lab)	3	2211
Labourer	1	7612
Administrative Assistant	1	1441
Warehouse Person	3	1472
Maintenance Foreman	1	7211
Utility Crew (pipeline, pumps, etc.)	1	7442
Primary Crusher Operator	6	9411
Secondary Crusher Operator	3	9411
Secondary Crusher Helper	2	9611
Belt Filter & Load-out Operator	6	9411

Positions	Number	NOC Code
Mechanic	2	7312
Mechanic Helper	1	7612
Safety/First Aid personnel	3	3234
Electrician/Instrumentation	2	7241
Locomotive Engineers	3	7361
Brakemen	3	7362
Yard Workers	3	7432
Subtotal	46	
Owner Management		
General Manager	1	0721
Geologist	3	2113
Environmental Technician	1	2231
Clerk	1	1441
Mine Engineer	1	2143
Innu Liaison	1	4212
Labrador offices	3	
Subtotal	11	
Contractor Management		
Site Manager	1	0711
Secretary	1	1241
Bookkeeper/Accountant	1	1231
Camp Operations	12	
Subtotal	15	
TOTAL - OPERATION	**109**	

Given the small numbers of trades-persons involved, it may be difficult to employ apprentices for some trades in the journeyperson to apprentice ratios determined in accordance with the provincial general conditions concerning apprenticeship. However, LIM will strive to maintain the journeyperson to apprentice rations where possible.

Additional information on employment during operation is provided in the NL Benefits Plan, which was developed in consultation with Natural Resources and other departments (Appendix D).

3.3.8 Goods and Services

Mine operations will require a wide range of goods and services, the majority of which are available in Newfoundland and Labrador. A review of local capabilities indicates that the following will be available on a commercial basis from within Newfoundland and Labrador:

- fuel and refuelling services;
- welding and machining goods and services;
- catering services and camp management;
- vehicle rental, rail passenger and air transportation services;
- maintenance operations;
- hardware stores miscellaneous tools and small equipment;
- heavy equipment rental (e.g. cranes, excavators and loaders);
- local contracting services (e.g. construction, electrical and mechanical);
- Mine contractors;

- Beneficiation Equipment operation; and
- Power Supply.

Some other goods and services will be available from elsewhere in the Province. Specific targets with respect to procurement of goods and services are provided in the NL Benefits Plan (Appendix D).

3.4 Decommissioning

3.4.1 Closure Rehabilitation

As described in Section 3.2.7, comprehensive environmental monitoring programs will be conducted as part of the mine development and operations and these data will be utilized to evaluate the Rehabilitation and Closure Plan, required under the *Newfoundland and Labrador Mining Act*, on an ongoing basis. Additional studies, such as re-vegetation trials, will be conducted over the operational phase of the mine which will be integrated into ongoing progressive rehabilitation activities and will be used in the development of the final closure rehabilitation design.

Part of the rehabilitation and closure activities conducted during mine operations will include scheduled review and updates of the Rehabilitation and Closure Plan, as required. These scheduled reviews will incorporate any new or revised data gained from operating experience, progressive rehabilitation activities, environmental monitoring, and rehabilitation-related operational studies.

Typically, the final review and update of the Rehabilitation and Closure Plan is conducted approximately one year prior to the cessation of operations. The final review of the Plan will provide the detailed closure rehabilitation design and procedures to fully reclaim the mine site. This Plan will be developed to a contract ready stage and would include Contract Documents and Drawings, as well as, a detailed cost estimate for construction (±15 percent).

Once mine operations have ceased, closure rehabilitation activities will commence as per the ‘final’ Rehabilitation and Closure Plan. Closure rehabilitation will generally include:

- increase in activities associated with rehabilitation of disturbed areas involving replacing overburden and re-vegetation of abandoned areas;
- removal of buildings and structures and clean-up at all work areas (i.e., beneficiation buildings, conveyors, crushing plant, laydown areas, fuel storage areas, open pits, etc.);
- clean-up, removal and proper disposal of all process and potentially hazardous materials;
- water treatment and monitoring for approximately two years;
- rehabilitation of reject fines disposal area’s outflow infrastructure;
- re-establishing surface water drainage patterns in the Silver Yard Area, including re-engineering of existing diversion channels;
- final contouring and re-vegetation of stockpile and waste rock areas;
- water pipelines, dewatering wells, and building foundations will be removed; and
- overall execution of the Rehabilitation and Closure Plan reviewed and approved by the Government of Newfoundland and Labrador.

Additional information on site rehabilitation and closure is presented in Section 8.4 of this document.

4.0 ENVIRONMENTAL SETTING

4.1 Physical Environment

4.1.1 Climate

The Project area has a sub-arctic continental taiga climate with severe winters based on 30-year Canadian Climate Normal data obtained from Environment Canada for the Schefferville Airport (1971-2000) (Environment Canada 2008).

4.1.1.1 Temperature

A summary of the daily average, daily maximum and daily minimum temperatures on a monthly basis over the period 1971 to 2000 is presented in Table 4.1. The annual average temperature is -5.3ºC.

Table 4.1 Summary of Average Temperature Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Daily Average (ºC)	-24.1	-22.6	-16	-7.3	1.2	8.5	12.4	11.2	5.4	-1.7	-9.8	-20.6	-5.3
Daily Maximum (ºC)	-19	-16.9	-9.8	-1.5	6	13.7	17.2	15.8	8.9	1.3	-6.1	-15.9	-0.5
Daily Minimum (ºC)	-29.2	-28.1	-22.2	-13.1	-3.6	3.3	7.6	6.5	1.7	-4.6	-13.5	-25.2	-10

4.1.1.2 Precipitation

A summary of the monthly average rainfall, snowfall, total precipitation (as equivalent rainfall based on a conversion factor for snowfall to equivalent rainfall of 0.1) and average snow depth on a monthly basis over the period 1971 to 2000 is presented in Table 4.2. The annual average total precipitation for the area is about 823 millimetres (mm).

Table 4.2 Summary of Average Precipitation Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Rainfall (mm)	0.2	0.2	1.6	8.4	27.7	65.4	106.8	82.8	85.3	24.4	4.5	0.9	408.1
Snowfall (cm)	57.4	42.6	56.6	54.8	22.9	8	0.5	1.7	12.7	57.2	70.7	55.4	440.5
Precipitation (mm)	53.2	38.7	53.3	61.4	52.1	73.7	107.2	84.5	98.4	80.5	69.4	50.7	822.9
Average Snow Depth (cm)	62	70	71	69	18	0	0	0	0	7	26	49	31

4.1.1.3 Wind Speed and Direction

Climate normal data with respect to wind speed and directionality is presented in Table 4.3. The annual average wind speed for the area is about 17 km/h and the most frequent wind direction, on an annual basis, is from the north-west.

Table 4.3 Summary of Wind Data

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Annual
Speed (km/h)	16.4	16.8	17.4	16.5	16	16.2	15.1	15.6	16.9	17.8	17.3	16	16.5
Most Frequent Direction	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
Maximum Hourly Speed (km/h)	85	97	83	77	66	97	65	61	80	89	84	80	80
Maximum Gust Speed (km/h)	134	148	148	130	101	126	103	117	137	137	142	153	131
Direction of Maximum Gust	W	W	SW	W	W	W	W	W	SW	SW	SW	SW	SW
Days with Winds ≥ 52 km/h	.7	1.4	1.9	1.1	0.9	0.4	0.6	0.4	0.8	1.1	1.8	2.1	13.9
Days with Winds ≥ 63 km/h	0.7	0.5	0.4	0.2	0.1	0.1	0.2	0.1	0.1	0.1	0.3	0.6	3.3

4.1.2 Air Quality

An Air Quality Technical Study (Appendix H) was conducted following accepted methodologies to establish existing (baseline) conditions, estimate emissions from the Project and predict the maximum downwind concentrations of the pertinent air contaminants. The methodologies and predictions are summarized in the following sections.

The key components of the Air Quality Technical Study are:

- Existing (Baseline) Conditions – On-site monitoring was conducted to measure and characterize the baseline ambient air quality in the region;
- Emissions Inventory – Maximum emission rates from the Project were estimated based on conceptual engineering design information and published sources of emission factors; and
- Air Quality Modeling – The emission rates in the exhaust and dust plumes were modelled to predict the maximum ground-level concentrations (GLC) due to Project emissions.

In this EIS, the potential environmental effects due to Project-related air contaminant emissions are assessed on the bases of these analyses. Although air quality is not considered a values environmental component or VEC in this assessment, a screening-level analysis considering the potential environmental effects of a change in ambient air quality due to Project-related emissions is provided in Section 4.1.2.2 below.

Emissions estimates and dispersion modeling were used to quantitatively assess the potential change in air quality due to substantive Project-related emissions during operation. The emissions occurring during construction are expected to be less than those occurring during operation.

4.1.2.1 Existing Conditions

An ambient air quality monitoring program was conducted between September and November 2008, specifically monitoring total particulate levels in the area of the Silver Yard. Air samples were obtained during the 2008 field ore crushing and sampling program on a six day schedule. Samples were obtained both on days when ore was being crushed as well as on days when operations were inactive. Results from the program indicated most samples had particulate levels that were below the laboratory detection limit of 0.3 mg, suggesting that the air quality in the region is well within acceptable standards. The highest particulate level sampled was 0.4 mg (28 µg/m^3), much lower than the NL standard of 120 µg/m^3. The detailed results of the ambient monitoring program undertaken between September and November 2008 are provided in the Air Quality Technical Study, submitted under separate cover and provided in Appendix H.

A search of the National Air Pollution Surveillance (NAPS) Network data records indicated that there were limited data available to determine background air quality for other air contaminants in the vicinity of the proposed operations (Environment Canada 2008). The nearest available sources of ambient air quality monitoring data are Goose Bay and Labrador City, both of which are more than 200 km from the site location.

For the purposes of air quality dispersion modeling, conservative background air quality estimates were provided by the Provincial Department of Environment and Conservation (Lawrence 2008). The background values considered in the modeling assessment are provided in Appendix H.

4.1.2.2 Emissions Inventory

Emissions of air contaminants from Project-related activities were considered for both the construction (Section 3.2.6) and operation phases (Section 3.3.2). Emissions were estimated for all substantive potential sources based on available literature and preliminary engineering design information. A detailed description of Project emissions estimates, including quantitative estimates and calculation methodologies, are provided in the Air Quality Technical Study, submitted under separate cover, and provided in Appendix H.

For construction, emissions are expected from fuel combustion in road vehicles and non-road equipment (including temporary diesel generators at the workers camp); as well as fugitive particulate matter from railway track installation, rail bed grubbing, clearing/grubbing for the site services area, and the erection of buildings. Project-related emissions during peak construction are expected to be substantively less than emissions during operation.

For operation, emissions are expected from fuel combustion, fugitive dust (particulate matter), standing losses from storage tanks, and on-site vehicle traffic at the primary processing facility. In addition, combustion and fugitive dust emissions are expected to occur due to ore hauling from the mine sites to the processing area, and ore mining activities.

4.1.2.3 Air Quality Modeling Methodology

Air quality dispersion modeling was performed to predict maximum ground-level concentration (GLC) from substantive Project emissions and quantitatively assess potential environmental effects. After consultation with Newfoundland and Labrador Department of Environment and Conservation (NLDEC), the California Puff (CALPUFF) modeling system was chosen (TRC Companies, Inc. 2007). The following subsections provide an overview of the modeling methodology. More details on the model used, inputs, assumptions, and model parameterization are provided in Appendix H.

Model Description

The core components of the CALPUFF modeling system consist of a meteorological model (CALMET), and a transport and dispersion model (CALPUFF).

The CALMET meteorological model is used to provide the meteorological data necessary to initialize the CALPUFF dispersion model. This model is initialized with terrain and land use data describing the region of interest, as well as meteorological input from potentially numerous sources. Various user-defined parameters control both how the input meteorological data is interpolated to the grid, as well as which internal algorithms are applied to these input fields. Output from the CALMET model includes hourly temperature and wind fields on a user-specified three-dimensional domain as well as additional two-dimensional variables used by the CALPUFF dispersion model.

The Department of Environment reviewed and requested changes be made to the CALMET input file for this Project during pre-consultation (November 18, 2008). All these required changes were addressed at that time. However, upon further review of the CALMET inputs, it appears there was a typo in the input file. The time zone for Schefferville was entered as UTC – 4:00 when it should have been UTC – 5:00. All other time zone inputs into CALMET were correctly defined. While this shift may cause the predicted values to change slightly on an hour-by-hour basis, when considered over a five-year period, the CALPUFF maximum predicted concentrations are not expected to change substantively. Therefore, it is not anticipated that the alteration of this CALMET parameter would change the overall non-significance conclusions of the effects analysis.

CALPUFF is a non-steady-state Gaussian puff dispersion model capable of simulating the effects of time and space-varying meteorological conditions on pollutant contaminant transport, transformation, and removal. This model requires time-variant two- and three-dimensional meteorological data output from a model such as CALMET, as well as information regarding the relative location and nature of the sources to be modelled for the application. Output from the CALPUFF model includes ground-level concentrations of the species considered, as well as dry and wet deposition fluxes.

Model Selection

CALPUFF was selected primarily because of its superior ability to characterize atmospheric dispersion in areas with complex, non-steady state meteorological conditions (NLDEC 2006). Atmospheric conditions in the region fit this criterion: areas with complex terrain in the study area create high variability in winds and turbulence. The model has specialized algorithms to deal with calm wind speed conditions and characterize dispersion in regions of complex terrain.

Dispersion Modeling Methodology

Dispersion modeling was used to investigate potential changes in air quality during the operation phase only. Emissions during the construction phase were assessed indirectly by considering the predicted maximum GLC during operation as a worst-case envelope.

The emission sources considered in the dispersion modeling included all substantive sources located at the primary processing during operation such as:

- combustion emissions from fuel oil boilers (note that based on updated design, these units are no longer required) and diesel generators (continuous power); and,
- particulate matter emissions due to crushing, loading/dumping, wind erosion, and dust from conveyors.

To consider a variety of worst-case meteorological events in the dispersion modeling, a five-year simulation period spanning 2002-2006 was selected. As Project operations are expected to cease during the winter months, emissions were not modelled from November to March. Model results were used to help quantitatively assess potential environmental effects due to Project emissions of NO_X, SO_2, CO, PM, PM_{10}, and $PM_{2.5}$. For each source modelled, emissions and other source characteristics were estimated based on preliminary design information and available literature.

As mentioned above, the baseline ambient concentrations considered in the modeling were provided by the NLDEC and are expected to conservatively estimate existing conditions in the region.

The most recent versions of the CALMET (v6.326) and CALPUFF (v6.262) models were used, as requested by the NLDEC.

Dispersion modeling was conducted to predict maximum GLC, which were added to the background concentrations and compared to the relevant air quality standards. A nested grid of receptors covering the Study Area was designed in accordance with the Newfoundland and Labrador Guidance for Plume Dispersion Modeling (NLDEC 2006) to find the maximum off-property GLC occurring over the five year period. In addition, maximum GLC were predicted at discrete sensitive receptors representing cabins, residences, and recreational areas. Figure 4.1 shows the locations of the sensitive receptors relative to the area where Project activities will occur. For all simulations, the model inputs and parameters were selected after consultation with the NLDEC (Lawrence 2008).

For the operation phase, emissions due to standing losses from storage tanks at the primary processing area are not expected to be substantive as the contents will have relatively low vapour pressures (diesel and heavy oil). Similarly, emissions due to on-site vehicle traffic are not expected to be substantive relative to the other combustion and fugitive dust sources in the primary processing area. As these sources are expected to represent only a small fraction of the total emissions from the primary processing facility, neither of the sources was included in the modeling simulations.

Emissions due to fuel combustion and fugitive dust from trucks hauling ore from the deposits to the processing area during operation were also not considered in the modeling. Although fugitive dust emissions will occur due to vehicle traffic along the road, the majority of the fugitive dust will remain in lowest 1-2 meters above ground level and settle within a few hundred meters of the road (DRI 1999). The haul route is an existing dirt road, and although traffic along the route is expected to increase with Project activities, no more than five trucks are expected to pass in a given hour. As such, while changes in air quality may occur due to fugitive dust emissions during certain meteorological conditions when trucks pass, these events will be localized and short in duration.

Emissions due to blasting and on-site traffic at the mine site locations during operation are not expected to cause substantive changes in air quality as they will be emitted inside a pit, mechanical methods will be used where possible, and the distances from the site to the nearest sensitive receptors are relatively far (more than 1.5 km). Therefore, these emissions were excluded from further modeling.

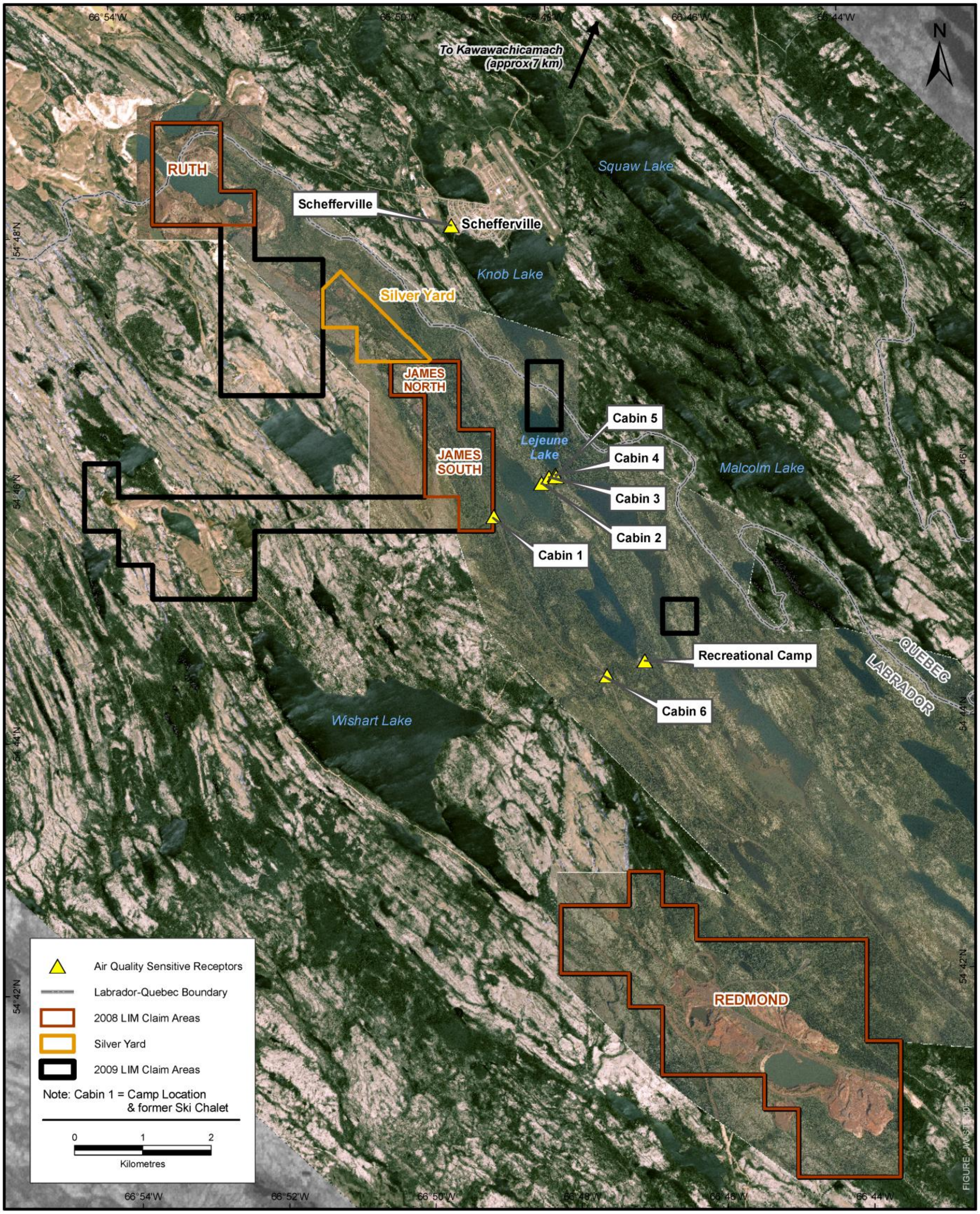


Figure 4.1 Sensitive Receptor Locations

Emissions from the diesel locomotive used for transporting ore from the beneficiation area during operation are not expected to cause substantive changes in air quality as such emissions will be intermittent (one trip per day) and short-term in duration. Therefore, these emissions were not included in the modeling assessment.

As the diesel generators installed at the worker's camp will be operated in standby mode, any emissions from these units will be intermittent, short-term in duration and negligible compared to other emissions occurring during operation. Therefore, these emissions were excluded from further modeling.

4.1.2.4 Air Quality Modeling Results

Modeling was conducted over all applicable averaging periods, and maximum predicted GLC were compared with applicable regulatory standards. Estimates for background ambient air contaminant concentrations were added to the model predictions to characterize maximum potential changes in air quality. The results of the dispersion modeling assessment are presented in Appendix H.

The maximum predicted concentrations in Appendix H show that during certain rare meteorological conditions, exceedances of the regulatory standards for NO_2, TSP, PM_{10}, and $PM_{2.5}$ could potentially occur near the property line of the facility (within 150 meters of the facility). These higher predicted values are due to emissions from the diesel generators (NO_2) and from fugitive dust sources at the primary processing facility (TSP, PM_{10}, and $PM_{2.5}$). Over the five-year modeling period and including ambient background concentrations, there were 73 predicted exceedances of the 24-hr PM standard, 131 predicted exceedances of the 24-hr PM_{10} standard, 42 exceedances of the 24-hr $PM_{2.5}$ standard, and 1 predicted exceedance of the 1-hr NO_2 standard. The predicted exceedances of NO_2 occur approximately 130 m from the property line (thus not near any residences) and are primarily due to emissions from the diesel generator stacks. The predicted exceedances of particulate matter are primarily due to fugitive dust sources, such as ore loading and storage pile erosion. No exceedances of the regulatory standards for SO_2 or CO were predicted. All predicted GLC near cabins, residences, and recreational areas are well below the regulatory standards. As well, more details are provided in the Air Quality Technical Study, provided under separate cover.

It should be noted that the emissions estimates used as input to the dispersion modeling were based on conservative assumptions and published emissions factors, and do not take into account potential mitigative measures to reduce fugitive dust at the facility. Based on the final design of the facility, mitigative measures will be put in place to minimize emissions and resultant fugitive dust near property limits. These measures, as described in Section 8.1 of the EIS, will include wet suppression of roads and storage piles to minimize fugitive dust. With such mitigation measures in place, fugitive dust emissions (and resultant off-property PM concentrations) would be reduced to below ambient air quality standards LIM will implement mitigation measures efficiently and effectively to ensure that no significant adverse environmental effects occur due to Project-related emissions during operation. Follow-up ambient air monitoring (as discussed in Section 8.3 of the EIS) will confirm Project-related emissions during construction and operation for additional mitigation development and implementation, if appropriate. This approach (mitigation and follow-up monitoring) is a preferable option, and therefore re-modeling of the conservative and theoretical fugitive dust emission from the Project is not required. Furthermore, all model-predicted values represent a conservative worst-case estimate of potential downwind concentrations during adverse meteorological conditions (considering five years of meteorological data).

Contour plots of the predicted maximum ground-level concentrations (including winter months) are shown for NO_2 (1 hr averaging period), and TSP (24 hr averaging period) in Figures 4.2 and 4.3, respectively. The plots show that, as mentioned above, the region of the predicted exceedances is limited to a small area near the property line and more than 1.5 km from any of the sensitive receptor locations. The maximum predicted concentrations at the two sensitive receptor locations nearest to the primary processing facility (Schefferville, Private Cabin) are presented in Appendix H. As mentioned above, the predicted GLC near cabins, residences, and recreational areas are well below the regulatory standards.

Section 5 of the Air Pollution Control Regulations does not apply to the boiler stack or the baghouse stack because the emissions are below the prescribed limits. Based on the methodology used in the emissions inventory and the dispersion modeling, SO_2 and PM emissions from the boiler stack were conservatively estimated to be 5.3 tonnes and 1.3 tonnes respectively, while the PM emissions from the baghouse were estimated to be 6.7 tonnes. These are all below the 20 tonne per year limit described in Section 5 of the Air Pollution Control Regulations. Note that based on updated design information, the boilers are no longer required. However, to be conservative, the potential contributions of these sources are still considered in the air quality assessment.

4.1.2.5 Potential Changes in Air Quality due to Project Activities

The Project activities during construction and operation may result in emissions of air contaminants to the atmosphere. These emissions have the potential to cause adverse environmental effects via a change in ambient air quality. In the following sections, the significance of these potential environmental effects is rated for both operation and construction.

Operation

Emissions estimates for the Project during operation were developed for all potentially substantive sources using the list of potential sources provided in the guidelines as a basis. Where emission sources identified in the guideline were found to be not substantive or not applicable, emissions were not estimated. All source screening and emissions estimates were based on preliminary data for the Project. The potentially substantive emission sources during operation can be broadly grouped as either combustion emissions or fugitive dust emissions. Emissions were estimated for numerous non-negligible sources including boilers (note that based on updated design, these units are not required), generators, on-site vehicles, ore loading, ore crushing, stockpile erosion, and on-site conveyor systems. The final emissions inventory (with more detailed estimates and methodology) is provided in the Air Quality Technical Study which is submitted under separate cover and provided in Appendix H. The emission sources during operation can be categorized into three groups:

- emissions from the primary processing facility;
- emissions due to trucks hauling ore from the mines to the processing area; and,
- emissions due to blasting and on-site traffic at the mine site locations.

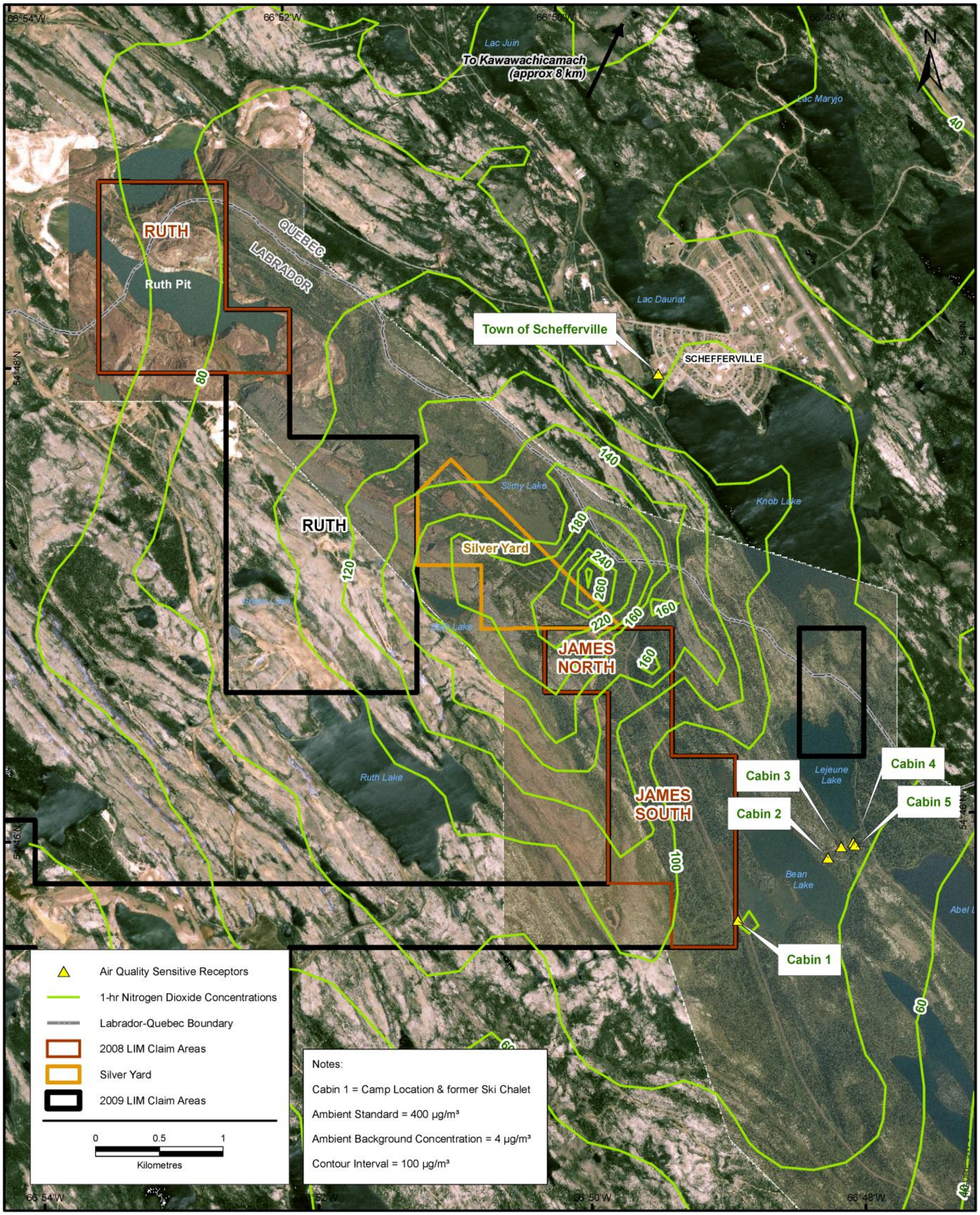
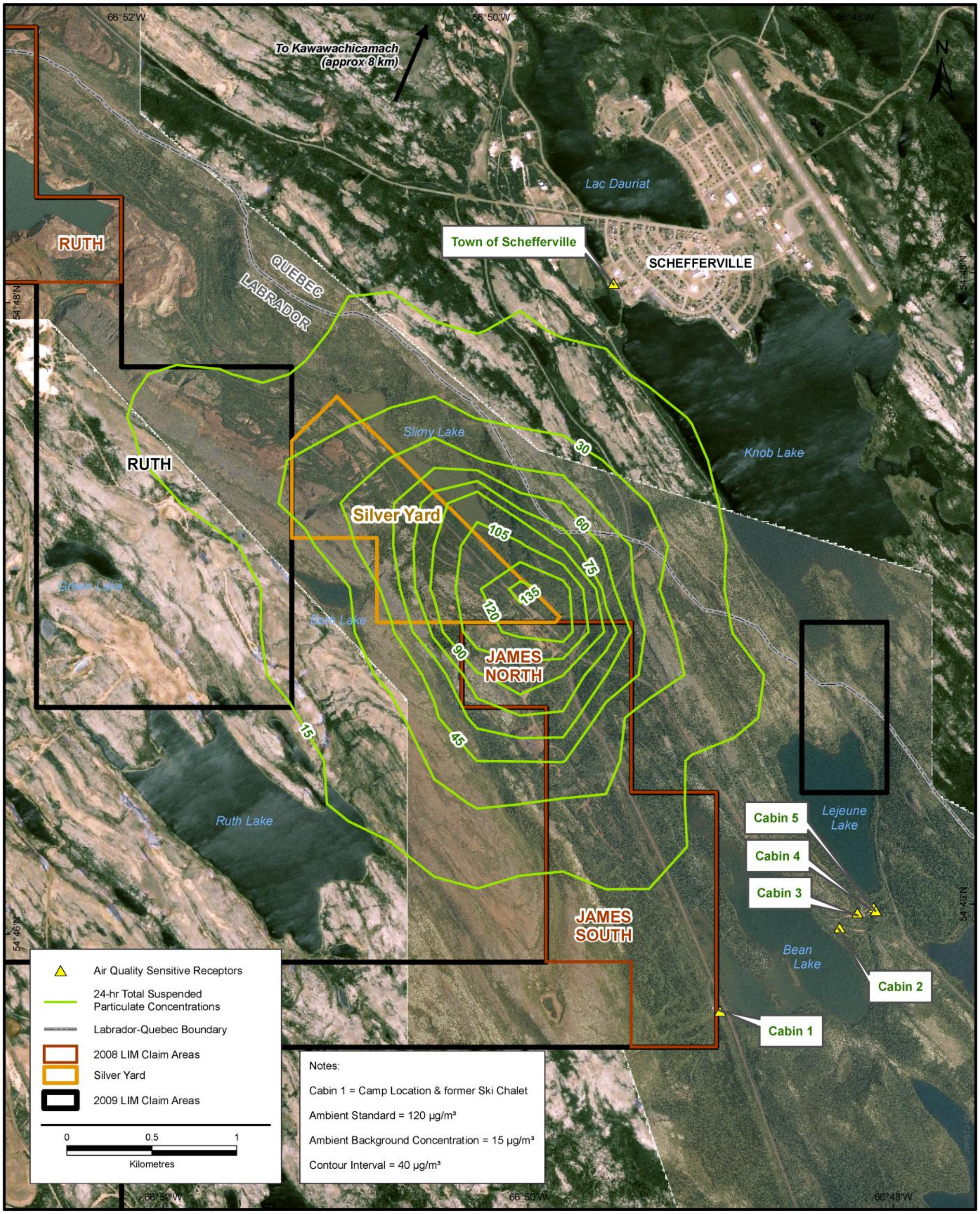


Figure 4.2 Maximum Predicted 1-hr NO_X Ground-level Concentrations



Notes:

Cabin 1 = Camp Location & former Ski Chalet

Ambient Standard = 120 µg/m³

Ambient Background Concentration = 15 µg/m³

Contour Interval = 40 µg/m³

Figure 4.3 Maximum Predicted 24-hr TSP Ground-level Concentrations

As shown in the dispersion modeling of emissions from the primary processing facility presented above, although there may be exceedances of regulatory standards at locations near the property line during adverse meteorological conditions, these higher values are limited to within 150 m of the property line. As this region is far from any of the sensitive receptor locations, it is unlikely that prolonged human exposure to air contaminant concentrations at these levels will occur. Therefore, as the predicted exceedances represent worst-case meteorological conditions, are limited in spatial extent, and are short-term in duration, no substantive changes in air quality are expected due to emissions from the primary processing facility.

Although fugitive dust emissions will occur due to vehicle traffic along the road during operations, the majority of the fugitive dust will remain in lowest 1-2 meters above ground level and settle within a few hundred meters of the road (DRI 1999). The haul route is an existing dirt road, and although traffic along the route is expected to increase with Project activities, no more than five trucks are expected to pass in a given hour. As such, while some dusting of vegetation may occur due to vehicle traffic during certain meteorological conditions, no substantive environmental effects are expected due to such emissions as they will be localized in extent and short-term in duration.

Emissions due to blasting and on-site traffic at the mine site locations are not expected to cause substantive environmental effects as will be emitted inside a pit and the transport distances to the nearest sensitive receptors are relatively far (greater than 1.5 km).

Emissions from the diesel locomotive used for transporting ore from the beneficiation area are not expected to cause substantive environmental effects as these emissions will be intermittent (one trip per day) and short-term in duration.

Similarly, emissions from the standby diesel generators installed at the worker’s camp will be intermittent, short-term in duration, and negligible relative to other emissions during operation. Therefore, such emissions are not expected to cause substantive environmental effects.

Therefore, no significant adverse environmental effects due to Project-related emissions are anticipated during operation.

Construction

As outlined in Section 3.2.6, emissions to the atmosphere may occur during construction activities such as railway track installation, rail bed grubbing, clearing/grubbing for site services area, and the erection of buildings at the primary processing facility location. Fuel combustion and fugitive dust from the movement of soil and vehicles are expected to contribute most substantively to emissions during this phase. In addition, combustion emissions are expected from the temporary diesel generators installed at the worker’s camp.

As the emissions occurring during construction are expected to be fractionally small compared to those occurring during operation, the potential effects to air quality during this Phase can be assessed indirectly by considering the model-predicted concentrations using the operation phase as a worst-case envelope. Since no significant adverse environmental effects are anticipated due to a change in air quality during operation, it follows the same conclusion will apply for construction.

Therefore, no significant adverse environmental effects due to Project-related emissions are anticipated during construction.

Summary

Based on the above rationales, the environmental effect of a change in air quality due to emissions from Project-related activities, through all phases, is rated not significant.

4.1.3 Landscape

4.1.3.1 Regional Geology

At least 45 hematite-goethite ore deposits have been discovered in an area 20 km wide that extends 100 km northwest of Astray Lake, referred to as the Knob Lake Iron Range, which consists of tightly folded and faulted iron-formation. The iron deposits occur in deformed segments of iron-formation, and the ore content of single deposits varies from one million to more than 50 million tonnes.

The Knob Lake properties are located on the western margin of the Labrador Trough adjacent to Archean basement gneisses. The Labrador Trough, known as the Labrador-Québec Fold Belt, extends for more than 1,000 km along the eastern margin of the Superior craton from Ungava Bay to Lake Pletipi, Québec. The belt is about 100 km wide in its central part and narrows considerably to the north and south.

The western half of the Labrador Trough can be divided into three sections based on changes in lithology and metamorphism (North, Central and South). The Trough is comprised of a sequence of Proterozoic sedimentary rocks including iron formation, volcanic rocks and mafic intrusions known as the Kaniapiskau Supergroup (Gross, 1968). The Kaniapiskau Supergroup consists of the Knob Lake Group in the western part of the Trough and the Doublet Group, which is primarily volcanic, in the eastern part.

The Central or Knob Lake Range section extends for 550 km south from the Koksoak River to the Grenville Front located 30 km north of Wabush Lake. The principal iron formation unit, the Sokoman Formation, forms a continuous stratigraphic unit that thickens and thins from sub-basin to sub-basin throughout the fold belt.

The southern part of the Trough is crossed by the Grenville Front. Trough rocks in the Grenville Province to the south are highly metamorphosed and complexly folded, which has caused recrystallization of both iron oxides and silica in the primary iron formation to meta-taconites.

Geological conditions throughout the central division of the Labrador Trough are generally similar to those in the Knob Lake Range.

A geological map of the Project area is shown in Figure 4.4.

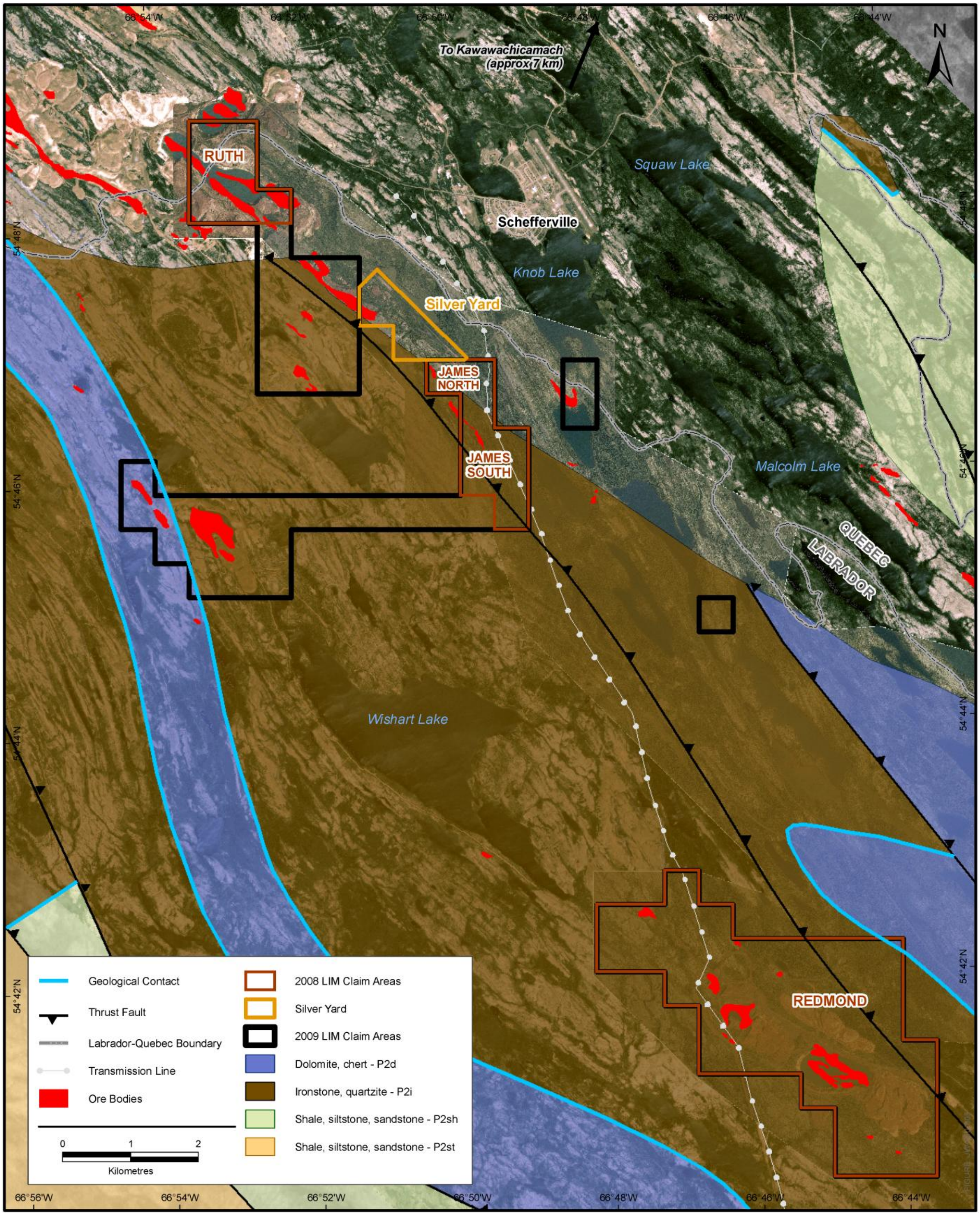


Figure 4.4 Geological Map (Project Area)

4.1.3.2 Knob Lake Range Geology

The general stratigraphy of the Knob Lake area is representative of most of the range, except that the Denault dolomite and Fleming Formation (described below) are not uniformly distributed. The Knob Lake Range occupies an area 100 km long by 8 km wide. The sedimentary rocks including the cherty iron formation of this area are weakly metamorphosed to greenschist facies. In the structurally complex areas, leaching and secondary enrichment have produced earthy textured iron deposits. Unaltered banded magnetite iron formation (taconite) occurs as gently dipping beds west of Schefferville in the Howells River deposits.

Most of the secondary earthy textured iron deposits occur in canoe-shaped synclines with some as tabular bodies. In the western part of the Knob Range, the iron formation dips gently eastward over the Archean basement rocks for about 10 km to the east, then forms an imbricate fault structure with bands of iron formation.

Subsequent supergene processes converted some of the iron formations into high-grade ores, preferentially in synclinal depressions and/or down-faulted blocks. Original sedimentary textures are commonly preserved by selected leaching and replacement of the original deposits. Jumbled breccias of enriched ore and altered iron formations, locally called rubble ores, are also present.

The stratigraphy of the Schefferville area is represented by the following formations.

Attikamagen Formation. It consists of argillaceous material that is thinly bedded, fine grained, greyish green, dark grey to black, or reddish grey. Calcareous or arenaceous lenses occur locally interbedded with the argillite and slate, and lenses of chert are common.

Denault Formation. The Denault Formation consists primarily of dolomite being more clastic at its base and cherty at its top. Leached and altered beds near the iron deposits are rubbly, brown or cream coloured.

Fleming Formation. It occurs a few kilometres southwest of Knob Lake and only above dolomite beds of the Denault Formation. It consists of rectangular fragments of chert and quartz within a matrix of fine chert.

Wishart Formation. The Wishart Formation is a sandstone formation (quartzite and arkose) cemented by quartz and minor amounts of hematite and other iron oxides. It is well differentiated from the iron ore bearing overlaying formations by its texture and color.

Ruth Formation. It is a black, grey-green or maroon ferruginous slate, 3 to 36 metres thick. This thinly banded material contains lenses of black chert and various amounts of iron ore.

Sokoman Formation. More than 80 percent of the ore in the Knob Lake Range occurs within this formation. Lithologically, the iron formation varies in detail in different parts of the range and the thickness of individual members is not consistent.

A thinly bedded, slatey facies at the base of the formation consists largely of fine chert with an abundance of iron silicates and disseminated magnetite and siderite. Fresh surfaces are grey to olive green, and weathered surfaces brownish yellow to bright orange. Thin-banded oxide facies of iron formation occurs above the silicate-carbonate facies in nearly all parts of the area. The thin (<1.25cm) jasper bands are mostly deep red, but in some places are greenish yellow to grey, and are interbanded with hard, blue layers of fine-grained hematite and a minor magnetite.

The thin jasper beds are located underneath thick massive beds of grey to pinkish chert and beds that are very rich in blue and black iron oxides, and make up most of the Sokoman Formation. The upper part of the Sokoman Formation comprises discontinuous beds of dull green to grey or black massive chert.

Menihek Formation. A thin-banded, grey to black argillaceous slate conformably overlies the Sokoman Formation in the Knob Lake area. Thicknesses are unknown since the slate is found in faulted blocks in the main ore zone.

4.1.3.3 Regional Mineralization

The earthy bedded iron deposits are a residually enriched type within the Sokoman iron formation that formed after two periods of intense folding and faulting, followed by the circulation of meteoric waters in the fractured rocks. The enrichment process was caused largely by leaching and the loss of silica, resulting in a strong increase in porosity. This produced a friable, granular and earthy-textured iron ore. The siderite and silica minerals were altered to hydrated oxides of goethite and limonite. The second stage of enrichment included the addition of secondary iron and manganese which appear to have moved in solution and filled pore spaces with limonite-goethite. Secondary manganese minerals, i.e., pyrolusite and manganite, form veinlets and vuggy pockets. The types of iron ores developed in the deposits are directly related to the original mineral facies. The predominant blue granular ore was formed from the oxide facies of the middle iron formation. The yellowish-brown ore, composed of limonite-goethite, formed from the carbonate-silicate facies, and the red painty hematite ore originated from mixed facies in the argillaceous slaty members. The overall ratio of blue to yellow to red ore is approximately 70:15:15. The proportion of each varies widely within the deposits.

Only the direct shipping ore is considered beneficial to produce lumps and sinter feed and will be part of the resources for the LIM Project. The direct shipping ore was classified by IOC in six categories based on their chemical, mineralogical and textural compositions. This classification is still used in the evaluation of the mineralization. The following ore categories and other mineralization categories not part of the potential economic mineralization, are:

- High Non-Bessemer (HNB);
- Lean Non Bessemer (LNB);
- High Silica (HiSiO2) (waste); and
- Treat Rock (TRX) (waste but previously stockpiled for possible later treatment).

The blue ores, which are composed mainly of the minerals hematite and martite, are generally coarse grained and friable. They are usually found in the middle section of the iron formation.

The yellow ores, which are made up of the minerals limonite and goethite, are located in the lower section of the iron formation. These ores have the unfavourable characteristic of retaining high moisture content.

The red ore is predominantly a red earthy hematite. It forms the basal layer that underlies the lower section of the iron formation. Red ore is characterized by its clay and slate-like texture.

Direct shipping ores and lean ores mined in the Schefferville area during the period 1954-1982 amounted to some 150 million tons. Based on the original ore definition of IOC (+50% Fe <18% SiO2 dry basis), approximately 200 million tonnes of iron resources remain in the area, exclusive of magnetite taconite. LIM has acquired rights to approximately 50 percent of this remaining iron resource.

4.1.3.4 Deposit Types

The Labrador Trough contains four main types of iron deposits:

- soft iron ores formed by supergene leaching and enrichment of the weakly metamorphosed cherty iron formation; they are composed mainly of friable fine-grained secondary iron oxides (hematite, goethite, limonite);
- taconites, the fine-grained, weakly metamorphosed iron formations with above average magnetite content and which are also commonly called magnetite iron formation;
- more intensely metamorphosed, coarser-grained iron formations, termed metataconites which contain specular hematite and subordinate amounts of magnetite as the dominant iron minerals; and
- minor occurrences of hard high-grade hematite ore occur southeast of Schefferville at Sawyer Lake, Astray Lake and in some of the Houston deposits.

The Labrador Iron Mountain deposits are composed of iron formations of the Lake Superior-type. The Lake Superior-type iron formation consists of banded sedimentary rocks composed principally of bands of iron oxides, magnetite and hematite within quartz (chert)-rich rock, with variable amounts of silicate, carbonate and sulphide lithofacies. Such iron formations have been the principal sources of iron throughout the world.

The Sokoman iron formation was formed as chemical sediment under varied conditions of oxidation-reduction potential (Eh) and hydrogen ion concentrations (pH) in varied depth of seawater. The resulting irregularly bedded, jasper-bearing, granular, oolite and locally conglomeratic sediments are typical of the predominant oxide facies of the Superior-type iron formations, and the Labrador Trough is the largest example of this type.

The facies changes consist commonly of carbonate, silicate and oxide facies. Typical sulphide facies are poorly developed. The mineralogy of the rocks is related to the change in facies during deposition, which reflects changes from shallow to deep-water environments of sedimentation. In general, the oxide facies are irregularly bedded, and locally conglomeratic, having formed in oxidizing shallow-water conditions. Most carbonate facies show deep-water features, except for the presence of minor amounts of granules. The silicate facies are present in between the oxide and carbonate facies, with some textural features indicating deep-water formation.

Each facies contains typical primary minerals, ranging from siderite, minnesotaite, and magnetite-hematite in the carbonate, silicate and oxide facies, respectively. The most common mineral in the Sokoman Formation is chert, which is closely associated with all facies, although it occurs in minor quantities with the silicate facies. Carbonate and silicate lithofacies are present in varying amounts in the oxide members.

The sediments of the Labrador Trough were initially deposited in a stable basin which was subsequently modified by penecontemporaneous tectonic and volcanic activity. Deposition of the iron formation indicates intraformational erosion, redistribution of sediments, and local contamination by volcanic and related clastic material derived from the volcanic centers in the Dyke-Astray area.

The consolidation of the sediments into cherty banded iron formation is due to diagenesis and low grade metamorphism, which only reached the greenschist rank. The iron may be a product of erosion. It is unlikely that the Nimish volcanism made a significant contribution.

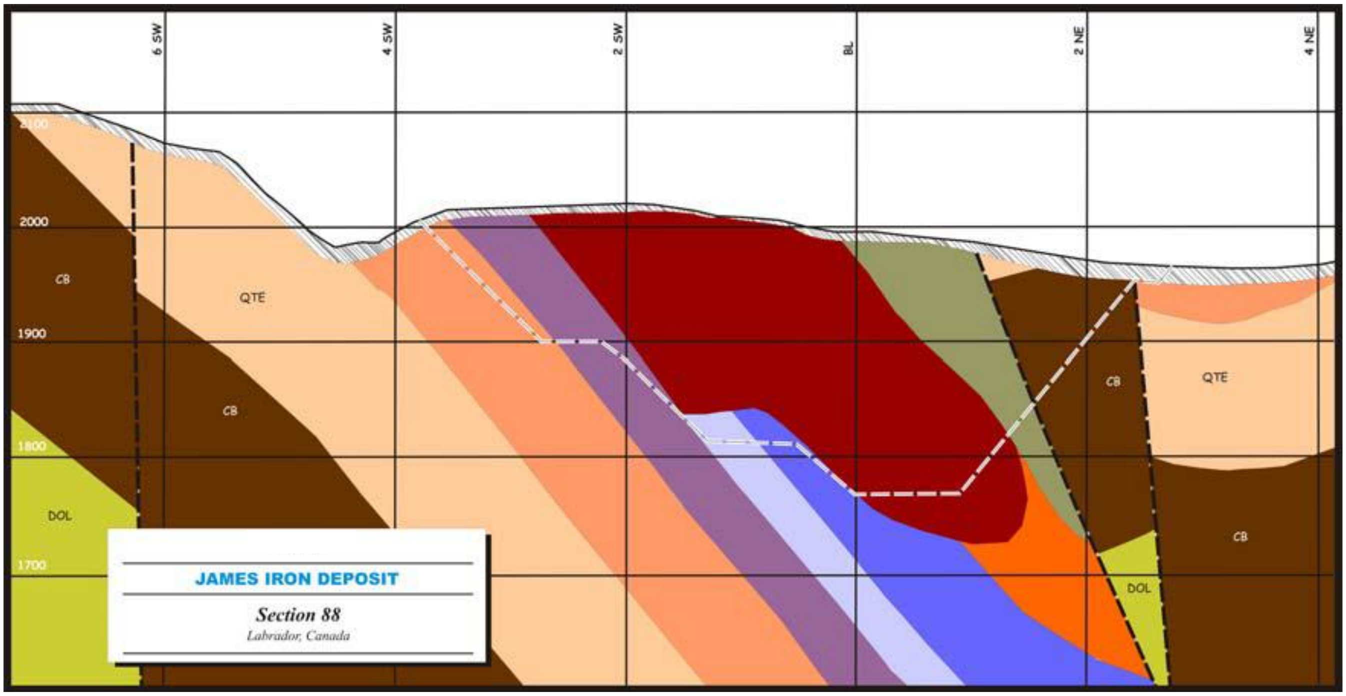
The Project currently involves the James North, James South and Redmond Deposits.

James Deposit

The James deposit is a northeast dipping elongated iron deposit with a direction of N330° in its main axis and it appears to be structurally and stratigraphically controlled. The stratigraphic units recorded in James area go from the Denault Formation to the Menihek Formation. The main volume of the mineralization is developed in the Middle Iron Formation (MIF) and lower portion of the Upper Iron Formation (UIF) both part of the Sokoman Formation.

The iron mineralization in the James deposit consist of thin layers (<10 cm thick) of fine to medium grained steel blue hematite intercalated with minor cherty silica bands <5 cm thick dipping 30° to 45° to the northeast. The James mine mineralization has been affected by strong alteration which removed most of the cementing silica giving it a sandy friable texture.

A typical section developed by IOC is shown in Figure 4.5.



Source: Labrador Iron Mines Limited

Figure 4.5 Generalized Cross Section-James Deposits

Redmond Deposit

The Redmond deposits are developed along a northwest trending synclinal that extends to the south to the Redmond No.1 deposit and to the north to the Wishart mine. The Redmond deposits enclosed in license 016291M are small rounded medium Fe grade mineralized bodies.

4.1.3.5 Geomorphology, Surficial Geology, Soils and Permafrost

There are dominant surficial materials within the area surrounding the Project deposits of drift-poor areas, glacial till and other surficial deposits (undifferentiated), with occasional areas of glaciofluvial deposits.

The till and other surficial deposits (undifferentiated), are predominantly nonstratified, poorly sorted, silty to sandy diamicton, gravel, and sandy gravel, deposited either directly from ice or by meltout during ablation and includes glaciofluvial, glaciolacutrine, marine, and fluvial deposits of either minor areal extent or thin (less than two m) and discontinuous.

The drift-poor areas are described as greater than 80 percent bedrock; including areas of till and other surficial materials generally < 1 m thick and discontinuous.

The glaciofluvial deposits are classified as proglacial or ice contact sand and gravel, forming ice contact fans and deltas, outwash plains and terraces, pitted outwash, crevasse fillings, kames and kame terraces, commonly associated with eskers and including areas of extensive, thick fluvial sediments derived from pre-existing glaciofluvial deposits.

The areas in and surrounding the deposits associated with the Project being predominantly greater than 80 percent bedrock, and a previously mined area, do not possess a high number of identifiable landforms. There is evidence of striae, indicating direction of flow known and unknown, as well as identified eskers (esker ridge; kame or splay deposit) in the area (R.A. Klassen et al. 1992).

Permafrost

There have been observations of permafrost of 120 m in thickness in the Schefferville region (Brown 1979). The Schefferville area has been previously identified as the “tentative southern limit of continuous permafrost”, Jenness (1949), then later as the “approximate southern limit of permafrost”, Thomas (1953). It was later concluded that there were no continuous zones of permafrost in the Labrador-Ungava and boundaries of discontinuous and sporadic zones were specified (Black 1951). An area 160 km north of Schefferville was indicated as the southern limit of discontinuous permafrost and extending to within 80 km of the Gulf of St. Lawrence was the sporadic zone (Pryer 1966).

Permafrost was determined to be more widespread than thought once IOC began mining near Schefferville in 1954. As described by Brown (1979), the southern limit of the discontinuous permafrost zone approximately extends along the 51st parallel of latitude from the southern end of James Bay to the Strait of Belle-Isle, 1500 km to the east (Figure 4.6). The western extremity of the northern limit of the discontinuous zone begins at Hudson Bay in the vicinity of Post-de-la-Baleine, 55oN latitude. The eastern extremity of this zone ends in the vicinity of Hopedale. Schefferville is situated at the northern margin of the permafrost. The permafrost occurs as scattered islands which increase in size and number from south to north. Although permafrost is present within the Fleming-Timmins group of deposits, 25 km northwest of Schefferville (Garg 1982), permafrost has not been identified within the current project area.

Various studies on permafrost refer to vegetation and snow cover as having correlation with permafrost presence and thickness. Snow depth and density changes with relief, weather and vegetation (Thom 1969). Thom suggests thick permafrost (up to 60 m) is likely in areas where snow cover is less than 0.4 m during the winter months of January and February.

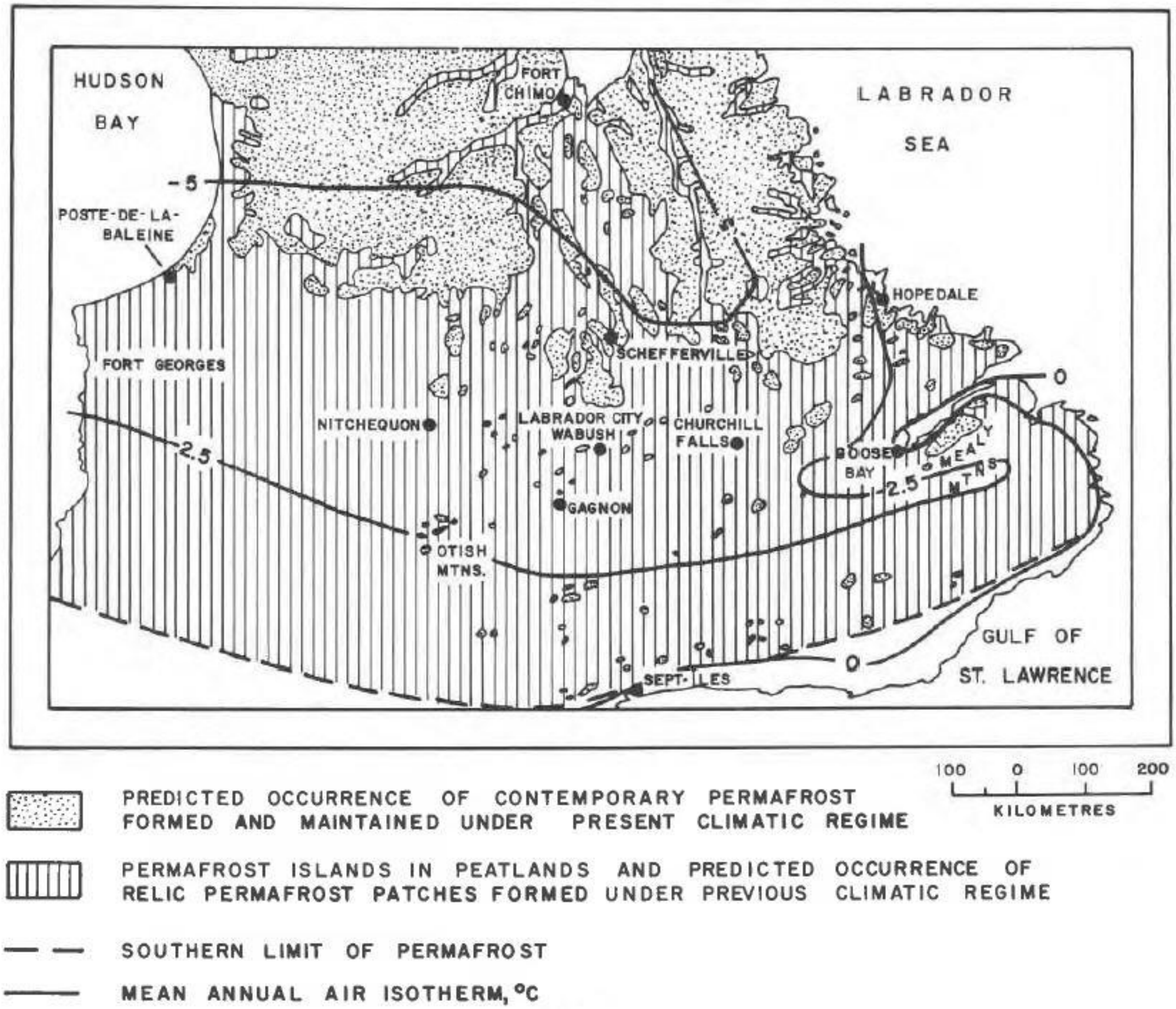


Figure 4.6 Permafrost Distribution in Nouveau-Québec and Labrador (Source Brown, 1979)

Research on permafrost distribution at numerous sites in the Schefferville area has been conducted by Nicholson (February 1978). Two sites north of the Project included Timmins 4 and Fleming 7, at an elevation of 700 m, between 1973 and 1975. It was determined that deep permafrost underlies areas of high elevation, which were exposed and vegetation cover consisted of tundra. The permafrost ranged from 60 to 100 m in depth, and entirely unfrozen areas occurred in valleys on the edge of these sites. No permafrost was present on less exposed and low-lying wood covered ground surfaces (Nicholson and Lewis 1976). Permafrost is expected to be absent beneath water bodies in the area that are so deep they do not freeze solid during winter, due to the water bodies' ability to produce higher ground temperatures. Permafrost is not expected to occur within 30 m from permanently covered shoreline (Nicholson February 1978).

Permafrost has not been observed in the Project Area and therefore it is not anticipated that permafrost will interfere with mining at the James and Redmond deposit areas.

4.1.3.6 Acid Rock Drainage

Based on the geology associated with iron ore deposits and specifically the deposits associated with the James and Redmond Properties that form the Project, the geological materials to be excavated, exposed and processed during mining of the James and Redmond deposits have low to no potential for Acid Rock Drainage (ARD). However, due diligence requires that ARD potential for any new mine site be fully evaluated and LIM is committed to ensuring the long term chemical stability of the Project through all stages of the mine life.

To date, sufficient historical and baseline data, as well as current laboratory test work, exists to suggest that ARD potential is extremely low for this Project. The following sections summarize the available data and the ongoing test work that will be completed.

Historical and Baseline Water Quality

Exploration and mining activities have occurred at the Project site dating back to the 1950s. IOC excavated large open pits and stockpiled considerable waste rock, low grade ore and other materials around the site. These materials have been exposed to both water and air (both required conditions for acid generation from rock) for decades and to date there is no evidence of poor or deteriorating water quality (lowered pH, elevated metals) in the flooded pits, stockpile drainage areas, or the surrounding natural water bodies.

Water quality monitoring on and around the James and Redmond Properties completed by AECOM in 2007 and 2008 (see Appendix I) indicates generally good water quality with pH ranging from 6.5 to 8.5 and normal metal concentrations.

ARD Sampling and Testing Program

A phased ARD sampling and testing program has been initiated to investigate and confirm the ARD potential for all geological materials (ore and waste) to be exposed at this site. To date, preliminary ‘static’ ARD test work has commenced on geological materials available from LIM’s 2008 sampling (trenching and boreholes) program.

The results of the acid base accounting test work completed to date are compiled in Table 4.4. These samples contain very low concentrations of sulphur and the NP/AP ratios for these samples tested range from 37 to 44 over seven samples. Based on the static ARD test results available to date, it is not anticipated that any of the ore or waste materials for this Project will be acid generating.

Bulk metals analysis was completed on seven samples by strong acid digestion (4 Acid) for trace metals (ICP-AES and ICP-MS). These results are shown in Table 4.4 and show generally typical element composition with the exception of iron, as would be expected.

Additional ARD test work will be completed as additional samples from LIM’s 2008 sampling (trenching and boreholes) program become available. Additional test work will be designed to provide coverage of all geological materials and spatial extents of the planned mine workings.

Table 4.4 Acid Base Accounting (ABA) Results

Deposit	Sample Method	Material Type	Paste pH	Total Sulphur	Acid Leachable SO_4-S	Sulphide -S	Total Carbon	Carbonate	NP (t $CaCO_3$/ 1000t)	AP (t $CaCO_3$/ 1000t)	Net NP (t $CaCO_3$/ 1000t)	NP/AP Ratio
			(units)	(%)	(%)	(%)	(%)	(%)				
James	Bulk	HGO	6.98	< 0.005	< 0.1	< 0.01	0.040	0.127	12.5	0.31	12.2	40.3
James	Bulk	LGO	7.10	< 0.005	< 0.1	< 0.01	0.091	0.024	12.5	0.31	12.2	40.3
Redmond 2	Bulk	LGO	7.55	< 0.005	< 0.1	< 0.01	0.048	0.029	13.0	0.31	12.7	41.9
Redmond 2	Bulk	Waste	6.95	< 0.005	< 0.1	< 0.01	0.047	0.119	11.6	0.31	11.3	37.4
Redmond 2B	Bulk	HGO	7.04	< 0.005	< 0.1	< 0.01	0.141	0.228	13.4	0.31	13.1	43.2
Redmond 5	Bulk	HGO	7.41	< 0.005	< 0.1	< 0.01	0.081	0.017	13.7	0.31	13.4	44.2
Ruth	Bulk	Waste	8.03	0.121	0.3	< 0.01	0.026	0.031	12.1	0.31	11.8	39.0

4.1.4 Hydrology

This section describes the existing hydrological conditions at the James and Redmond properties. Relevant details are summarized in the subsections below with additional details, including field work and hydrological assessment details, presented in Appendix J. The impacts to the existing hydrological regime by the proposed Project, as described in Chapter 3, are presented in Chapter 7.

In general, the drainage systems in the study area are strongly influenced by the underlying geology. Streams and lakes tend to be oriented northwest/southeast to match the strike of the bedrock units. Watershed boundaries are generally quite clearly defined by exposed bedrock ridges that run in a northwest/southeast direction.

4.1.4.1 James Property

The James Property is located at the base of an eastern slope of a prominent northwest/southeast trending bedrock ridge. Bean Lake is located to the east and is the closest lake to the James Property (Figure 4.7).

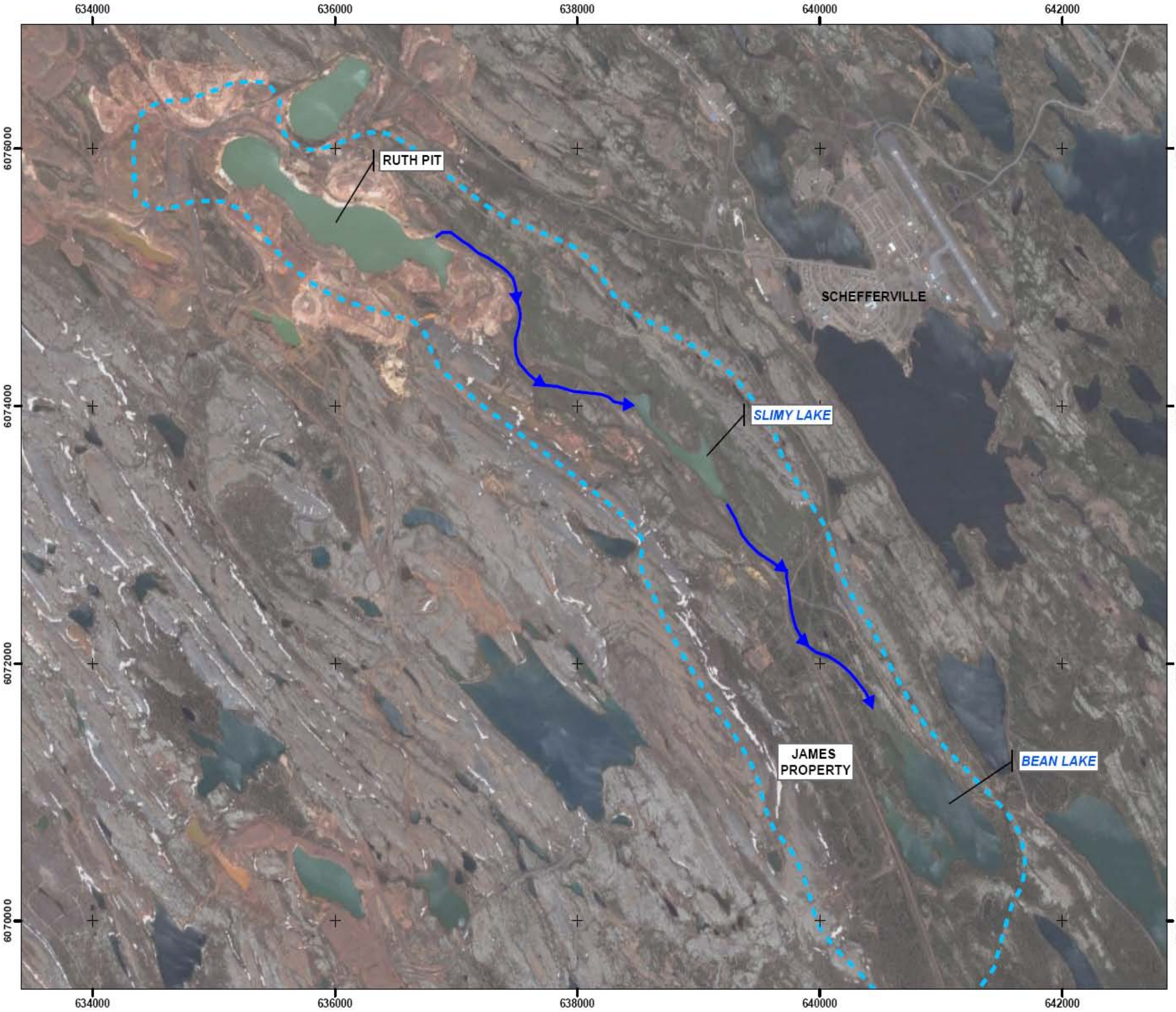


Figure 4.7 James Creek/Bean Lake Drainage Area

Bean Lake is fed primarily by James Creek which enters the lake at its northern-most point. James Creek originates at the Ruth Pit via a submerged/blocked culvert that is located along the east side and towards the south end of the pit. James Creek flows southeast past the south end of Ruth Pit into Slimy Lake, then flows out of Slimy Lake continuing southeast to Bean Lake.

There are two springs on the James Property that form an unnamed tributary that flows directly into Bean Lake. These springs (and tributary) figure prominently in the hydrological assessment of the James Property and to the water balance of the system.

Bean Lake discharges from the southeast and flows into a stream that discharges from Lejeune Lake.

Hydrological measurements were collected in 2008 using stream gauges and groundwater monitoring wells installed and monitored by WESA at appropriate locations across the James Property. WESA also completed an assessment of these measurements and other pertinent data and details of this assessment are presented in Appendix J. A summary of the relevant findings of the assessment is presented below.

James Creek/Bean Lake Water Balance

The measured combined inflows to Bean Lake (surface and groundwater) and the combined outflows (surface water flow and evaporation) are presented in Table 4.5 and Figures 4.8 and 4.9.

Table 4.5 Combined Inflows and Outflows to Bean Lake (needs some formatting)

Inflow and Outflow	**June** m^3/min	**Sep** m^3/min
SG4 (Un-named tributary)	2.4	1.2
SG8 (James Creek inlet to Bean Lake)	42.1	46.6
XS-1-N	0.4	0.4
XS-2-S	2.2	2.2
Groundwater Discharge	18.9	18.9
Total Inflow	**66.0**	**69.3**
SG5 (outlet from Bean Lake)	61.0	54.4
Evaporation	0.8	0.8
Total Outflow	**61.8**	**55.2**
Difference	4.2	14.1
Percent Difference	6.6	23

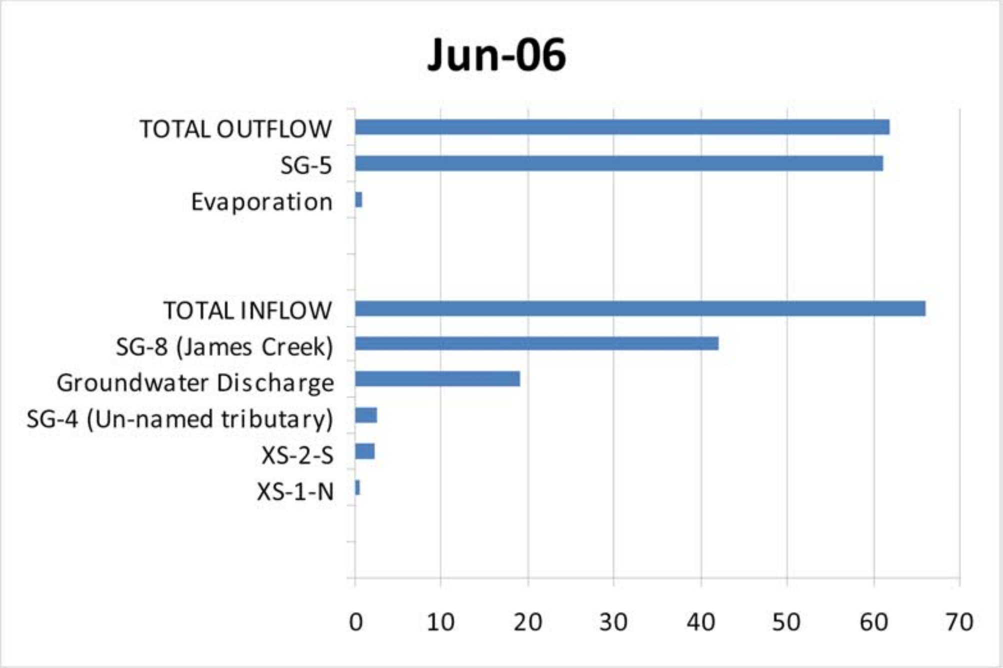


Figure 4.8 Components of the Water Balance for June 6, 2008

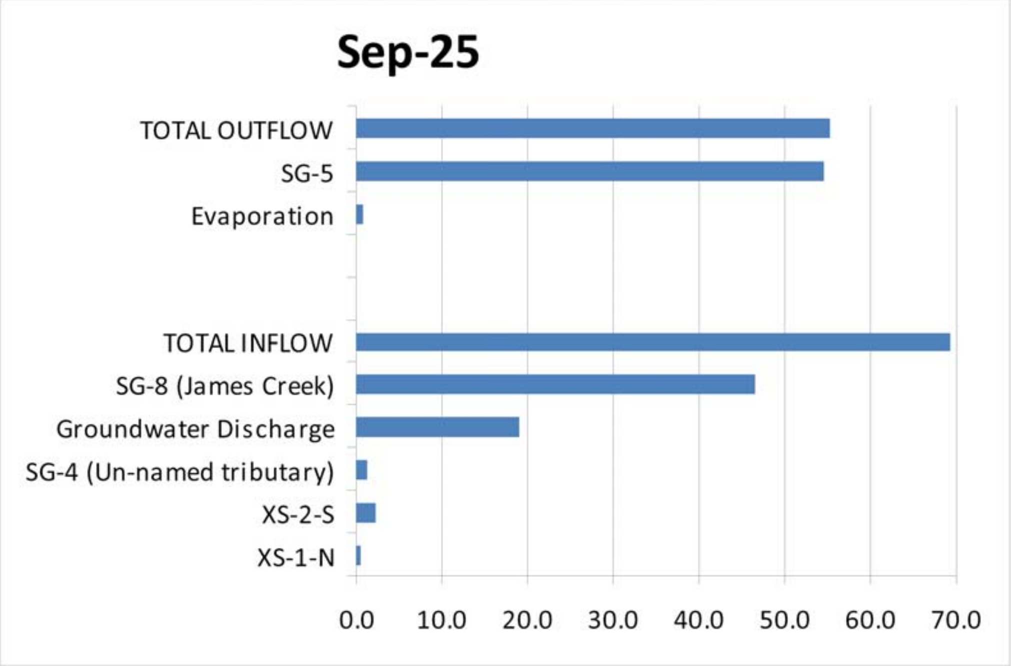


Figure 4.9 Components of the Water Balance for September 25, 2008

The difference between the total inflow and outflow amounts is assumed to represent the cumulative error in the measurements and estimations that make up the components of the water balance. The June values balance closely while the balance for September is not as close. The total inflow values to Bean Lake were consistent between the June and September 2008 measurement periods. The component with the greatest unknown degree of accuracy is the groundwater flux, because the cross-sectional area of flow was determined based on an estimate of the width and depth of the groundwater zone that discharges to Bean Lake, and the zone may differ from the estimate. More wells closer to the lake would be required before a more precise groundwater flux estimate could be developed; however, this is not considered to be necessary at this time because flow estimates were sufficiently accurate for assessment purposes. The outflow estimate from Bean Lake was lower in September than in June; it is possible that the groundwater discharge to Bean Lake decreased over the course of the summer and/or that water from the lake was lost to groundwater later in the season.

Overall, the June and September water balance ‘snapshots’ were quite similar: the flows were similar, and the relative contributions of the various components in the balance were similar. They are therefore considered to be representative of the entire ice-free season.

Summary of James Property Hydrology

The hydrological measurements collected for the James Property watershed have been very useful in gaining a general understanding of the water balance for the region as well as more specific details for the proposed James North and South open pit developments. Based on the assessment conducted by WESA, the collected data provides much more useful and representative information than the alternative method of estimating runoff obtained from published runoff rates for Labrador due to the impacts from the existing pits and natural springs in the area. For example, when the monthly cumulative flow measurements for the Bean Lake inlet and outlet locations were compared to the monthly runoff values that were estimated using published runoff rates for the closest available station (Station 03LE002, The Hydrology of Labrador, 1997), it was determined that the flow measurements were approximately double what would be predicted using the runoff rates and the watershed area. The difference in this determination is related to the flow from Ruth Pit and the two natural springs which were captured in WESA’s assessment.

The hydrology and hydrogeology of the James Property has distinctive characteristics because of the influence of the two groundwater springs. The approach that was taken to assess the water balance focused on these springs and the groundwater/surface water interactions at the James Property and the overall water balance of Bean Lake.

Data was collected from the main surface water inputs to Bean Lake and the outlet from Bean Lake from early June until October 2008. Prior to this period, during the preceding winter months, snow and ice pack studies were conducted and observations of surface water feature conditions in winter were conducted and recorded to provide full seasonal data. The results of the flow monitoring during 2008 indicate that the ranges of flows at most of the stream gauge locations were low during the June to October 2008 monitoring period. It is also noted that the period of seasonal runoff in Labrador occurs from May to August, with June generally contributing the most runoff of any month through the year (NLDEC 1997).

Stream flow measurements over the spring/summer/fall of 2008 appear to represent seasonally above average flow conditions and the flow rates drop substantially during the winter months. Longer term monitoring will be undertaken in the future to confirm these conditions.

Figure 4.10 shows a plot of the flow at the Bean Lake outlet monitoring station over the course of the 2008 monitoring period. Also shown on this graph are the precipitation events over that time frame (obtained from Schefferville weather station). A direct correlation can be seen between precipitation events and increased flow, with a delay of approximately one day as a result of the attenuative effect of Bean Lake.

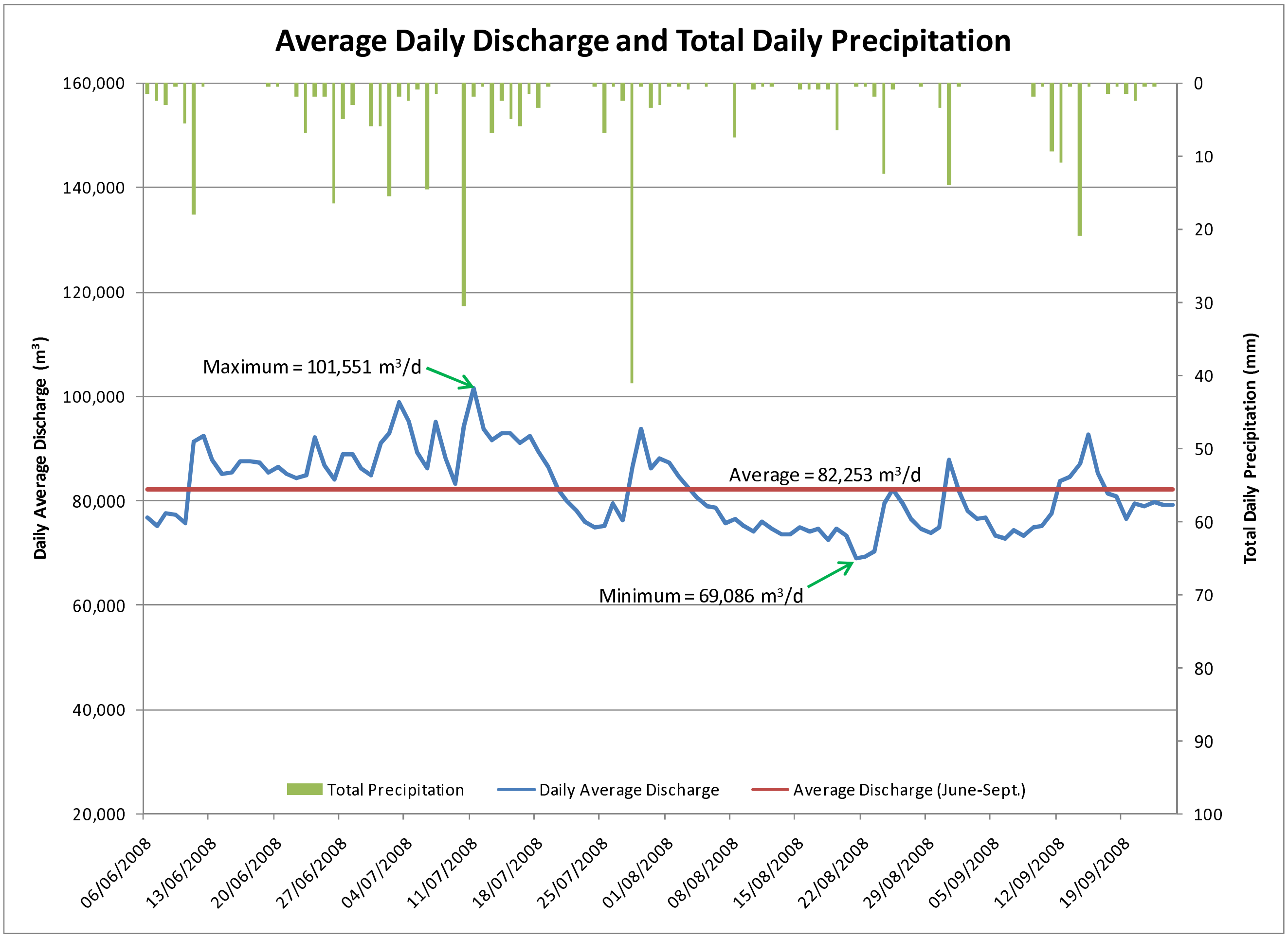


Figure 4.10 Average Daily Discharge from Bean Lake Outlet and Total Daily Precipitation

4.1.4.2 Redmond Property

Open pit mining was conducted at the Redmond property by IOC until the early 1980s in the Redmond 1 and Redmond 2 open pits. Both of these pits have filled with groundwater and surface water over the years since mining occurred. Other than the surface water in the two open pits, the main surface water feature at the Redmond Property is a small stream that starts in a pond northeast of the former railway turnaround area north of the Redmond 2 pit and flows southeast past the north side of the Redmond 1 pit and eventually discharges into Redmond Lake (Figure 4.11, “Redmond Pit” is IOC Redmond 1).

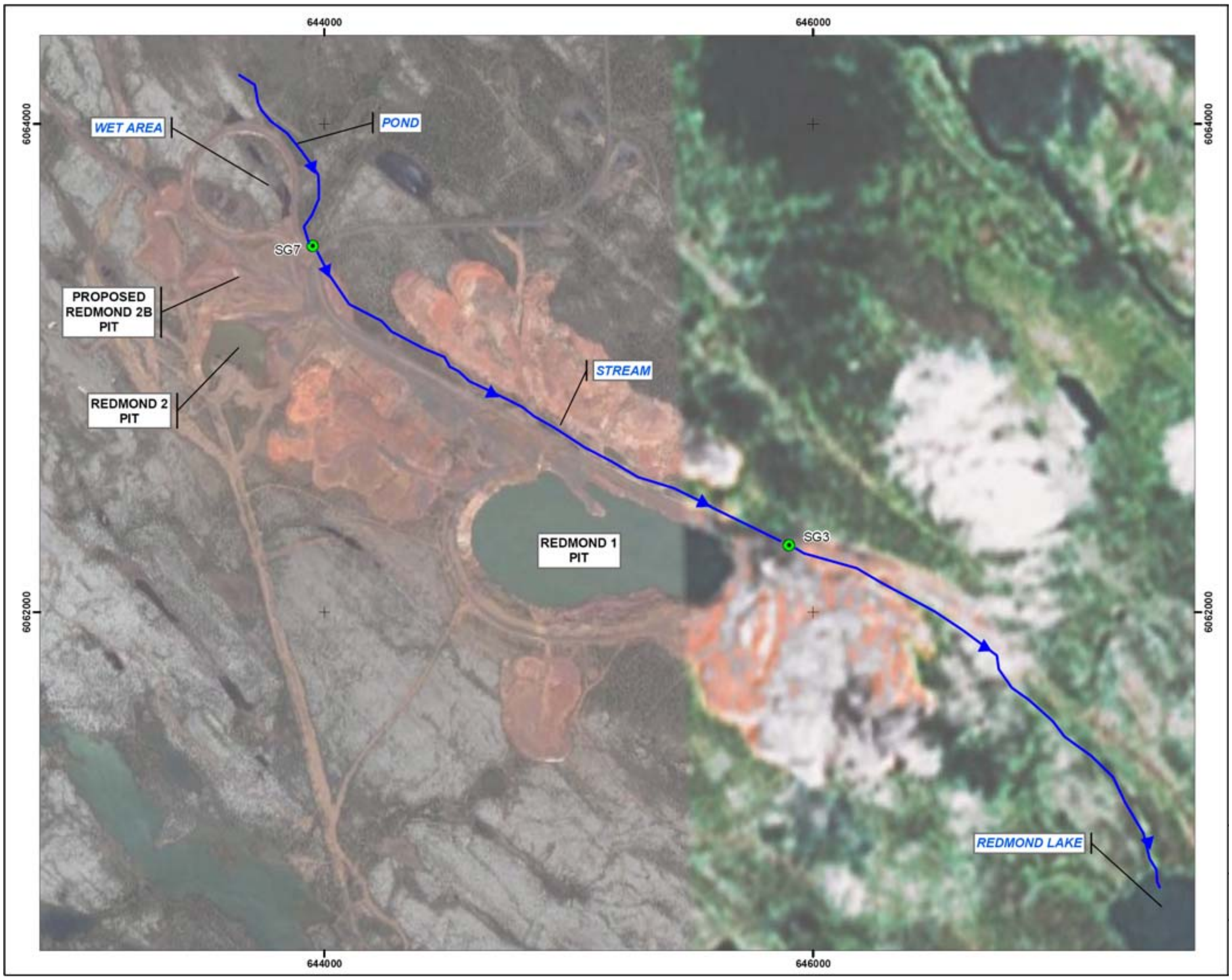


Figure 4.11 Redmond Property Drainage Area

The proposed Redmond 2B pit will be located immediately to the northwest of the existing Redmond 2 pit. Runoff from this area flows to the north and northeast toward the wetland in the former railway turnaround area. There is a wetland community located north of the proposed Redmond 2B pit within the turnabout area, outside of the development limits. This wetland is considered a fen wetland type according to the Canadian Wetland Classification System and receives water through a combination of precipitation, overland flow and groundwater inputs. The railway turnabout structure acts as a barrier to water and flow to and from this wetland is significantly restricted. This can be seen through the conformed ‘circle’ shape of the wetland vegetation, as physically defined by the turnabout. There is a stream that originates east and outside of the turnabout area which flows to Redmond Lake. The drainage area to this stream is largely from vegetation communities to the northeast of the turnabout and a spring north of Redmond 1 to the north. Water from Redmond 1 pit is thought to be the source of the spring via subsurface flow. There is no surface flow connection between Redmond 1 and any streams/ponds or Redmond 2 and any streams/pond, and there is no intention to dewater the Redmond 1 pit or to discharge water to Redmond 1 pit as part of this project.

Hydrological measurements were collected in 2008 using stream gauges and groundwater monitoring wells installed and monitored by WESA at appropriate locations across the Redmond Property. WESA also completed an assessment of these measurements and other pertinent data and details of this assessment are presented in Appendix J. A summary of the relevant findings of the assessment are presented below.

Summary of the Redmond Property Hydrology

The hydrology of the Redmond Property is described in terms of the contributions made by surface water and groundwater discharge. Flows were examined in early spring, mid-summer and fall.

Details of the flow measurements collected in the one stream located on the Redmond Property are provided in Appendix J. Stream flow measurements over the spring/summer/fall of 2008 appear to represent seasonally above average flow conditions and the flow rates drop substantially during the winter months. Longer term monitoring will be undertaken in the future to confirm these conditions.

Groundwater in the wells located within the proposed future Redmond 2B pit footprint was encountered at a depth of approximately 25 metres below ground surface, at an elevation of approximately 530 m asl. Groundwater in the shallower wells located north of the proposed pit was encountered at depths ranging from approximately four to seven metres below ground surface, at elevations ranging between approximately 526 and 528 m asl. The ground surface north of the proposed pit area is currently approximately 20 metres lower than in the pit area, so this is why groundwater is so much shallower there. Groundwater is estimated to flow to the north.

4.1.5 Ambient Water Quality

4.1.5.1 Groundwater Quality

Well Installation and Sampling Methodology

A total of 27 groundwater monitoring wells were installed at eight well nest locations at the James Property and six wells at three well nest locations were installed at the Redmond Property (Figure 4.12 and Figure 4.13).

Samples were collected in laboratory supplied bottles. Filtered and unfiltered samples were collected for dissolved and total metals analyses. The filtered samples were filtered in the field using in-line 0.45 micron dedicated water filters. The samples were shipped to ALS Laboratory Group in Kitchener, Ontario where they underwent analyses for metals and general chemistry.

Groundwater samples were also collected from the pumping wells during the two pumping tests that were conducted at the James Property. These samples were collected using submersible pumps.

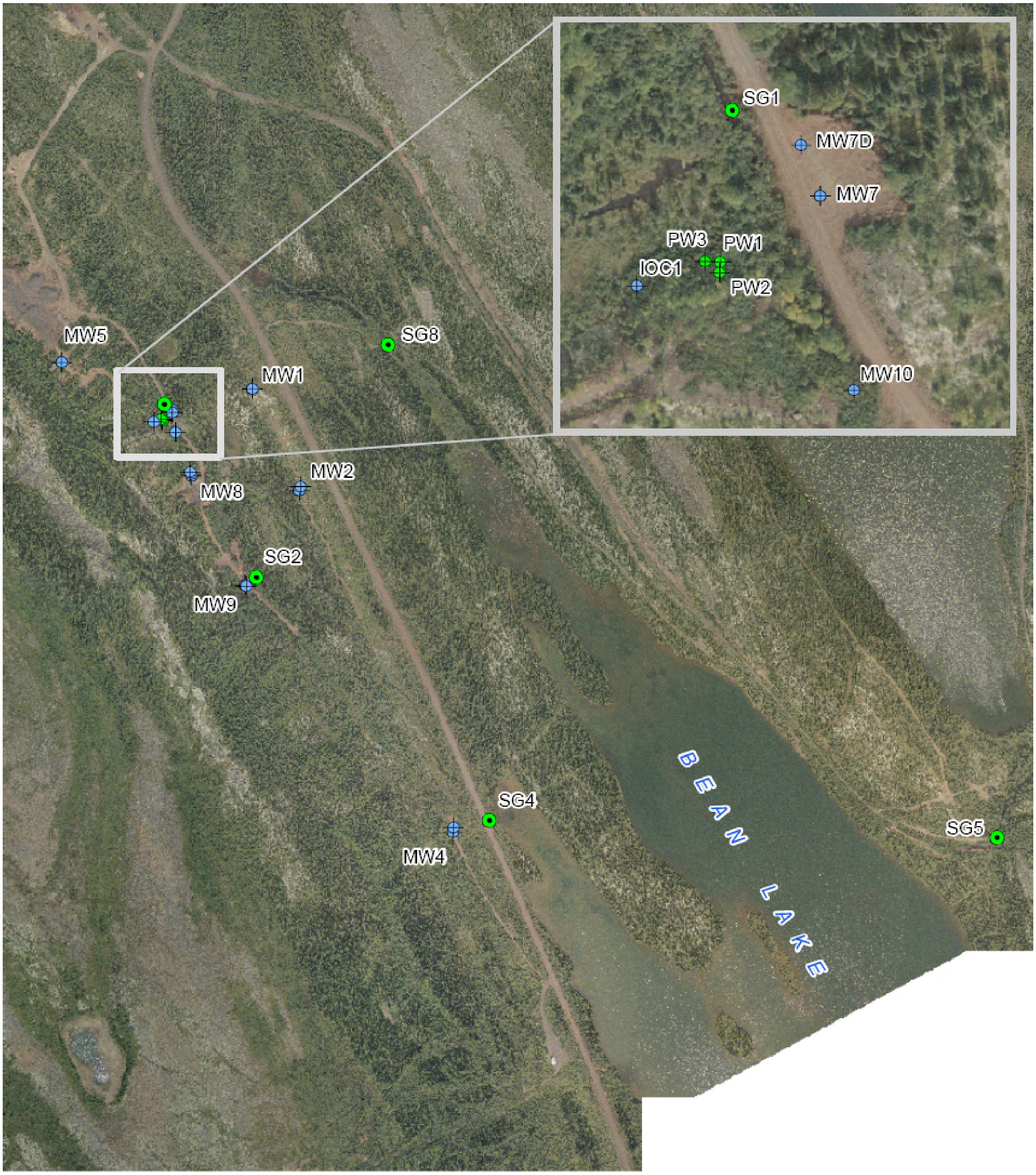


Figure 4.12 James Property Monitoring Wells and Stream Gauges Locations

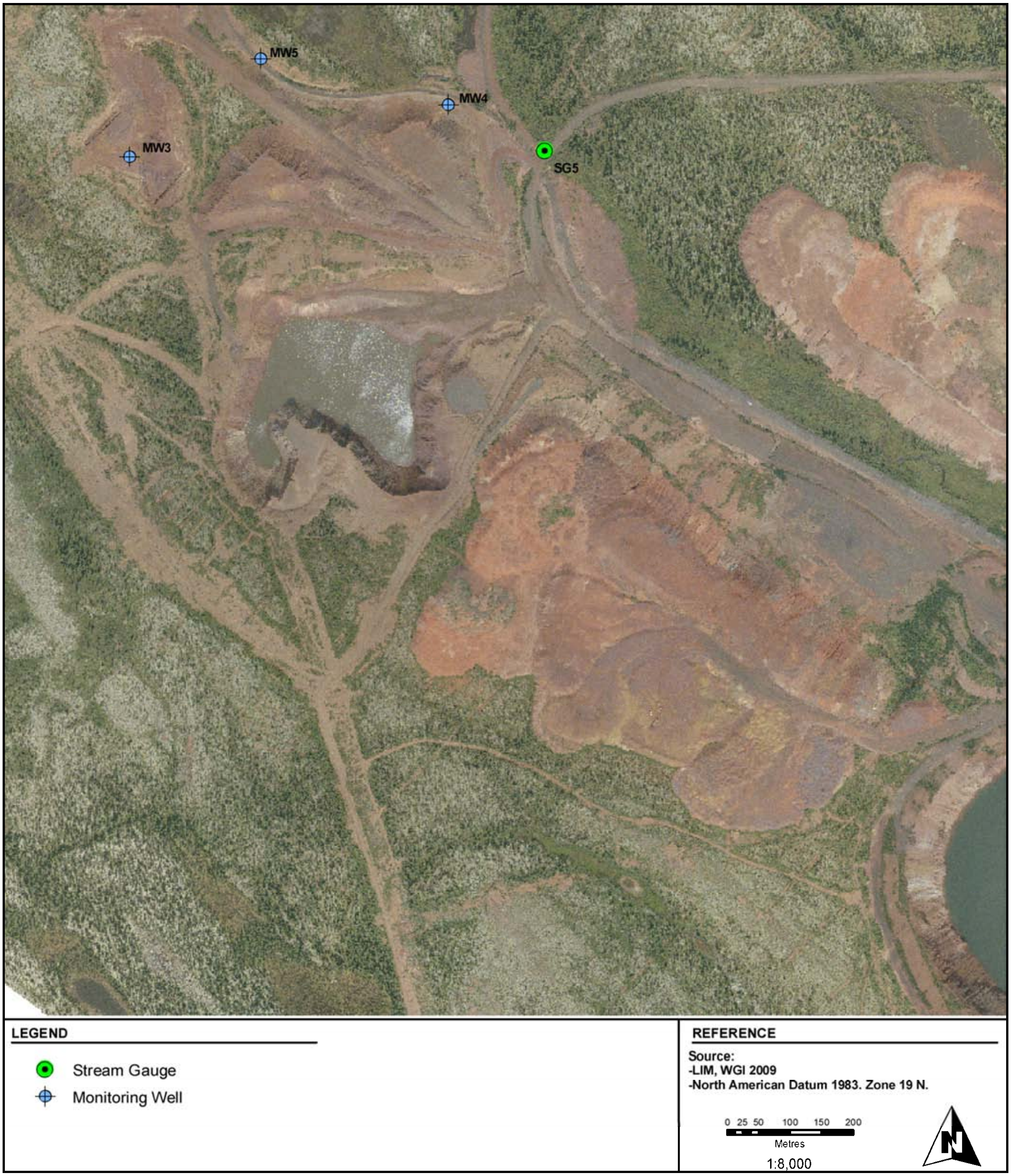


Figure 4.13 Redmond Property Monitoring Wells

Results

James Property

The groundwater chemistry results for the James Property wells have been summarized in Appendix I. For the unfiltered samples, the Total Suspended Solids (TSS) concentrations ranged from 270 to 67000 mg/L and the Total Dissolved Solids (TDS) concentrations ranged between <20 and 1800 mg/L. The water is quite soft, ranging from 8 to 78 mg/L as CaCO3. As there are no CWQG for dissolved metals, the dissolved metals sample results have been discussed in context of the total metal guidelines presented in the CWQG.

The TSS concentrations from the groundwater monitoring wells and pumping test wells were higher than the TSS limits listed in Environmental Control of Water and Sewage Regulations, 2003. The water quality from the perimeter dewatering wells will be much lower in TSS after the full scale wells have been developed. LIM acknowledges that this water will have to meet the required Provincial and Federal effluent limits prior to discharge to the environment. In this case the filters will be the first stage of water treatment followed by discharge to a settling pond which will be designed to retain the water/effluent for sufficient time to settle any remaining suspended solids, and then allow direct discharge to the environment under the appropriate regulatory criteria.

Total Metals

The total iron results for the unfiltered samples ranged between <0.05 and 130 mg/L. The only other metals that were consistently detected in the unfiltered samples were aluminum (range of <0.01 and 61.9 mg/L), cobalt (<0.005 to 0.08 mg/L), copper (<0.001 to 0.08 mg/L), manganese (range of 0.002 to 37.4 mg/L), titanium (<0.002 and 0.3 mg/L), vanadium (range of <0.001 and 0.07 mg/L) and zinc (0.007 and 0.77 mg/L). The results were compared to the Canadian Water Quality Guidelines for Freshwater Aquatic Life (CWQG). At most well locations, total iron exceeded the CWQG of 0.3 mg/L, copper exceeded the CWQG of 0.002 mg/L, and zinc exceeded the CWQG of 0.03 mg/L.

Dissolved Metals

The dissolved iron results were all below detection limit with the exception of wells JA-MW5C (0.48 mg/L) and JA-MW7B (0.08 mg/L). The aluminum results were below detection limit except at well JA-MW1-A1 (0.08 mg/L), copper ranged from <0.001 mg/L to 0.004 mg/L, manganese ranged from 0.001 to 0.101 mg/L, and zinc ranged between 0.003 and 0.123 mg/L. Dissolved iron did not exceed the CWQG at any well locations at the James Property. Dissolved copper exceeded the CWQG of 0.002 mg/L in 11 of the 30 groundwater samples collected from monitoring wells at the James Property. Dissolved zinc exceeded the CWQG of 0.03 in 8 of the 30 samples collected from the monitoring wells. The dissolved metals results were consistently considerably lower than the total metals results.

Pumping Wells Water Chemistry

Pumping tests were conducted on pumping wells that were installed southeast of the James North Spring. Water quality from the pumping wells is considered to be more representative of water quality to be expected initially from the dewatering system than individual monitoring well results because the pumping wells draw water from a larger portion of the aquifer than do individual monitoring wells. Total and dissolved metals and general chemistry samples were collected from the pumping wells.

The groundwater chemistry results for the pumping tests that were conducted at the James Property were generally similar to the average groundwater monitoring well with respect to parameters detected and their concentrations. The total iron concentrations in the water from the pumping wells ranged from <0.05 to 1.8 mg/L, the total copper concentrations were between <0.001 and 0.017 mg/L, and the total zinc concentrations were between 0.01 and 0.039 mg/L. The water from the pumping wells did not contain detectable dissolved iron or copper. The dissolved zinc concentrations in the pumped water ranged from 0.004 to 0.007 mg/L, and were well below the CWQG of 0.03 mg/L.

The water purged and sampled from each monitoring well and pumped from the pumping wells during the pumping test was brownish red in colour. This reddish colour in the water was present over the duration of the pumping tests. Discussions with a former IOC employee who was involved with dewatering work when IOC was operating mines in the Schefferville area have revealed that water from the IOC dewatering wells would commonly be red when the dewatering wells were first installed and started pumping, but that the water would normally clear up after several weeks of pumping (D. Hindy, pers. com.). It is possible that this will also occur with dewatering of the proposed future James and Redmond 2B pits.

Redmond Property

The groundwater chemistry results for the monitoring wells installed at the Redmond property can be found in Appendix I. TSS results for the unfiltered samples ranged between 11000 and 27000 mg/L. TDS results ranged from 30 to 450 mg/L. The hardness levels ranged between 14 and 65 mg/L (CaCO3).

The TSS concentrations from the groundwater monitoring wells and pumping test wells were higher than the TSS limits listed in Environmental Control of Water and Sewage Regulations, 2003. The water quality from the perimeter dewatering wells will be much lower in TSS after the full scale wells have been developed. This water will be discharged to and held within the Redmond 2 Pit, and therefore, no treatment will be required.

Total Metals

The total iron results ranged from <0.05 to 212 mg/L. Aluminum ranged between <0.01 and 43.8 mg/L. The results for cobalt were between <0.0005 and 0.232 mg/L. Copper ranged from <0.001 to 0.38 mg/L. The manganese concentrations were between 0.005 and 45.7 mg/L, and zinc ranged between 0.018 and 1.14 mg/L. At most well locations, total iron exceeded the CWQG of 0.3 mg/L, copper exceeded the CWQG of 0.002 mg/L, and zinc exceeded the CWQG of 0.03 mg/L.

Dissolved iron was only detected at one well (Red-MW3B at 0.07 mg/L). Aluminum was detected only at RED-MW3A and 3B (0.02 and 0.07 mg/L respectively), manganese ranged from <0.001 to 0.017 mg/L, and the zinc concentrations were between 0.004 to 0.083 mg/L.

Dissolved Metals

The dissolved metals concentrations in the wells at Redmond were consistently lower than the total metals concentrations. The concentrations of TSS and total and dissolved metals tended to be higher in water collected from groundwater monitoring wells at Redmond than at the James monitoring wells.

4.1.5.2 Surface Water Quality

Surface water sampling followed the protocols outline in Environment Canada’s Metal Mining Guidance Document for Aquatic Environmental Effects Monitoring, June 2002

Results of surface water samples collected by AECOM in the Redmond and James properties in 2007 and 2008 (Appendix I) were compared with the Canadian Water Quality Guidelines for the Protection of Aquatic Life (CWQG, FWAL) and the Guidelines for Canadian Drinking Water Quality (GCDWQ). In general, the results for the Redmond property (Appendix I), James property (Appendix I), and offsite areas adjacent to James were consistent with the good water quality reported by LIM from baseline data collected seasonally since 2005.

James Property

Sampling sites for the James deposit (Figure 4.14) are situated as follows:

- JP1: In James Creek, located under the main road to Redmond Property;
- JP5: Located adjacent to Silver Yard on James Creek. Also located upstream of JP1;
- JP 2: James Creek prior to discharge into Bean Lake;
- JP3: Unnamed tributary. Culvert at the road at southern edge of James property;
- JP4: Spring that discharges to JP3; and,
- JP6: Spring that merges with JP4 and discharges to JP3.

Of the 19 surface samples collected on the James property, all were within the applicable referenced guidelines with the following summarized exceptions.

JP4, JP5

Zinc concentrations in surface water samples collected in late winter, 2008, at JP4 and JP5 sites exceeded CWQG, FWAL guideline of 30 ug/L. These variances suggest a seasonal variability, e.g., zinc concentrations were elevated in March and April 2008 at sites JP4 and JP5 in comparison to 2007 values, which were below the applicable guidelines.

Offsite Upgradient Samples

In addition to the samples listed above, additional samples were collected offsite at upgradient locations to observe nearby background concentrations near but off of LIM’s James property. The following summarizes the sampling locations (Figure 4.14):

- Slimy 1: Spring adjacent to Slimy Lake, Located 1.5 km upstream from JP5 and is headwater lake for James Creek;
- Slimy Lake: adjacent to the Silver Yard area;
- Bean L. Out: Outlet for Bean Lake and encompasses the entire watershed for the James and Silver Yard locations;
- Bean: Located in Bean Lake adjacent to James property;
- Ruth Out: Origin of James Creek and located approximately 4 km upstream from JP5; and
- Ruth Pit: Surface water samples from proposed processing water supply and reject line from Silver Yard Benefaction area.

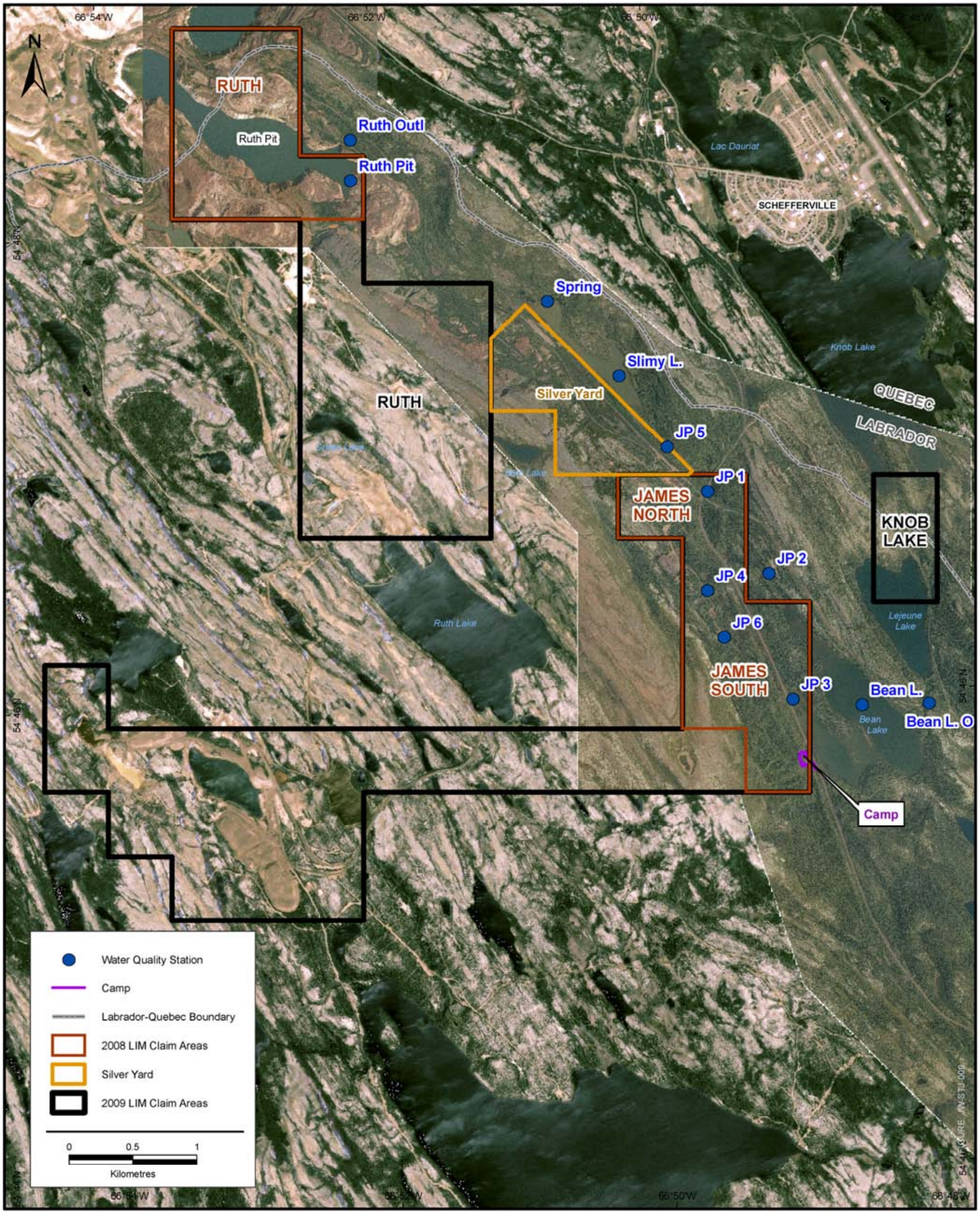


Figure 4.14 Surface Water Sampling Stations, James

The following summarizes the exceedances of the applicable guidelines at the offsite sampling locations:

- Slimy 1 and Bean.

Zinc concentrations in surface water samples collected in late winter, 2008, at Slimy 1 and Bean Lake sites exceeded CWQG, FWAL guideline of 30 ug/L. The spring at Slimy appears to indicate bedrock mineral characteristics, with exceedances for aluminum and manganese also being noted. Aluminum concentrations return to acceptable levels before station JP5, but zinc and manganese remained elevated until Bean Lake. Variances based on continual monitoring of Bean Lake suggest there is a seasonal variability, but Slimy 1 spring appears to maintain a higher level of zinc than other surface water features associated with the Project. This type of seasonality has been observed and reported (Wetzel 1983 and Goldman 1994).

Redmond Property

Screening results from sampling of the Redmond Property in 2005 and 2006 indicated that surface water quality is very good: pH approximately neutral, alkalinity and hardness were very low, electrical conductivity was also very low (11 – 36 µS/cm), with TDS very low (5 – 18 ppm), as well.

For the five samples locations on the Redmond property (Figure 4.15), a total of 20 surface water quality samples have been collected since April 2006. Of these samples, all surface water results generally meet CWQG, FWAL and the GCDWQ, with the exceptions described below.

RP2

The pH value of 6.46 recorded in the pit in April 2007 was marginally below 6.5, the CWQG, FWAL pH guideline value. Of a total of ten samples, the remaining nine pH recorded values were all within the applicable pH range. It is noted that the lab report provides pH to two decimal points as compared to the CWQG, FWAL, which reports to one decimal place. In consideration of this, the result is approximately the same as the lower end of the acceptable CWQG, FWAL range. Water in the pit is dilute with a total dissolved solids value of 12 mg/L and alkalinity results less than the detection limit of 5 mg/L.

RP3, RP4, RP5

Iron and manganese results in April and March 2007 and 2008 at RP3, RP4 and RP5 were elevated up to 60 times the GCDWQ and CWQG, FWAL. In September, these results return to within acceptable guidelines. Therefore, this pattern suggests a seasonally dependent variation consistent with anoxic conditions that frequently develop under ice cover in late winter in small shallow ponds in many shield locations. Based on general limnological documentation, iron in sediments has been observed to go back into solution under anoxic conditions to levels even more elevated than those observed here. Under ice free conditions, iron and manganese rapidly oxidize and precipitate, leaving iron concentrations in water well within GCDWQ guideline of 300 ug/L. This is observed in the September sampling episodes. For example, iron concentrations of 5800 ug/L at RP4 in April 2007 were reduced to 70 ug/L in September of the same year. Similarly, manganese concentrations at RP3 of 780 ug/L observed in March 2007 were reduced to 10 ug/L in September, well below the GCDWQ guideline of 50 ug/L.

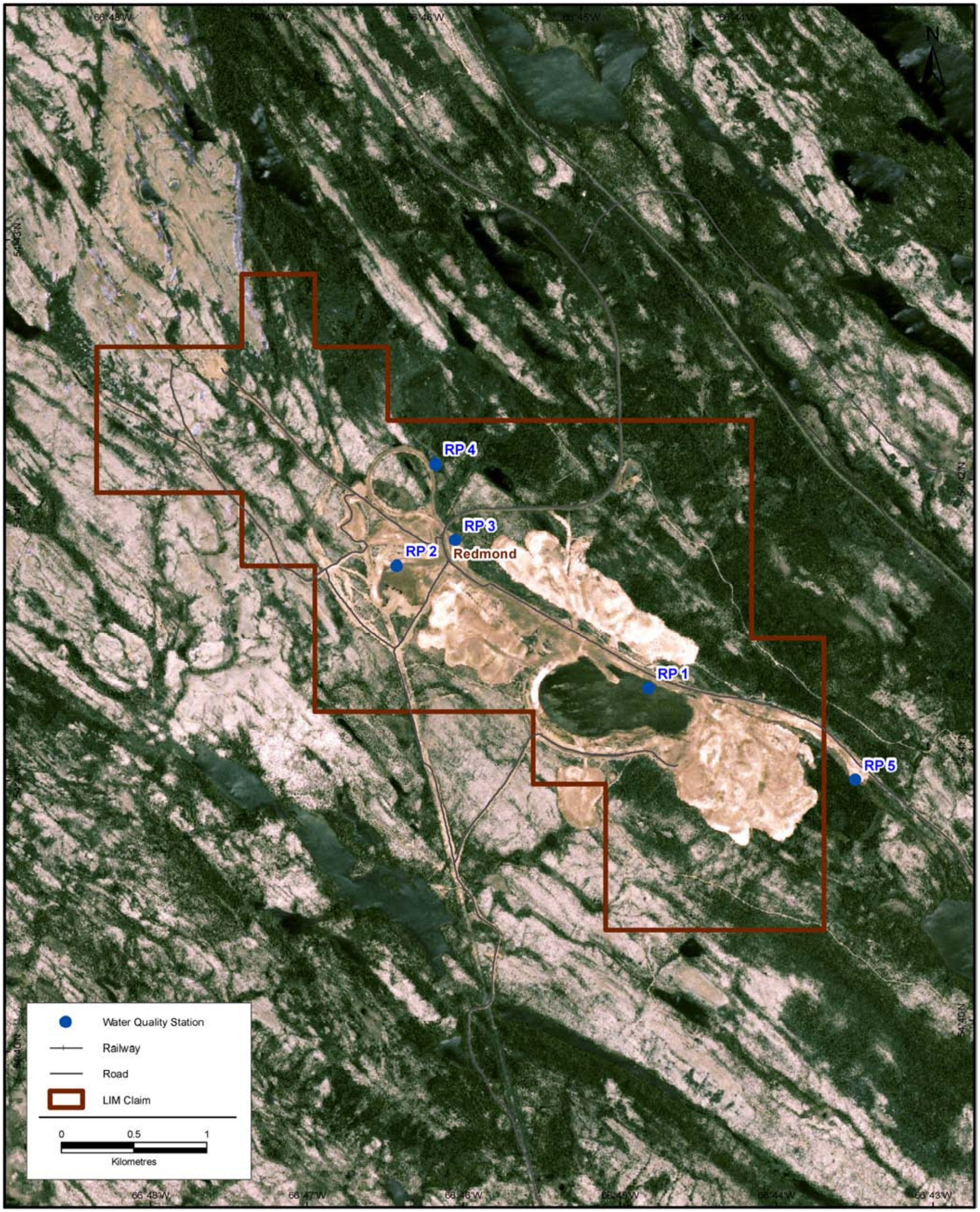


Figure 4.15 Surface Water Sampling Stations, Redmond

RP3 and RP4

Colour, an aesthetic parameter, was reported at RP3 at levels at or exceeding the GCDWQ guideline during the April and September 2007 sampling episodes. This location, at the culvert, could not be accessed during the Spring 2008 sampling program.

Colour at RP4 exceeded the GCDWQ guideline in April 2008, but was within acceptable limits in April 2007 and September 2007.

These exceedances also appear to be associated with seasonal variation.

RP5

It should also be noted that a total zinc concentration of 153 ug/L was noted for RP5 in March 2008. The dissolved zinc value for the same sample was reported as <3 ug/L. This was the first sample collected at this location and additional samples, as well as duplicates, will be collected seasonally to verify the viability of the total zinc result.

Manganese was also noted at 111 ug/L, exceeding the GCDWQ guideline of 50 ug/L. It should be noted the JP5 is in an exposed area conveying flows over historic stockpile of low grade iron ore.

4.2 Biological Environment

4.2.1 Wetlands and Flora

4.2.1.1 Description of Study Area

James North and James South Properties

Approximately 50 percent of this area has been disturbed due to past mining activities. Two pits are planned at James North and James South that will be established on either side of a spring that divides the two properties.

Silver Yard

The proposed beneficiation area is to be situated at the Silver Yard, located north of the James North property. Although the former rail spur lines have been removed, linear infrastructure (roads and the spur rail bed) are still present and in good condition. The Project includes the re-establishment of the railway spur along the existing rail spur bed, the placement of a semi-mobile washer and crusher, stockpile areas and a loading area to facilitate transport of ore via rail cars.

Redmond Property

More than 90 percent of the Redmond property has been disturbed by past mining activities. Abandoned and flooded pits, a former rail line turnaround, a rail bed, and historic rock stockpiles are present on the property.

4.2.1.2 Methods

Field Sampling

Detailed investigations of the existing on-site natural vegetation communities for all three sites included a comprehensive plant species inventory as well as a description of site and soil conditions.

Vegetation Inventory

Twenty-nine detailed ecological plots were established in the James, Redmond and Silver Yard areas to describe vegetation within the four sites. Plots were located within areas of varying species composition and were described using a combination of aerial photograph interpretation, satellite imagery interpretation, soil profile examinations and multilayer (canopy, sub-canopy, groundcover) vegetation inventories. Soil pits approximately 30-50 cm (depending on geological conditions) were excavated to examine soil profiles at each plot. A vegetation inventory examined a $10m^2$ area around the soil pit. The abundance of individual plant species along with their location within the flora strata was noted.

Vegetation communities were classified and delineated utilizing the following systems: The Canadian Wetland Classification System (National Wetlands Working Group, 1997) and The Canadian Vegetation Classification System (National Vegetation Working Group, 1990).

A hand-held global positioning system (GPS) was used to record the location of all the plots. Representative photographs were taken at each site.

4.2.1.3 Results

Appendix K presents a floral species list for each vegetation community delineated and representative photographs of each ecological plot.

Climate and Ecological Site Context

The Schefferville region is situated within the Labrador Uplands Ecoprovince, Smallwood Reservoir-Michikamau Ecoregion. The region has a continental, subarctic climate with cool, short summers and long, severe, cold winters.

Black spruce (*Picea mariana*) is the dominant tree species. White spruce (*Picea glauca*) and tamarack (*Larix laricina*) also occur. Open stands of lichen-spruce woodland with an understory of feathermoss are dominant. The general aspect of the region is that of a rolling plain with numerous lakes and isolated rugged hills composed of Achaean granites, gneisses and acidic intrusives that occur about 150 m above the general landscape. Humo-Ferric Podzolic soils are dominant with major inclusions of Ferro-Humic Podzols, Mesisols, and Organic Cryosols.

James Property

The James site is situated within a valley between two parallel ridges trending northwest to southeast. Former mining operations for this property ceased in 1982. Since then, disturbed areas have been left to re-vegetate resulting in alternating communities of spruce forest and birch/alder/spruce forest particularly along the northeastern flank of the most southwesterly ridge.

Seven upland and one wetland vegetation community were observed within the James property. Vegetation is typical of the varying land classes encountered in the area. The predominant tree species is black spruce, white spruce, and tamarack with various mixed stands of birch (Betula spp.). Ground vegetation is consistent with the typical biophysical land classes associated with spruce-moss, spruce-shrub and open lichen forests. The shrub layer consists mostly of birch (*Betula pumila*), willow (*Salix* spp.) and alder (*Alnus* spp.). Some sedge-dominant wetland pockets (fens) also occur where surface drainage is poor.

The following describes the vegetation communities on the James Property:

- **Intermediate, closed deciduous shrub stand dominated by birch species** - is one of the major vegetation communities within the study area. It covers the gentle to moderately steep slopes of the ridges, as well as the lower parts of the slopes. The community is dominated 80 percent by shrub species including dwarf birch and green alder (*Alnus viridis ssp. crispa*). Tree cover is sparse and consists of black spruce. Ground cover, comprised mainly of bunchberry (*Cornus canadensis*), with some mosses and lichens, is also sparse covering approximately 5 percent of the ground. This vegetation community is not located within the Project footprint.
- **Intermediate, open deciduous tree stand dominated by black spruce** - is located on the low and moderate slopes of the ridges and dominated by intermediate trees with tall and low shrubs. The tall shrub layer consists of dwarf birch; the low shrub species are lowbush blueberry (*Vaccinium angustifolium*), black crowberry (*Empetrum nigrum*) and redberry (*Vaccinium vitis-idea*). Tree cover is 40 to 60 percent and consists of black spruce (*Picea mariana*). Groundcover is sparse (5 percent), dominated by aster (Aster sp.) and willowherb (*Epilobium* sp.). This vegetation community is partially within the Project footprint.
- **Intermediate, open deciduous stand dominated by birch species** - is an example of the regeneration of previous forest harvesting, which occurred approximately 25 to 30 years ago. The tree cover is approximately 40 percent and consists of mountain paper birch (*Betula papyrifera*), resin birch (*Betula glandulosa*) and black spruce. The high shrub layer includes dwarf birch and green Alder (Alnus viridis ssp. crispa); the low shrub species are Labrador tea (*Ledum groenlandicum*), lowbush blueberry, bog bilberry (*Vaccinium uliginosum*), black crowberry and redberry. Groundcover is sparse to non-existent. This community is partially within the Project footprint.
- **Tall, closed deciduous shrub stand dominated by green alder** - is typical along the access roads and distributed in narrow strips (3-5 m in width). This vegetation is also associated with recently (5 to 7 years) disturbed areas such as exposed till. The community is dominated strictly by green alder. The tree cover is sparse (5 percent) and consists of black spruce and mountain paper birch. The ground cover consists of bare ground and rocks. This community is partially within the Project footprint.
- **Tall, closed coniferous forest dominated by black spruce with mosses** – occurs at lower parts of the slopes with limited drainage. The community is dominated by 70% tree cover, including black spruce (90 percent of tree cover) and white spruce (10 percent of tree cover). Shrub cover is 10 percent and consists of birch, Labrador tea, lowbush blueberry, bog bilberry and black crowberry. Groundcover is relatively dense (25 to 30 percent) and dominated by bunchberry, twinflower (*Linnaea borealis*) and wood cranesbill (*Geranium sylvaticum*). This community is within the Project footprint.
- **Tall, open coniferous forest dominated by black spruce with birch associates** – is prevalent on drier parts of lower and medium gentle slopes with better drainage. This community is dominated by tree and shrub species. Tree cover is 50 percent and includes black spruce and white spruce. Shrub cover on the plot is about 40 to 50 percent and the dominant plants are dwarf birch, Labrador tea, black crowberry, lowbush blueberry and bog bilberry. Ground cover is sparse and dominated by bunchberry. This community is partially within the Project footprint.
- **Open, nonvascular lichen stand** – occurs along the highest points of the ridges. It is dominated by lichen species and exposed rock. This community is outside the Project footprint.

The following describes the two specific fen wetlands of low, closed herb grammoid stands dominated by sedge species:

- **Low, closed herb graminoid stand dominated by sedge species** – is a fen that can be characterized as moderately rich with slightly higher concentrations of dissolved minerals and dominated by sedges and brown moss. Sedge species dominate the sub-stratum (95 percent) and willow/berry bearing shrubs constitute the low-lying canopy on elevated hummocks. Tree cover is less than 5 percent and consists of stunted spruce and tamarack trees on hummocks. Organic soils occur up to 30 centimetres deep consisting of slightly decomposed roots of sedges, grass and moss. Dominant species include water sedge (Carex aquatilis); willow shrubs (Salix sp.), buckbean (Menyanthes trifoliata), leatherleaf (Chamaedaphne calyculata), redberry (Vaccinium vitis-idea) and black crowberry (Empetrum nigrum.). This community is within the Project footprint.

- **Low, closed herb graminoid stand dominated by sedge species** – is a fen located in a local depression that receives most of the water from direct precipitation and runoff from the slopes. The fen has an outflow stream on the west side. Sedge species dominate the sub-stratum and Sphagnum mosses constitute the ground cover. Shrub cover is less than 5 percent and consists of three species of willow (Salix sp.). Organic soils are up to 20 centimetres deep consisting of slightly decomposed roots of sedges and leaves. Sedge species are predominated by water sedge (Carex aquatilis); wildflower species include buckbean (Menyanthes trifoliata) and silverweed (Potentilla palustris). The vegetation community is within the Project footprint.

Silver Yard

The Silver Yard property is similar to the Redmond site as it has numerous service roads. The service roads, with a north-south orientation, are extensively bordered with alder and willow regeneration. The Silver Yard is within a large valley bordered on the east by a talus slope forested at the base, and to the west, by another slope heavily covered with spruce at the base thinning to almost no vegetation near the summit.

The following describes the vegetation communities identified for the Silver Yard:

- **Low, closed deciduous shrub stand dominated by birch species** - is dominated by shrub species (80 to 90 percent cover) that include dwarf birch and Labrador tea. Tree cover is sparse and consists of black spruce. Groundcover is also sparse (5 to 10 percent), dominated by bunchberry. The site has a north-easterly aspect and a slope of 9° (20 percent). This community is partially within the Project footprint.
- **Intermediate, closed deciduous shrub stand dominated by alder species** – is prevalent on recently disturbed exposed till surfaces and is dominated by green alder. Other shrubs include dwarf birch, bog bilberry willows. The tree cover is sparse (<5 percent) and consists of black spruce. The ground cover is sparse and consists of grasses (<5 percent) and mosses and lichens. Bare ground and rocks occur over approximately 50 percent of the plot. This community is partially within the Project footprint
- **Intermediate, closed deciduous shrub stand dominated by birch species** – is located along the western lakeshore of Slimy Lake and is dominated by shrub species. These include dwarf birch, willow and skunk currant (*Ribes glandulosum*). Trees are absent. Ground cover is approximately 40 percent and it is dominated by horsetail (*Equisetum sp.*), Aster (*Aster sp.*) and yarrow (*Achillea millefolium*). This community is partially within the Project footprint.

Redmond Property

The Redmond site has a wide range of habitat types, largely due to the presence of former mine and pit operation. The habitats range from completely bare ore piles and service roads, to heavily blanketed areas with alder and willow thickets. This area also has a large, flooded pit in the southwest corner of the site. The undisturbed areas are mostly mature black spruce at lower elevations, with stunted spruce – lichen stands along the ridge summits.

The following describes the vegetation communities identified for the Redmond Property:

- **Low, sparse deciduous shrub stand dominated by crowberry with lichen patches** - is the main vegetation community that is widely distributed on the top of ridges. It covers approximately 100 percent of this area along with the lichen-shrub dominated stands. There is approximately 60 to 70 percent exposed bedrock that includes granite/gneiss. Low-lying shrub species cover approximately 15 percent of the area and consist of black crowberry, bog bilberry, dwarf birch, net-veined willow (*Salix reticulata*), and redberry. Lichen species represent 10 percent of vegetative cover in this community. This community is partially within the Project footprint.
- **Low, open deciduous shrub stand dominated by crowberry and lichen species** – is located on steeper slopes and hilltops. The community is dominated by lichen species and shrubs. Lichen species include coral lichen (*Cladina stellaria*) and reindeer lichen (*Cladina rangiferina*). Total cover of lichens is 95 to 100 percent. The shrub canopy is dominated by black crowberry, dwarf birch, Labrador tea and redberry. This community is partially within the Project footprint.
- **Intermediate, closed deciduous shrub stand dominated by green alder and a variety of herbaceous plants** – is located in the narrow valley between two hills. The community is dominated by shrub species. Total shrub cover is 90 percent. Species observed include green alder, dwarf birch, willow and skunk currant. Groundcover is approximately 15 percent and is dominated by bunchberry, wood cranesbill, aster and violet. The dominant moss species is red-stemmed feathermoss (*Pleurozium schreberi*). This community is partially within the Project footprint
- **Intermediate, open deciduous shrub stand dominated by birch and sphagnum moss** – is located in a depression that collects water to form a fen that is flat to slightly concave. Sedge species dominate the sub-stratum (75 to 80 percent) and sphagnum mosses constitute 95 percent the ground layer. The dominant species of sedge is beaked sedge (*Carex rostrata*); wildflower species include buckbean (*Menyanthes trifoliata*). Shrub cover is about 30 percent and consists of dwarf birch and two species of willow (*Salix s*p.). Organic soils up to 20 centimetres deep consist of slightly decomposed sphagnum moss. This community is outside the Project footprint.
- **Tall, open coniferous tree stand dominated by tamarack, polytrichum and sphagnum moss** – is situated on the edge of the fen (described above) and forms the transition zone between the slopes and the bottom of the depression. This community is dominated by shrubs and trees. The tree species include black spruce and tamarack. The shrub canopy is dominated by dwarf birch, Labrador tea, bog bilberry and bog rosemary (*Andromeda polifolia*). Moss cover is dense and consists of haircap moss (*Polytrichum* sp.) and sphagnum moss (*Sphagnum* sp.). Ground cover is sparse (5 percent), with bunchberry, willow herb (*Epilobium* sp.) and grasses. This community is outside the Project footprint.
- **Tall, closed coniferous tree stand dominated by white spruce** - is dominated by shrubs and trees. The tree layer is entirely white spruce while the shrub layer is dominated by dwarf birch, Labrador tea and lowbush blueberry. Moss and lichen cover are relatively dense and consist of red-stemmed feathermoss and star-tipped reindeer lichen (*Cladina stellaris*). Groundcover is sparse, and dominated by bunchberry and grasses. This community is outside the Project footprint.

- **Low, closed herbaceous graminoid stand dominated by sedge species** – is a fen located between the access road and the stream on the riparian zone of the stream. Sedge and grass species dominate the sub-stratum (90 percent) and willow shrubs constitute the canopy. Moss cover represents less than 10 percent of the plot. Open water constitutes 10 to 15 percent of the plot. Organic soils occur up to 20 cm deep consisting of slightly decomposed roots of sedges, grass and silty clay (from the road). This community is outside the Project footprint.
- **Northern Ribbed Fen** – is located in the narrow valley between the ridges. This community is dominated by low shrubs and sphagnum mosses. The tree species include stunted forms of black spruce and tamarack. The shrub canopy is dominated by leatherleaf (*Chamaedaphne calyculata*), cloudberry (*Rubus chamaemorus*), dwarf birch and Labrador tea. The sphagnum cover is dense. The wildflower species include buckbean. Organic soils occur up to 50 centimetres deep consisting of black to dark brown peat. This community is outside the Project footprint.
- **Northern Ribbed Fen** – hollow/shallow pools – Sedge species dominate the sub-stratum (10 to 60 percent). The rest of the site consists of open water. Wildflower species include buckbean, cottongrass (*Eriophorum* sp.), leatherleaf and three-leaved false soloman's seal (*Maianthemum trifolium*). Organic soils up to 40 centimetres deep consist of highly decomposed sphagnum moss. This community is outside the Project footprint.

Rare Plant Species

Based on recent fieldwork conducted by AECOM and a search of the Atlantic Canada Conservation Data Centre (AC CDC) database, there are no known occurrences of plant species listed under the federal *Species at Risk Act* or the *Provincial Endangered Species Act* within the Project footprint.

4.2.1.4 Wetlands

Wetland communities within the study area have been classified according to the Canadian Wetland Classification System (National Wetlands Working Group, 1997). The corresponding Vegetation Classification (National Vegetation Working Group, 1990) designation has also been described in Section 4.2.1.3.

Wetland communities within the study area generally occur within depressions or along the foot of surrounding ridges. Wetland communities have also been observed along the road network, lakes and watercourses. All wetland communities within the subject properties are comprised of either fen or swamp forms. Fens are peatlands with fluctuating water tables. The waters in fens are rich in dissolved minerals and are dominated by moderately decomposed sedge and brown moss peats of variable thicknesses. A swamp is a treed or tall shrub (also called thicket) dominated wetland that is influenced by minerotrophic groundwater, either on mineral or organic soils. The essential features of the swamp class are the dominance of tall woody vegetation, generally over 30% cover and the wood-rich peat laid down by this vegetation. Table 4.6 below lists all the wetland communities observed within the James, Silver Yards and Redmond properties.

Table 4.6 Wetland Communities observed within James, Silver Yard and Redmond Properties

Color	Map Unit*	Community Designation	Community Location
Fen Wetland	16	Low, closed herbaceous sedge stand**	
	16a	Basin Fen	Occurs within topographically confined basins isolated from inflow/outflow streams. Three ecological plots were conducted for this community within the James and Redmond properties.
	16b	Stream Fen	Occurs along the banks of permanent /semi-permanent streams that are low gradient and slow moving. One ecological plot within the Redmond property was conducted for this community.
	16c	Floating Fen	Occurs adjacent to ponds or lakes. The peat surface is generally less than 0.5 m above water level. Dominant species were noted within this wetland type. A combination of cranberry, buckbean and leatherleaf species occur within this community.
	16d	Northern Ribbed Fen	Occurs within elongated hollows and contains a series of parallel ridges. One ecological plot was conducted within the Redmond property for this community.
Swamp Wetland	17	Riparian Swamp	
	17a	Intermediate, sparse tamarack evergreen stand with willows	Occurs along fen communities and contains tamarack and willow species. Dominant species were noted within this wetland type
	17b	Tall, open tamarack, black spruce, evergreen stand with sphagnum moss	Occurs in low lying areas within water conveyance along fen communities. One ecological plot was conducted for this community within the Redmond Property.
	17c	Tall, closed black spruce evergreen stand with sphagnum moss	Occurs in low lying areas within water conveyance along fen communities. One ecological plot was conducted for this community within the James Property.

James Property

There are nine wetlands (totalling 6.906 ha) within the 64.5 ha James Property, with only approximately 0.5 ha within the actual proposed mining footprint. A map of wetland locations on the James Property is provided in Figure 4.16.

The following wetland communities were observed within the James property:

- Low, closed herb graminoid stand dominated by sedge species: Basin Fen;
- Low, closed herb graminoid stand dominated by sedge species: Stream Fen;
- Riparian Swamp: Intermediate, sparse tamarack evergreen stand with willows; and
- Riparian Swamp: Tall, closed evergreen tree stand dominated by black spruce with mosses.

Silver Yard Area

There are no wetlands identified within the Silver Yard footprint area.

Redmond Property

Within the Redmond property, there are 14 wetlands comprising 38.5 ha, however, there are no wetlands within the proposed mining footprint. The following wetland communities were observed within the Redmond property:

- Low, closed herb graminoid stand dominated by sedge species: Basin Fen;
- Low, closed herb graminoid stand dominated by sedge species: Floating Fen;
- Low, closed herb graminoid stand dominated by sedge species: Stream Fen;
- Low, closed herb graminoid stand dominated by sedge species: Northern Ribbed Fen;
- Riparian Swamp: Intermediate, sparse tamarack evergreen stand with willows;
- Riparian Swamp: Tall, open tamarack black spruce, evergreen stand with sphagnum moss; and
- Riparian Swamp: Tall, closed black spruce evergreen stand with sphagnum moss.

The wetlands discussed in the Avifauna section (Section 4.2.3) are outside of the proposed development footprint area for the Redmond property. Wetlands were classified as per the Canadian Wetland Classification System.

Where feasible, wetlands will be avoided. Effects on the wetlands outside the Project footprint will be avoided or minimized through the implementation of the EPP (Section 8.5) and ongoing environmental planning.

Wetland Evaluation

The Wetland Evaluation Guide developed by the North American Wetlands Conservation Council (Canada) produced in 1992 was used as a guideline to assess the true ecosystem value of the potentially affected wetlands. Approximately 0.5 ha of wetland will be disturbed within the zone of influence (i.e., mining footprint) at the James Property. The location of all wetlands (Jc, Je and Jf) within the James property footprint is presented in Figure 4.16. Table 4. 7 presents the form, area and relative position to the mining footprint for all wetlands within the James Property.

To assess the ecosystem value of these affected wetland areas, their functions or capabilities need to be understood. Wetland functions provide many benefits to society and are defined as the capabilities of wetland environments to provide goods and services including basic life-support systems.

All of the affected wetland areas are similar in size and contain similar habitat composition (e.g., they are all sedge dominant basin fens). Therefore, this wetland evaluation will be utilized for all three wetland systems.

Table 4.7 Wetlands within James Property

Label*	Type	Total Area (ha)	Area within Foot Print
Ja	Stream Fen	0.8	
Jb	Intermediate, sparse tamarack evergreen stand with willows	0.8	
Jc	Basin Fen	0.2	0.2
	Intermediate, sparse tamarack evergreen stand with willows	0.15	
Jd	Basin Fen	0.12	
Je	Basin Fen	0.14	0.14
Jf	Basin Fen	0.16	0.16
Jg	Stream Fen	0.95	
Jh	Stream Fen	1.2	
	Intermediate, sparse tamarack evergreen stand with willows	1	
	Tall, closed black spruce evergreen stand with sphagnum moss	1.3	
Ji	Floating Fen	0.086	
	Total area for James Property	64.5 ha	
	Total wetland area for James Property	6.906 ha	
	Total wetland area within footprint	0.49 ha	
	Percent of James Property comprised of wetland	10.70%	
	Percent of James Property wetland area within footprint	7.1%	

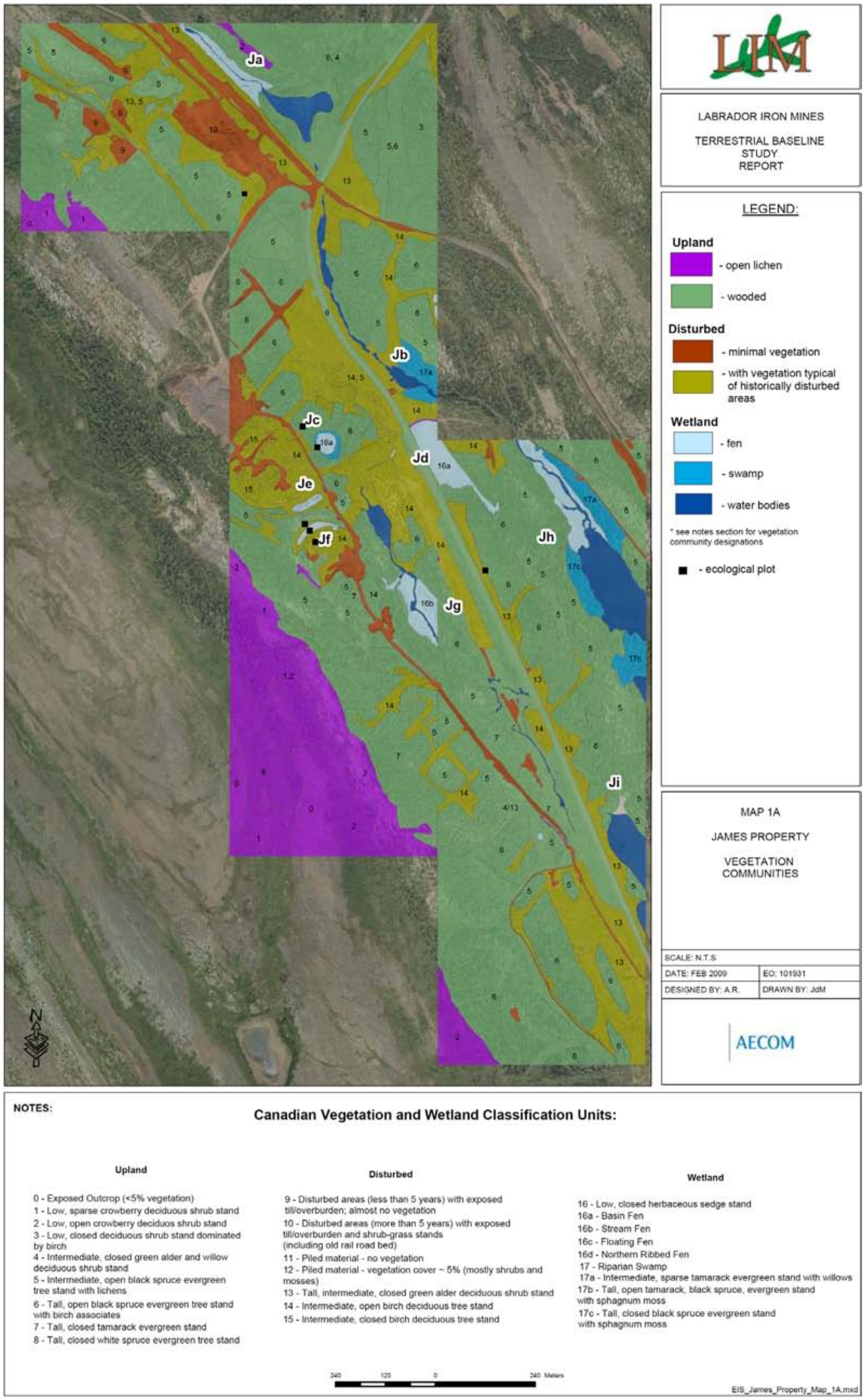


Figure 4.16 Wetlands Map, James Property

Potential wetland functions, as adapted in the Wetland Evaluation Guide, are:

- **Regulation/ Absorption** – climate regulation via methane and carbon dioxide release/storage, absorption of toxic substances and heavy metals, stabilization of biosphere processes, water storage and cleansing;
- **Ecosystem Health** – nutrient cycling, food chain support, habitat, biomass storage, genetic and biological diversity;
- **Science/Information** – specimens for research, zoos, botanical gardens, representative and unique ecosystems;
- **Aesthetic/Recreational** – non-consumptive uses such as viewing, photography, bird watching, hiking and swimming;
- **Cultural/Psychological** – wetland uses may be part of community traditions, religious or cultural uses, future (option) opportunities;
- **Subsistence Production** – natural production of game birds, fish, plants (e.g., berries, rushes, wild rice); and
- **Commercial Production** – production of foods (e.g., fish, crops), fibre (e.g., wood, straw), soil supplements (e.g., peat).

The major functions that the wetland systems are capable of within the James property mining footprint include: water storage and habitat for resident wildlife. However, these attributes are not considered significant since all wetland systems are less than 0.2 ha in size and receive water inputs only during rain events and snow melt. They also have low biodiversity where wetland systems are made up of one vegetation type; sedge dominant basin fen. This provides habitat for resident bird species and amphibians, but considering that this habitat type occurs elsewhere, no major impact to these species is anticipated.

Photograph 1 – view of wetland system "Jf"

Photograph 2 – view of wetland system "Jc"

Given the location of the wetlands within the proposed James Property mining footprint, scientific study, aesthetic/recreational, cultural/psychological and subsistence/commercial production function values are very low to non-existent. The contribution of the wetlands to the remaining functions of regulation/absorption and ecosystem health are also considered low due to their small size (all are less than 0.2 ha) and similarity of habitats to other wetlands in the region.

4.2.2 Wildlife

4.2.2.1 Caribou

Labrador's caribou (*Rangifer tarandus*) can be classified into two main groups, the migratory and sedentary (also known as woodland) ecotypes, which are distinguished by their use of calving grounds or fidelity to specific calving sites. Migratory caribou travel large distances, occupy large home ranges, and aggregate during calving periods. Conversely, sedentary caribou display limited movements, occupy smaller home ranges, and tend to disperse during the calving period (Schaefer et al. 2000; Bergerud et al. 2008).

The Project occupies a portion of Western Labrador which overlaps with the range of the George River (GR) Herd. Straddling the Québec-Labrador peninsula, the GR Herd is one of the world's largest Rangifer populations, with population estimates peaking at almost 800,000 individuals in the 1980's (Couturier et al. 1996; Russell et al. 1996, Rivest et al. 1998). This area of western Labrador overlaps the GR Herd as a portion of their winter range (Jacobs 1996).

In addition to the GR Herd, there is another migratory ecotype that is recognized on the Ungava Peninsula and known as the Rivière-aux-Feuilles ('Leaf River') (RAF) Herd. Existing and recognized sedentary populations include the Lac Joseph (LJ) Herd located south of the Assessment Area, and the Red Wine Mountains (RWM), the Joir River (JR), and the Mealy Mountains (MM) Herds all much further to the east. The Mealy Mountains act as a geographic barrier separating this herd from the other herds of Labrador, but the lack of a geographic barrier between the other three sedentary herds results in an overlap of herd ranges (Schmelzer et al. 2004; Bergerud et al. 2008). Schmelzer et al. (2004) indicates that during the winter months, the George River Caribou Herd encounters the outer limits of their ranges providing the opportunity for the intermingling of animals. The proposed site of the Project occurs entirely within the range of the GR Herd.

Although there is no evidence of sedentary caribou herds existing within the Assessment Area at present, they were reported historically (e.g., Caniapiscau or McPhayden Herds) (LWCRT 2005, Bergerud et al. 2008). The sedentary herds of this region have declined or disappeared since the 1960s with the advent of the snowmobile and expanded transportation network allowing greater access. The migratory and sedentary caribou inhabiting the Ungava peninsula (i.e., Labrador and northeastern Québec) are, and historically have been, an integral component of the way of life for aboriginal and non-aboriginal people for many centuries (Schmelzer and Otto 2003; Loring 2008).

As part of the baseline and monitoring research associated with this Project, LIM co-sponsored an intensive aerial survey of approximately 50 km radius of the Project (plus a similar distance around the NML project) during May 2009 (LIM and NML 2009). Completed in co-operation with the Provincial Governments of Newfoundland and Labrador and of Québec, this intensive survey of a 12,900 km^2 area located only 7 caribou [one group of four (one adult female that was captured and equipped with satellite collar, an adult female with a male calf, and a yearling male), a group of two (one adult male and one yearling male) and a dead female (estimated at 10+ years that was killed by a single wolf)], (Figure 4.19). These sightings and that of another group of caribou tracks were at least 22 km west and southwest of the Project. Measurements of two animals suggest these animals belong to the migratory ecotype, although tissue samples from these animals and a satellite collar deployed on an adult female may provide additional insight as to the herd affiliation.

Assessment Boundaries

Spatial and Temporal

Temporal boundaries for the George River and possible woodland caribou herd effects assessment comprise four timeframes: existing environment, construction phase (approximately six months), operation phase (approximately 5 years), and decommissioning phase (post-operation phase).

The range of the GR Herd occupies over 800,000 km^2 in Labrador and Northern Québec. Caribou from this herd travel large distances over the Québec-Labrador peninsula and aggregate on traditional calving grounds each June demonstrating strong site fidelity (i.e., returning to similar locations annually) (Schmelzer and Otto 2003). The GR Herd has been known to rut and overwinter in this area, but there is no evidence supporting any calving activities in the Assessment Area.

The nearest sedentary herd known to exist in the Schefferville area is the Caniapiscau Herd, located approximately 100 km west. The recognized range of this herd and of the Lac Joseph Herd (Bergerud et al. 2008), located southeast of the Project Area (200 km), are not believed to interact with the Project. RRCS (1989) indicated that the McPhadyen River Herd was known to have overlapped the Schefferville Area. Whether caribou from this woodland herd (or other woodland herd) still exist is unknown. Prior to the May 2009 survey (LIM and NML 2009), the most recent documented search effort was from the mid-1980s (Phillips 1982, St. Martin 1987). At the time of writing, the results from the May 2009 survey suggest that the caribou observed during that period are affiliated with the migratory ecotype (based on physical measurements of two animals), although additional information is being collected (i.e., through the satellite telemetry collar and pending genetics analyses). Despite this information and as a conservative measure in compliance with direction from the resource management agency, it is assumed that woodland caribou remain in the vicinity of Schefferville and as such, a woodland caribou strategy will be implemented during construction and Year 1 of operation, at which time it will be reviewed for appropriateness.

Administrative and Technical

The regulatory requirements and jurisdictional or planning programs that apply to the management of different species are referred to as administrative boundaries. This includes the listing of species by federal or provincial legislation and designations by COSEWIC, the Committee on the Status of Endangered Wildlife in Canada who listed the sedentary caribou populations of Labrador as “Threatened” (COSEWIC 2008, SARA 2008). Hunting of sedentary herds is illegal; however, the hunting of the migratory GR Herd is legal within the seasons (August 10-April 30) and quotas for George River are defined by the provincial government (NLDEC 2008).

Given the available information from the literature and from the results of the May 2009 aerial survey, there is sufficient information available on the migratory and sedentary caribou populations of the area to assess the potential interactions and environmental effects of the Project in light of the proposed mitigation (ongoing) and monitoring efforts associated with this Project.

Assessment Area

The caribou Assessment Area is delineated by a 100 km^2 grid block represented in Figure 4.17. This area includes an approximately 50 km area around the LIM claim areas of James North and James South, as well as the Redmond Mine Area where the initial mining will take place.

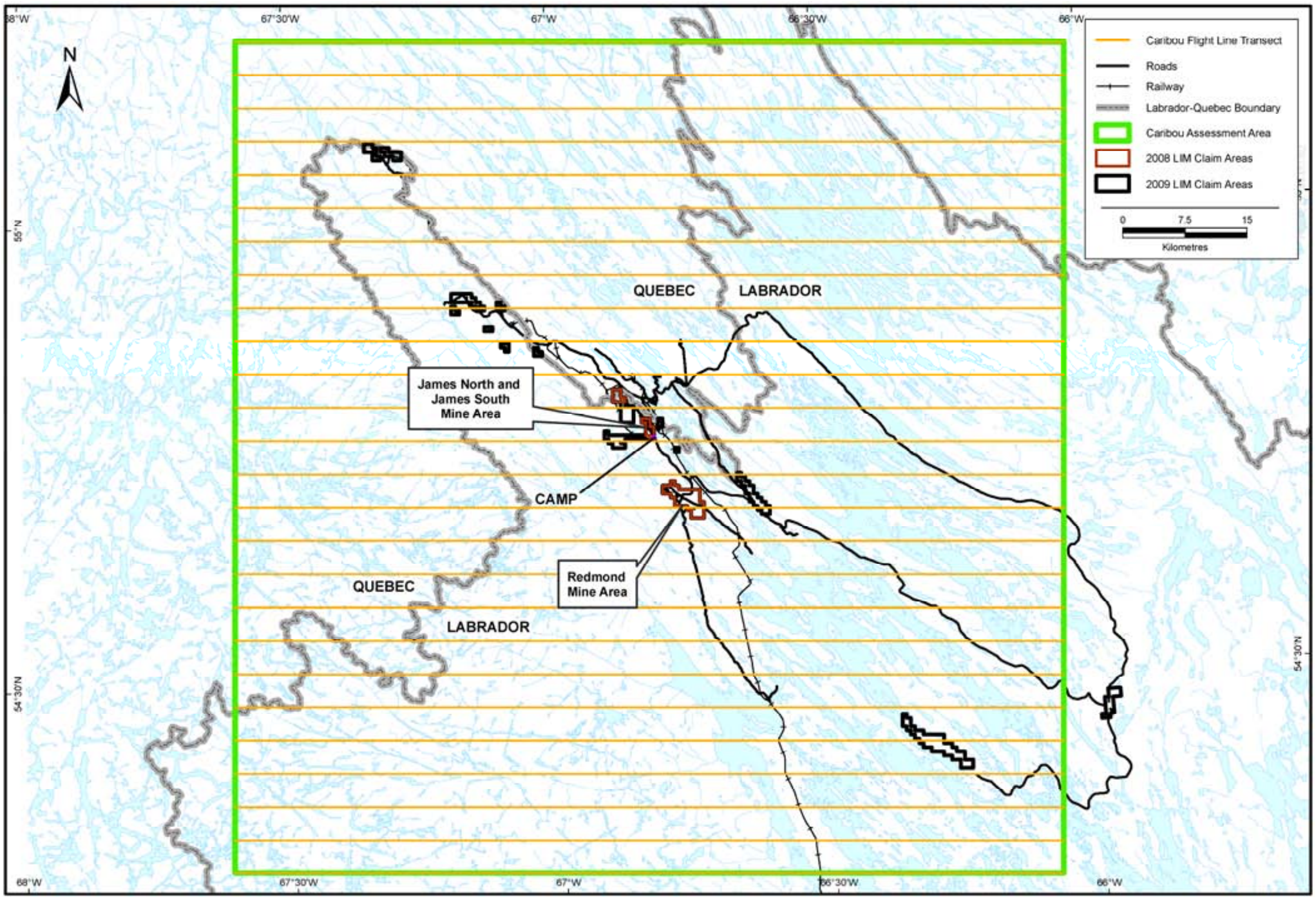


Figure 4.17 Caribou Assessment Area

Sources of Information

Government documents, peer-reviewed literature, and technical reports were examined for relevant information on caribou in Labrador and north-eastern Québec, focusing on the Assessment Area. The Study Team consulted Provincial Wildlife Division personnel in Labrador City, Happy Valley-Goose Bay, and Corner Brook, and representatives attended the 12th North American Caribou Workshop held in Happy Valley-Goose Bay. Local Aboriginal and non-Aboriginal groups were consulted and observations of wildlife and caribou were tracked during field studies. Caribou-related activities and information within the Project area have been monitored by a LIM representative. In addition, LIM has conducted public meetings with the Québec Innu (Montagnais) and traditional knowledge meetings with representatives of the Kawawachikamach Naskapi Nation to acquire traditional knowledge and presented caribou and other wildlife presence on drawings (August 2008 and March 2009). The recent aerial survey of most of the caribou Assessment Area in May 2009 (LIM and NML 2009), provided additional insight regarding distribution and abundance, as well as possible ecotype affiliation of caribou that were observed at this time.

Existing Environment

The caribou herds within Labrador and northeastern Québec occur within three large vegetation biomes. The taiga, in the southernmost portion of caribou range, is characterized by black spruce (*Picea mariana*), jack pine (*Pinus divaricata*), larch (*Larix laricina*) and terrestrial lichens, grading northward to become forest tundra, which is sparsely populated by stunted black spruce and larch (Courtier et, al.1990). The tree line, which stretches from east to west along 58oN latitude in Québec and north of 56oN latitude in the elevated Labrador plateau (Hearn et al. 1990), delineates the transition from forest tundra to arctic tundra. The absence of trees and the presence of a lichen carpet with sparse thickets of stunted ericaceous plants are common to the arctic tundra (Couturier et al. 1990).

LIM operations will occur at the southern edge of the forest tundra, yet reflect extensive surface disturbance from previous mining operations. The baseline report prepared by AECOM (2008) for LIM describes the area as ranging from exposed tundra/exposed bedrock with lichen and sparsely populated trees and low-lying shrubs to low wetlands and boggy areas. Intermediate land classes consist of varied forest types, dominated by spruce-lichen and spruce-moss. The James North and James South properties have been approximately 50 percent disturbed as a result of previous mining activities on the landscape. The James property runs along both sides of an existing road which connects Schefferville to the Redmond property. Sparsely forested parallel ridges and valleys oriented northwest to southeast are typical of the local landscape (AECOM 2008).

Herd Ranges

Migratory Caribou

Schmelzer and Otto (2003) studied the winter range of the GR Herd and noted that the location of their winter range is unpredictable regarding site fidelity; however, after travelling large distances through the winter over the Québec-Labrador peninsula, they aggregate on traditional calving grounds (located several hundred kilometres north of the Assessment Area) each June. The annual range of the GR Herd includes tundra, forest-tundra, and boreal forest habitat and encompasses most of Northern Québec and Labrador between 55oN and 60oN latitude, from the Labrador Sea to Hudson Bay (Messier et al. 1988). There is a 47,000 km^2 tundra area used for calving by the GR Herd, considered smaller than that of any other large Canadian herds (Bergerud and Luttich 2003).

The Rivière-aux-Feuilles Caribou Herd occupies Northern Québec only, but their fall and winter range has often over lapped with that of the GR Herd (Créte et al. 1990). The recognized range of the RAF Herd does not include the Assessment Area (CRA 2004). While the GR Herd has declined in recent years, the RAF Herd has shown an increase, almost doubling in numbers since a census in 1991 at 260,000 and in 2001 at 628,000 individuals (Government of Québec 2005). Créte et al. 1990 state that telemetry data indicates that RAF Caribou calve and spend the summer north of the tree line and partially move south of the tree line in the winter, west of Kuujjuaq (1990). Recent research has suggested that the GR and RAF Herds overlap in their fall rutting range, resulting in genetic overlap, and may be functioning as a metapopulation (Boulet et al. 2007).

Although the ranges for these migratory herds are known, the specific movements of individuals are unpredictable from year to year (Bergerud and Luttich 2003; Schmelzer and Otto 2003). Within their range, caribou may be present in one location for a given year, but absent the next. This pattern was documented for the GR Herd by Schmelzer and Otto (2003) who attributed seasonal variation in winter habitat use to an avoidance strategy by the herd.

Woodland Caribou

In a recent review of sedentary woodland caribou on the Ungava Peninsula, Bergerud et al. (2008) describe the historical and current existence of such herds in this region of northeastern Québec and western Labrador, including the Caniapiscau herd, the McPhadyen River herd, the Lac Joseph herd, and the Red Wine herd.

The eastern edge of the range of the Caniapiscau is described by RRCS (1989) as occurring approximately 100 km to the west of Schefferville. In a review of early aerial surveys (e.g., Banfield and Tener 1958, Des Meules and Brassard 1964, Pichette and Beauchemin 1973), Bergerud et al. (2008) indicate that animals ‘were seen just west of Schefferville’ in the 1950s and 1960s.

The McPhadyen River Herd is indicated by RRCS (1989) as overlapping the area of the Project, but they also do not provide any further detail. Bergerud et al. (2008) describe the efforts of Phillips (1982) and St. Martin (1987) and the confusion from the telemetry data of the latter investigation. Bergerud et al. (2008) suggest that the lack of philopatry observed in these collared animals in the mid-1980s shed doubt as to whether these animals should be ‘called a herd and managed as a unit’.

The Lac Joseph Herd comprises a range of up to 59,000 km^2, that in the 1980s extended to as far north as 50 km southeast of Schefferville, but now has a seasonal range that is south of Churchill Falls (i.e., approximately 200 km southeast of Schefferville). Located over 200 km to the east is the Red Wine Mountains herd with a range of 46,000km^2 (Schmelzer et al. 2004).

The potential overlap of these herds (Figure 4.18) and the Project is adapted from the Labrador recovery strategy for woodland caribou (Schmelzer et al. 2004). Whether woodland caribou in the vicinity of the Project (i.e., within 50 km) remain, is unknown. The Lac Joseph Caribou Herd is the closest recognized sedentary herd to the Assessment Area, approximately 200 km southeast.

Population Sizes and Trends

Many studies have documented the history of the migratory GR Herd throughout the Ungava Peninsula and its annual migrations. In the 1950s, the GR Herd was estimated at 10,000 individuals and experienced a rapid increase to over 600,000 by the mid-1980s (Harrington 1996). This growth occurred despite the fact that accessibility to the herd resulted in increasing hunting pressure. Also, road development made travel to the herd easier, opening up more country to hunting (Harrington 1996). The most recent estimate of this herd is 296,000 individuals, based on a post-calving estimate (Couturier et al. 2004). The cause of the increase and decrease is a matter of much debate. However, the increase in survival and recruitment through decreased density-dependent natural mortality from wolf predation, and legal and illegal hunting, must have been involved (Hearn et al. 1990). Emigration to the increasing Rivière-aux-Feuilles population has also been suggested as a potential cause of the GR Herd’s apparent decline (Boulet et al. 2007).

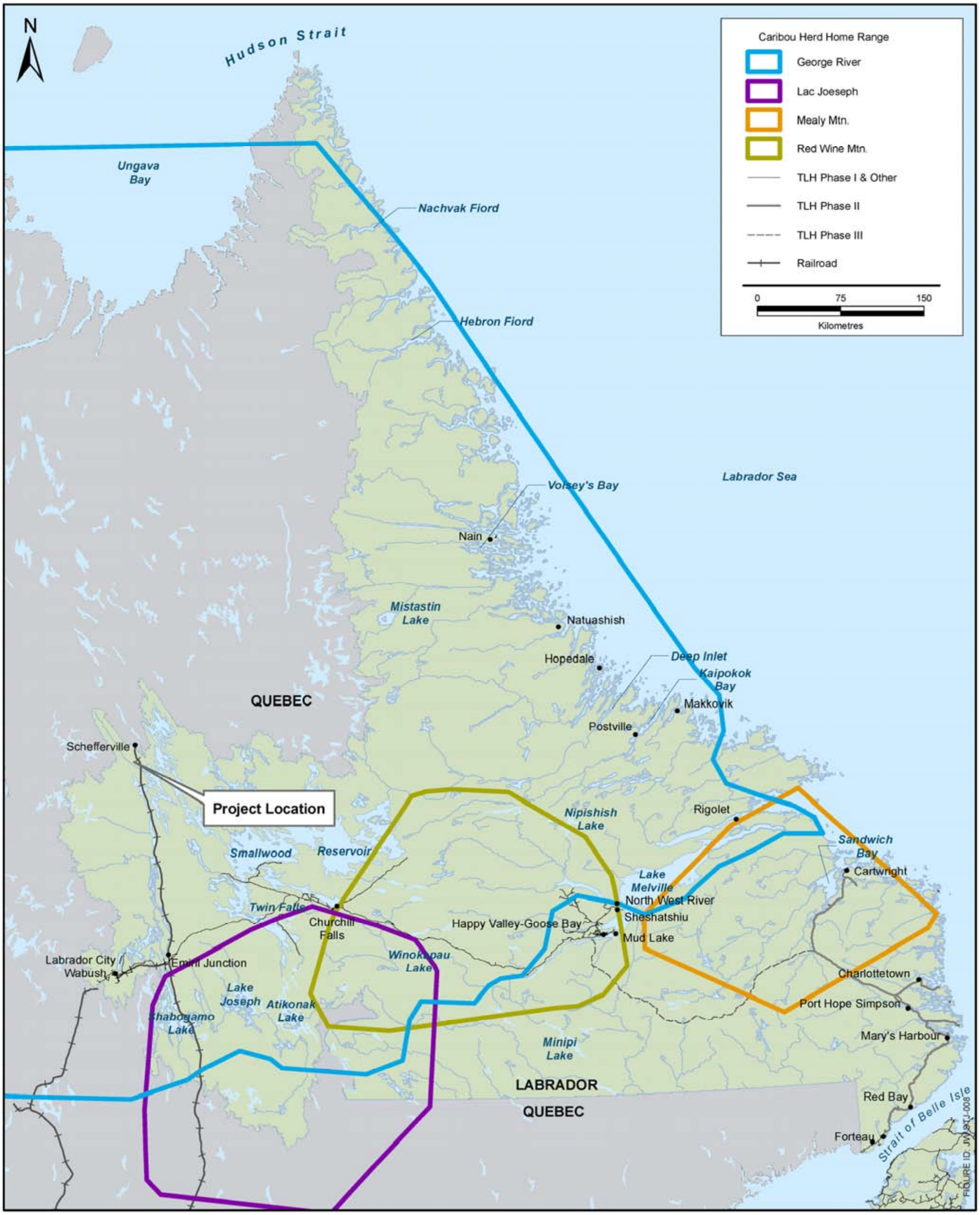


Figure 4.18 Selected Caribou Herd Ranges, Labrador and Northeast Québec (Source: Schmelzer et al. 2004)

The sedentary woodland populations in Labrador have been listed as “Threatened” by the Committee on the Status of Endangered Wildlife in Canada since May 2002 (COSEWIC 2008; SARA 2008). Population trends among the herds are mixed as the Red Wine Mountains Herd is showing a decline in number of individuals, while the Lac Joseph and Mealy Mountain Herds are indicating stabilization or an increase in number of individuals (Newfoundland and Labrador Inland Fish and Wildlife Division 2005). The most recent available estimate of the Caniapiscau herd is described in Bergerud et al. (2008) as 2,700 animals by Brown et al. (1986) and Paré and Huot (1985). There is no known estimate of the McPhadyen River herd and it may be questionable as to whether these caribou still exist. The George River Caribou Herd and Rivière-aux-Feuilles Herd are not listed as populations of conservation concern provincially or federally.

Population declines in the sedentary herds have been examined in relation to moose densities, predation by wolves, hunting and other factors, such as emigration (Coutois et al. 2003). Emigration of Red Wine caribou to the GR Herd may represent the second greatest contributor to loss of radio collared females during the period of decline, although it could not logistically be quantified (Schaefer at al 1999). The most recent population estimates of these herds are presented in Table 4.8.

Table 4.8 Population Estimates for Five Herds in Southern Labrador

Caribou Herd[1]	Population Estimate	Year	Population Trend	References
George River	296,000	2001	Declining	Couturier et al. (2004)
Riviere-aux-Feuilles	628,000	2001	Increasing	Couturier et al. (2004)
Caniapiscau	926 600	1977 1977	Unknown	Le Henaff and Martineau (1981) and Brown et al. (1986) respectively in Bergerud et al. (2008)
McPhadyen River[2]	Unknown	Not completed	Unknown	Bergerud et al. (2008)
Lac Joseph	1,101	2000	Increasing	Chubbs et al. (2001) , Schmelzer et al. (2004)
Red Wine Mountains	87	2003	Declining	Schmelzer et al. *(*2004)
Mealy Mountains	2,585	2002	Increasing	Otto 2002, Schmelzer et al. (2004)

[1] Sedentary populations also exist at Joir River and Torngat Mountains in Labrador.

[2] The May 2009 survey completed by LIM and NML observed 7 caribou (including one killed by a wolf) of unknown herd affiliation, over a large portion of the former range of these animals.

Habitat Use and Preference

For the migratory GR Herd, habitat can be described as tundra, forest-tundra and boreal forest habitat characteristic of the Boreal and Taiga Shield Ecozones. Habitat use is affected seasonally as the ranges change from winter to summer. Following an increase in herd population, summer habitat is considered spatially limited and alternative summer range is not available (Messier et al. 1988). Animals tend to avoid areas grazed during the previous winter and select alternate sites with more abundant lichen cover (Schmelzer and Otto 2003) having a preference for *Cladina* spp. (Cote 1998). Woodland caribou do not make migratory movements but there is a seasonal shift during calving and post-calving period to such forest types as black spruce forest, scrub or bog (Nalcor Energy 2009)

Caribou distribution and seasonal movements are a reflection of food availability in all seasons, insect relief during summer, and calving areas that have a low predator density that improves reproduction and survival of herd members. Disturbances that alter or destroy habitat, or change in habitat effectiveness, may displace caribou to less favourable habitats.

Western Labrador experiences a high amount of snowfall annually, with a precipitation frequency of 67 percent recorded in western Labrador (i.e., Wabush (Environment Canada 2008)). Caribou in central Labrador, however, are able to tolerate greater snow depths than most other North American herds (Brown and Theberge 1990). Snow depth affects the ability of caribou to detect (through smell) forage on the ground. In consideration of the extreme snowfall conditions in Labrador, caribou display adaptive feeding strategies. As an example, there is evidence that caribou are capable of distinguishing features to locate forage on the ground despite snow coverage (Brown and Theberge 1990). For sedentary herds, snow cover is a major influence on caribou winter habitat use with animals making greater use of forested areas during years of less snowfall.

Migration Patterns

Winter movements and distribution of the GR Herd can be attributed to many factors including predation risk and snow cover. Bergerud and Luttich (2003) have observed a pattern that may be driven by predation noting that in years of shallow snow cover, the majority of this Herd moved south of the tree line, but in years of deep snow cover, a large portion of the Herd remained above the tree line (2003). Predation by wolves may be more prevalent during heavy snow years as caribou may be more susceptible. In an attempt to decrease predation risk, caribou move into wind-swept tundra habitats whereas the opposite can occur in years of lower snow cover (Bergerud and Luttich 2003) when caribou move into forested habitats.

Bergerud and Luttich (2003), in their study of the GR Herd from 1958 to 1993, also noted that the GR Herd generally localized and reduced travel rates in late November or early December as snow cover increased, moving into the more restricted winter ranges, which can typically be considered from December to mid-March. They also noted the spring migration to calving grounds occurred from mid-March to April with a mean date of April 8 (Bergerud and Luttich 2003). For at least two decades, the females of this herd have used the plateaus of the George River for calving, occurring around mid-June (Toupin et al. 1996). The post-calving or summer range is thought to be regulated by forage limitations (Cote 1998). Typical of sedentary herds, calving locations are dispersed and there is not much consistency or fidelity in year to year site selection.

The GR Herd may be found in and around the Assessment Area during their spring and fall migrations, fall rut, and through the winter, with their range including most of northern Québec and Labrador (Boulet et al. 2007). The GR Herd has gradually shifted its winter range over the years to maximize the availability of forage (Schmelzer and Otto 2003).

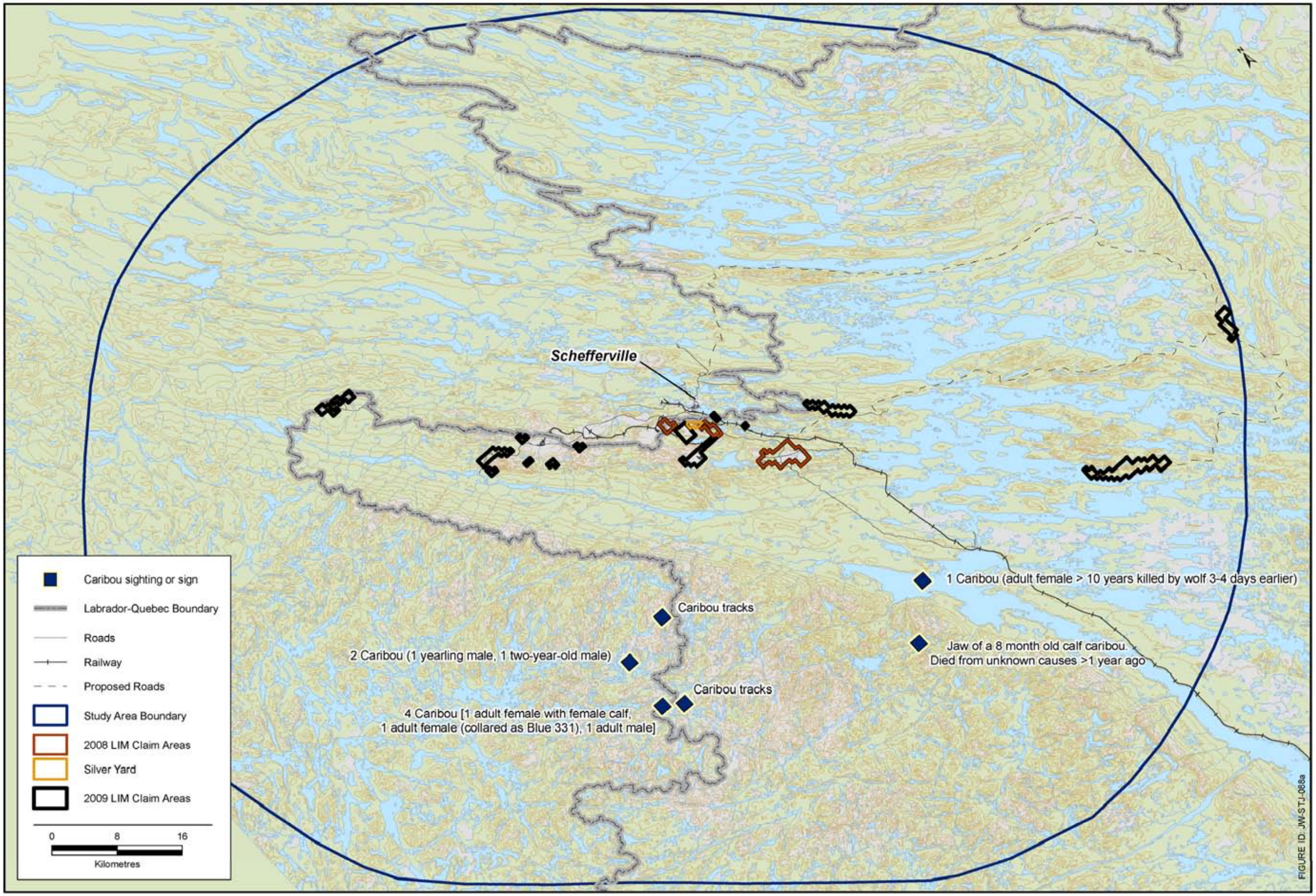


Figure 4.19 Observations of Caribou and Sign during May 2009 Survey

Local Hunting and Outfitting

Harvest quotas for the GR Herd are defined by the NLDEC (2008).

The presence of the GR Herd in Western Labrador and the Schefferville area during fall and winter (Jacobs 1996; Boulet et al. 2007) has created a regionally important outfitting industry. Because winter presence and size of the herd is unpredictable from year to year (Schmelzer and Otto 2003), hunting outfitters in the Schefferville area have had to adapt to their inconsistent movement patterns and seasonal distribution. One Schefferville outfitter states that caribou in the area are constantly changing their migration patterns, meaning that the success of traditional hunting sites varies annually (and within the season) according to the movements of the animals (Larocco 2008). Changes in the migration pattern of the Québec-Labrador caribou have also resulted in outfitters moving their hunting sites or having multiple camps in order to provide an efficient hunt for their clients (Bowhunting Canada 2008). Despite somewhat consistent movements annually, Schefferville residents report variability and during the winter of 2008-2009 did not report any caribou in this area so there was no opportunity for local hunting (R. MacKenzie, pers. comm.). Hunting of sedentary herds is illegal; however, the hunting of the migratory GR Herd is permitted from early August to late April (NLDEC 2008).

4.2.2.2 Other species

In addition to the recent aerial survey in May 2009, information sources on other wildlife species within the vicinity of the Project include a variety of sources. Interviews with wildlife research and conservation staff with the Wildlife Division, other consultants in the Province, McGill University, the Institute of Environmental Monitoring and Research (IEMR), local trappers, and available literature was supplemented with insight provided by LIM staff and contractors who have been active at this location in recent years. In general, there are few larger wildlife species found in these areas, as the Project is situated on the edge of the tundra and comprises thinning forest communities mixed with open barren habitats.

Black Bear (*Ursus americanus*)

During the early May 2009 survey, black bears or their sign (usually tracks) were common in the LIM Project area and surrounding area, with four sightings of live animals and at least ten sightings of tracks throughout the Study Area (LIM and NML 2009). Bear presence was also confirmed northwest of Slimy Lake and southeast of the James Property of the Project area during a meeting with local trappers held 13 August, 2008 in Schefferville. Black Bear are a forest-dwelling animal but were observed to also use barren and ice habitats during the May 2009 (LIM and NML 2009). Forest, barrens and river habitats are important during the summer and fall seasons. Bears have been reported occupying open areas, but tend to avoid recent burns (Jacques Whitford 1997). Seasonal habitat selection is usually related to foraging. Although they are the largest predator in the area, their diet mainly consists of plants, fruits, berries, green leaves, and tubers. They are known for their diversity within their diet, ranging from insects and plants to small mammals, dead animals and leftovers from human presence at local landfills or camping sites (http://dnr.wi.gov/org/land/wildlife/PUBL/wlnotebook/bear.htm).

Bears are frequently found in areas of domestic waste disposal where odours attract them and they become nuisance animals and a cause for concern to human safety. Informants indicate that bears have been observed at the Schefferville landfill, approximately 4 km from the LIM Project area and bear tracks have been noted in the vicinity of the deposits by LIM staff and contractors, but there have been no encounters to date. Nuisance bears have not been reported by workers at the LIM site itself.

Moose (*Alces alces*)

Moose are a relatively new species to Labrador that were first reported in western Labrador in 1949 (Folinsbee 1974). The population expanded to an estimated 5,000 individuals in Labrador by 1990 (Karns 1997). Due to the relatively low numbers of moose in the Schefferville area, there are only five hunting licenses for all of western Labrador designated annually (Parr, T. and Porter, C. 27 November, 2008).

Moose tend to be associated with mid-successional forests, favouring areas of highest forest productivity preferring stands where trees reach heights of 3 m and therefore are available above snow (Newbury et al. 2008; Bergerud and Manuel 1968). They also favour lakeshores and swamps (Banfield 1973). Likely due to habitat constraints, moose are not common in the Project area and sightings or tracks were observed on approximately five occasions during the May 2009 survey. As the Project area is situated on the edge of tundra and thinning forest communities, there are few hardwood species in this part of Labrador thus habitat requirements for this species are limited. Moose and signs were concentrated in the southeast portion of the study area during the May 2009 survey, where one adult male and four other separate locations of tracks were observed (LIM and NML 2009).

Furbearers

There are several furbearers in the vicinity of the Project. The species below, with the exception of wolverine and fisher, are trapped in western Labrador from fall to early spring (exact dates differ depending on species). There are no registered trap lines in Western Labrador and therefore trappers use their own discretion when choosing suitable sites and proximity to others (Porter, C. 27 November, 2008).

Beaver (Castor canadensis)

The beaver population in western Labrador is healthy and actively trapped with good returns (Porter, C. 27 November, 2008). There is a history of beaver in the Slimy Lake area as identified at a meeting held with local trappers on 13 August, 2008 in Schefferville. However, there are no individuals noted in this area at present [nor was any sign observed during the May 2009 survey (LIM and NML 2009)], which may be attributed to the absence of deciduous trees (particularly aspen) in this region, and thus a lack of food source. An old beaver lodge is present but is currently occupied by otter.

Beavers are herbivores, subsisting solely on woody and aquatic vegetation. They will eat fresh leaves, twigs, stems, and bark. Beavers will chew on any species of tree, but preferred species include alder, aspen, birch, maple, poplar and willow. Aquatic foods include cattails, water lilies, sedges and rushes.

Otter (Lutra canadensis)

This amphibious mammal has a healthy population in western Labrador. Typically otter are found no more than a few hundred meters from water and indeed they may be found in almost any water source with the presence of fish in western Labrador (Porter, C. 27 November, 2008) as they are entirely dependent on aquatic habitats for food. They are actively sought by trappers for their thick pelage. An otter has been observed occupying an old beaver lodge on Slimy Lake in the Project area, as noted at a meeting held with local trappers on 13 August, 2008 in Schefferville. A single animal was observed southeast of Schefferville during the May 2009 survey (LIM and NML 2009).

Mink (Mustela vison)

Mink are found throughout western Labrador in small brooks and ponds as they are proficient swimmers. Trappers in western Labrador are having great success with returns this year and it is believed the population is quite healthy (Porter, C. 27 November, 2008), although no presence of mink (i.e., tracks) has been noted at the Project area during summer or winter.

Muskrat (Ondatra zibethicus)

Muskrat numbers in western Labrador are currently at a high level and may be found throughout the region in a variety of aquatic habitats with cattail being an important food source (Feldhamer and Thompson 2003). Trappers in this region are currently experiencing good success (Porter, C. 27 November, 2008). Despite relatively high numbers of this species in the Labrador City area, no evidence of muskrat has been found in the Project area. Lack of suitable vegetation for forage may be a factor.

Coyote (Canis latrans)

Coyote are not prevalent in western Labrador and they have not been observed in the Project area. It is rare to see or hear reports of this species in the western Labrador region (Porter, C. 27 November, 2008) although the presence of large ungulates and snowshoe hare may indicate suitable habitat for coyote.

Ermine (weasel) (Mustela erminea)

Weasel maintains a healthy population in western Labrador where they feed on primarily snowshoe hare, small mammals and birds. They can be found in a variety of habitats including wooded and brushy areas, wetlands and tundra. Ermine have not been reported in the Project area, although it is suspected they are in this area due to suitable habitat and prey availability. Hunting and predation are limiting factors for ermine populations although weasels are not actively sought by trappers, but are reported as incidental catches (Porter, C. 27 November, 2008). Predators may include snowy owls, arctic fox, lynx and large raptors.

Red Fox (Vulpes vulpes)

Red fox has been in decline the past two years in western Labrador. They are relatively common around areas of human presence such as mining and construction sites (Porter, C. 27 November, 2008). There have been few observations of red fox at the mine facilities; one individual and tracks of others were recorded during the May 2009 survey (LIM and NML 2009). Habitat requirements include forests with safe denning sites. The omnivorous red fox preys on small mammals, birds and berries, while predators include wolves and coyotes.

Arctic Fox (Alopex lagopus)

Arctic fox are found throughout the northern part of western Labrador. In this region, their range extends south to approximately 100 km north of Labrador City/Wabush (Porter, C. 27 November, 2008). Arctic fox are occasionally observed in the Project Area (McKenzie, R. 7 May 2009). Wolves, Golden Eagle and bears are common predators of this species.

Lynx (Lynx lynx)

The lynx population is considered healthy, but not dense (Porter, C. 27 November, 2008). There are occasional sightings of lynx in western Labrador. Although some of the most commonly observed tracks in the Project area were of snowshoe hare of which lynx populations are closely linked, the absence of large tracts of forest in this region likely preclude lynx from inhabiting this area. Young lynx rely heavily on dense cover for protection and as a result, regenerating stands and/ or stands with thick understory are important to this species (Mowat and Slough 2003). No lynx have been observed in the Project area (Parks, D. 3 December, 2008) and were not recorded during the May 2009 survey (LIM and NML 2009).

Marten (Martes Americana)

The marten population of western Labrador is considered healthy; however, its presence in the Project area has not been noted. Marten are typically forest dwellers and require a variety of features provided in forest stands and landscapes, therefore habitat requirements may not be met due to lack of forest structure in this area.

Currently, marten are the most important furbearer in Labrador due to the high number of individuals and the high pelt price (Porter, C. 27 November, 2008). Trapping and habitat availability are limiting factors for marten.

Squirrel (Tamiasciurus hudsonicus)

Squirrel are plentiful throughout western Labrador; however, their presence in the Project area is not known. They are typically found in a wide variety of habitats, but may be limited to south of the tree-line as they use coniferous trees for both food and shelter. Since the Project area is on the edge of forest communities, it is thought red squirrel populations may be less dense here than further south. They are not sought by trappers, but are incidentally trapped (Porter, C. 27 November, 2008).

Wolverine (Gulo gulo)

Wolverine, listed both federally and provincially as endangered are typically found wherever there is prey available and has not been linked to specific habitats, occurring throughout its' range in a wide variety of habitats. Although both migratory caribou and wolf are known in this area and are associated with wolverine diet, wolverine presence is currently not known in western Labrador (Porter, C. 27 November, 2008). No observations of wolverine or wolverine sign have been made in the Project area.

Wolf (Canis lupis)

The wolf population is considered stable in the area with little fluctuation based on the availability of small mammal prey. The availability of primary prey, largely ungulates, is thought to be more important to wolf than specific habitat requirements. Wolf is common in western Labrador and individuals have been observed along the southern ridge in an area of open barrens adjacent to the Project site. Wolf tracks were observed only twice during the May 2009 survey [in association with the recently killed caribou located at Menihek Lake (Section 3.1)] and in the southeastern portion of the Study Area (LIM and NML 2009).

Fisher (Martes pennanti)

Overhead cover, denning sites, and foraging habitat, all of which are often provided by deciduous forests, are necessary habitat requirements for this species. As well, coarse woody debris provides necessary structure, which is a factor in defining foraging habitat as well as providing shelter in cold climates. As the Project area is situated on the edge of tundra and thinning forest communities, these requirements are likely not met here thus reducing the likelihood of fisher presence in this area. There has been no evidence of fisher observed in the Project area.

Porcupine (Erethizon dorsatum)

Although not a furbearer, porcupine has been included here due to their importance to local people. The porcupine can be found in a variety of habitats including coniferous, deciduous and mixed forests and can also be found in scrubby areas. Porcupine presence was noted southeast of Wishart Lake (meeting with trappers held 13 August, 2008 in Schefferville) and at other locations during the May 2009 survey (LIM and NML 2009).

Small Mammals

Small mammal populations reached peak levels in western Labrador (from Labrador City to Churchill Falls) in 2007 (Porter, C. 27 November, 2008). The small mammals believed to be present in Western Labrador include: Bog lemming (*Synaptomys borealis*), Ungava lemming (*Dicrostonyx hudsonius*), Red-backed vole (*Clethrionomys gapperi*), Heather vole (*Phenacomys intermedus*), Meadow vole (*Microtus pennsylvanicus*), and Masked shrew (*Sorex cinereus*). Jumping mice (unknown species) were trapped in the Schefferville area in 2007 and 2008 at two sites: near water and an open area (Millien, V. 2 Dec 2008).

4.2.3 Avifauna

AECOM conducted a forest avifauna survey at the Project site in 2008.

4.2.3.1 Methods

To aid in the field investigations and recorded observations, the following reports and websites were reviewed to gain a better understanding of the Project area:

- 2008. New Millennium Capital Group, Paul F. Wilkinson and Associates Inc. – Project Registration, Direct Shipping Ore Project. 2008;
- Wild Species Canada- webpage;
- Ministry of Natural Resources, 2000. Significant Wildlife Habitat: Technical Guide; and
- NatureServe Global Conservation Status Ranks – webpage;
- Atlas of the Breeding Birds of Ontario 2001-2005 (Cadman et al. 2007)

LIM undertook a complete and comprehensive literature review. There are no known publicly available data relevant to this issue that have been published from the LabMag project. Data for the LabMag DSO project was collected from different habitat types than those found in the LIM Project area. LIM did not have access to the LabMag information.

Field investigations followed the point-count method advocated by the Canadian Wildlife Service (CWS). For all of the point-counts, the highest level of breeding for each species was recorded. This enabled identification of site specific locations of breeding birds, within the point-count radius.

In order to complete this study, variable proximity locations were chosen. Point-counts were five minutes in duration and consisted of unlimited radius, except where adjacent count circles overlapped. All point-counts were conducted in conditions considered acceptable for proper data gathering (i.e., no rain, light winds, and good visibility). The spacing and frequency of point-counts within the study area were determined by the following factors: size of the study site; topography and line of sight; habitat type and frequency of distinctive habitats; and overall importance of a site to the objectives of the study.

At the Redmond and James Properties, point-counts were spaced at approximately 0.8 km intervals. The number of point-counts for both the large and small sites increased in areas of distinctive habitats. Bird monitoring locations are identified in Figure 4.20.

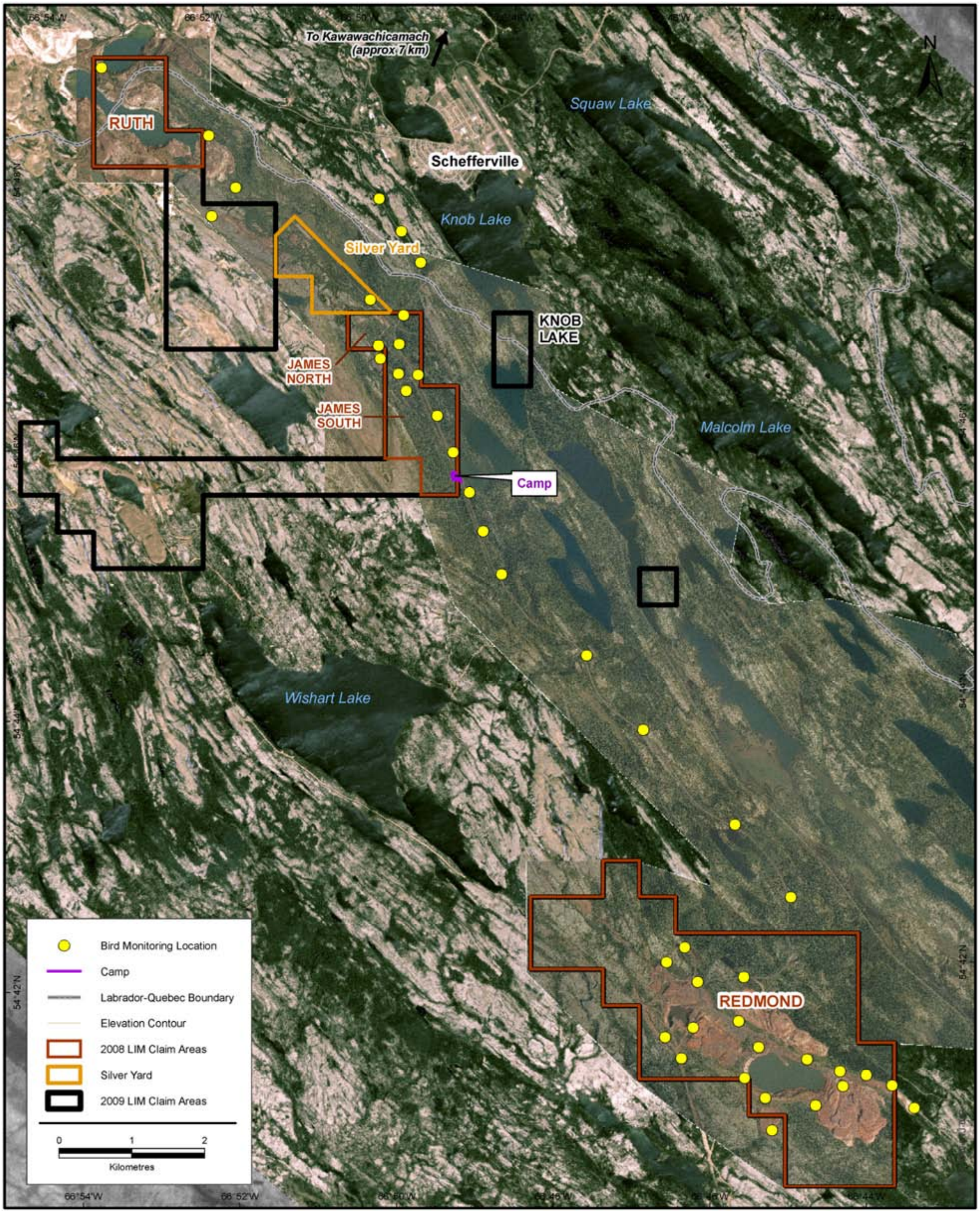


Figure 4.20 Bird Monitoring Locations

4.2.3.2 Results

The following presents the findings from the field investigations completed from July 8-14, 2008. Species observed as possible breeders are listed for each site along with their provincial and global ranks. A complete list of bird species noted can be found in Appendix L. An additional literature review was completed with respect to birds that may be expected to use or migrate through the Schefferville area. The following is a summarized table (Table 4.9) of Breeding and Migratory Birds of Labrador Iron Mines Study Area. For the entire table, refer to Appendix M.

Table 4.9 Breeding and Migratory Birds of Labrador Iron Mines Study Area

Common Name	Scientific Name
Common Loon	*Gavia immer*
Red-throated loon	*Gavia stellata*
Canada Goose	*Branta Canadensis*
Green-winged Teal	*Anas crecca*
Ring-necked Duck	*Aythya collaris*
American Black Duck	*Anas rubripes*
Greater Scaup	*Aythya marila*
White-winged Scoter	*Melanitta fusca*
Common Goldeneye	*Bucephala clangula*
Common Merganser	*Mergus merganser*
Red-breasted Merganser	*Mergus serrator*
Osprey	*Pandion haliaetus*
Bald Eagle	*Haliaeetus leucocephalus*
Spruce Grouse	*Falcipennis Canadensis*
Willow Ptarmigan	*Lagopus lagopus*
Semipalmated Plover	*Charadrius semiplamatus*
Greater Yellowlegs	*Tringa melanoleuca*
Solitary Sandpiper	*Tringa solitaria*
Spotted Sandpiper	*Actitis macularia*
Least Sandpiper	*Calidris minutilla*
Short-billed Dowitcher	*Limnodromus griseus*
Wilson's Snipe	*Gallinago delicate*
Herring Gull	*Larus argentatus*
Three-toed Woodpecker	*Picoides tridactylus*
Northern Flicker	*Colaptes auratus*
Yellow-bellied Flycatcher	*Empidonax flaviventris*
Alder Flycatcher	*Empidonax alnorum*
Horned Lark	*Eremophila alpestris*
Tree Swallow	*Tachycineta bicolor*
Gray Jay	*Perisoreus Canadensis*
Common Raven	*Corvus corax*
Boreal Chickadee	*Poecile hudsonica*
Winter Wren	*Troglodytes troglodytes*
Ruby-crowned Kinglet	*Regulus calendula*
Gray-cheeked Thrush	*Catharus minimus*

Common Name	Scientific Name
Swainson's Thrush	*Catharus ustulatus*
Hermit Thrush	*Catharus guttatus*
American Robin	*Turdus migratorius*
American Pipit	*Anthus rubescens*
Tennessee Warbler	*Vermivora peregrine*
Orange-crowned Warbler	*Vermivora celata*
Nashville Warbler	*Vermivora ruficapilla*
Yellow Warbler	*Dendroica petechia*
Yellow-rumped Warbler	*Dendroica coronate*
Blackpoll Warbler	*Dendroica striata*
Northern Waterthrush	*Seiurus noveboracensis*
Wilson's Warbler	*Wilsonia pusilla*
American Tree Sparrow	*Spizella arborea*
Lincoln's Sparrow	*Melospiza lincolnii*
Fox Sparrow	*Passerella iliaca*
White-throated Sparrow	*Zonotrichia albicollis*
White-crowned Sparrow	*Zonotrichia leucophrys*
Dark-eyed Junco	*Junco hyemalis*
Rusty Blackbird	*Euphagus carolinus*
Common Redpoll	*Carduelis flammea*
Pine Grosbeak	*Pinicola enucleator*
Pine Siskin	*Carduelis pinus*
White-winged Crossbill	*Loxia leucoptera*

James Property

The James site was surveyed primarily from the edge of the service road. The uniform habitat composition consisted of black spruce (*Picea mariana*), lichen woodland, and also included alder (*Alnus* sp.) thickets along the recently cleared roadsides and power line right-of-ways. The area also contained wet areas near the roads. The western part of this site has steep slopes, with the forest thinning towards the summit.

A total of 31 bird species were observed at 13 separate point-counts, all displaying some indication of breeding. Six of the 31 species were confirmed breeders, with another six species considered as probable breeders. Appendix L provides a description of preferred habitat for each confirmed breeding species. A complete list of observed species is also provided in Appendix L.

The eight most frequently recorded species within the James site, consisted of those associated with spruce forest. The wet and dense nature of vegetation at the James site resulted in a different avifauna community. Of these species, White-throated Sparrow is usually found in moist or bog-like situations and Northern Waterthrush is usually associated with alder thickets adjacent to a wetland.

Silver Yard Property

The Silver Yard is similar to the Redmond site, with numerous service roads encircling the flooded pits of the Ruth and James sites. The service roads, along the north and south orientation, were extensively bordered with alder and willow regeneration. The pit perimeter had minimal to no vegetation cover, while the open water component of the pits provided loafing areas for Herring Gull, however no obvious waterfowl nesting habitat was present.

The south end of this site had more extensive vegetation cover, with some areas consisting of dense spruce, and extensive thicket habitat along the roadsides. The Silver Yard as a whole, is part of a large valley bordered on the east by a talus slope forested at the base, and to the west by another slope covered with spruce at the base, thinning to essentially no forest cover or vegetation near the summit.

A total of 26 species were observed at seven separate point-counts, 25 of them displaying some indication of breeding. The most frequently recorded species at the Silver Yard site, were spruce forest specialists such as Fox Sparrow, Ruby-Crowned Kinglet, and Swainson’s Thrush. Also observed in moderate numbers were species favouring regenerative/open habitats, such as White-crowned Sparrow, and Common Redpoll. The widespread occurrence of Common Raven and Herring Gull was directly attributed to the proximity of the Schefferville landfill.

The spruce forest specialists observed east and west of the main service roads, with the forested slopes. Whereas the roadside areas attracted the regenerative specialists, due to the extensive areas of alder and willow present wherever the land had been cleared or disturbed.

Redmond Property

The Redmond site had a wide range of habitat types, largely due to the presence of a former mine and pit operation. The habitats ranged from completely bare ore piles and service roads, to heavily blanketed areas with alder and willow thickets. This area also had a large, flooded pit in the southwest corner of the site.

The undisturbed areas were occupied with mature black spruce at lower elevations, and stunted spruce – lichen along the ridge summits. This site also contained several wetland areas, most notably a large sedge fen enclosed by the former railway turning circle, as well as a lake / fen complex present where the main service road enters the Redmond site. (Note: these wetlands were part of the avifauna survey area but are not within the Project footprint)

A total of 40 species were recorded on 24 separate point-counts, with 39 of the observed species displaying some indication of breeding. Appendix L provides a description of each species preferred habitat along with the level of breeding observed.

The disturbed nature of the Redmond site and variety of vegetative species appeared to have influenced avifaunal diversity compared to more homogeneous sites. It is likely that the regenerative nature of disturbed areas account for some of the increase in diversity.

White-crowned Sparrow, which is often associated with disturbed sites and more open habitats, was the most frequently recorded species. Of the other more frequently recorded species, most are spruce forest specialists, except the Lincoln’s Sparrow found occupying the wetter components of the site.

During the May 2009 survey (LIM and NML 2009), Canada Goose (*Branta Canadensis*) were migrating through the area in large numbers. Flocks of 10 to 100 were often observed flying north or loafing on ice or ashkui (an Innu term that refers to areas of permanent or seasonal open water during winter. Over the course of the survey, other migratory avifauna [e.g., American Robin (*Turdus migratorius*), Common Snipe (*Capella gallinago*)] began to appear in Schefferville and increased in abundance in the subsequent days.

National / Provincial Species at Risk

The following bird species of special conservation status were observed.

Rusty Blackbird – one bird was observed on one point, Redmond Site. This species is designated as a COSEWIC Special Concern species, listed ‘vulnerable’ (Schedule C) in Newfoundland and Labrador. Rusty Blackbird usually nests in coniferous forest along the edge of a wetland. There are numerous areas of habitat suitable for this species within the Project area. Displacement of this species is, therefore, not considered to be limiting as any birds of this species would easily relocate to adjacent alternative habitat. This species occurs throughout most forested areas of Labrador (Godfrey 1986; Nature Serve 2007). Rusty Blackbird has undergone a widespread and substantial decline across its range.

Gray-cheeked Thrush is listed as Vulnerable on Schedule C of the *Newfoundland and Labrador Endangered Species Act*. It is associated with coniferous forest that has a dense understory (Lowther et al. 2001, Dalley et al. 2005). In Labrador, this species usually breeds in mature black spruce, white spruce, white spruce, balsam fir, and tamarack (Lowther et al. 2001). Gray-cheeked Thrush was generally found in the Project area, in areas of small spruce, thinly distributed, with an abundance of shrubby groundcovers, often heaths or alder thickets. The species was often found in higher elevations than other thrush species, avoiding the more densely wooded areas in the lowlands. They were most common along the margins of the open habitats, especially where the site transitions from open taiga to spruce, towards the north end. Outside of Labrador, the decline of these species relates more to alteration of habitat and risk of mortality during migration.

Note that the Short-eared Owl, the Common Nighthawk, and the Olive-sided Flycatcher are three other species of conservation status that may occur in the Project area. The Short-eared Owl is listed as a Species of Special Concern on Schedule 3 of the federal *Species at Risk Act* and Vulnerable on Schedule C of the provincial *Endangered Species Act*. Both Common Nighthawk and Olive-sided Flycatcher are designated as threatened by COSEWIC (but have not been listed on SARA). Both of the latter species are at, or near, the northeastern extent of their range in North America (Poulin et al. 1996, Altman and Sallabanks 2000), and have not been observed in the Project area. Consideration of these species will be included in bird monitoring programs to be conducted.

To address potential interaction with nest sites of these and other bird species, an Avifauna Environmental Management Plan (EMP) to address incidental take (the inadvertent disturbance of a nest site) will be completed consistent with the *Migratory Birds Convention Act*. This Avifauna EMP will be prepared and implemented prior to the start of construction. Further mitigation measures to protect nest sites are described in the EPP (Section 8.5), including CWS advice for vegetation clearing.

4.2.3.3 Raptors

Ospreys (*Pandion haliaetus*) were noted throughout the Project area. There are no nest sites noted directly on the James, Silver Yard, or Redmond sites. However, one Osprey nest was noted on the existing transmission line corridor to Menihek less than 150 m from the active roadway connecting the James and Redmond Properties. This nest has been active for the past several years, with young being fledged successfully, as noted by LIM employees working in the area. Two adults were noted during the counts on the James Property. At Silver Yard, one adult was noted on one point-count. Standard mitigation measures regarding construction and operation related activities for active Osprey nests are to avoid such areas by at least 200 m.

A Bald Eagle (*Haliaetus leucocephalus*) has been noted within the Project area during field work. This species has been observed flying over Bean Lake and has only been noted in the vicinity of the James Property. No nest locations have been identified for this species in the general vicinity of the Project area. One 3rd-year immature was also observed along Bean Lake. An adult Bald Eagle was observed during the May 2009 survey (LIM and NML 2009), feeding on the carcass of a caribou killed by a wolf on Menihek Lake. This species is locally uncommon but increasing (Brown, pers. comm., June 2005).

4.2.3.4 Migratory Species

A review of various birding guides (Sibley, 2003 and Peterson, 1980) and the Ontario Breeding Bird Atlas (Cadman et al. 2007) was conducted to identify potential migratory bird species that could be expected to be found or migrate through the Schefferville area. Based on this review, a total of nine species were identified. The Peregrine Falcon was the only identified migratory species that has a federal designation of Special Concern under Schedule 3 of the *Species at Risk Act* and Vulnerable under the provincial *Endangered Species Act*.

There will be non-significant effects to the potential migration of the Peregrine Falcon during the operation of the Schefferville Area Iron Ore Mine based on several factors:

- operations will occur within valley bottoms and thus there will be no interactions with ridges that could be used by migratory falcons;
- the mine will not operate during the winter. Spring migration should be 80% complete prior to the annual start up of operations;
- fall migration will take place during operational activities and thus there is potential for avoidance behaviour (e.g., migrating birds would avoid the area); and,
- habitat for successful migration is not limiting in the Schefferville area, as there are various ridgelines outside the Project area that can provide for successful migration, if migration does occur in this area (i.e., resting and feeding areas).

4.2.4 Fish and Fish Habitat

AECOM conducted fish surveys at the Project site in 2007 and 2008.

4.2.4.1 Methods

Surveys were conducted to characterize fish habitat and fish species present in the study area (i.e., the lakes and streams in the Project area as shown in Figure 4.21). Habitat is described using the methods and terms outlined by Sooley et al. (1998) and McCarthy et al. (2007 Draft) and fish sampling was conducted using methods detailed in Sooley et al. (1998).

Qualitative measures undertaken include rod and reel angling and visual observations for fish in lakes, visual determinations for fish species in streams, along with general fish habitat characterization for areas adjacent to the proposed works.

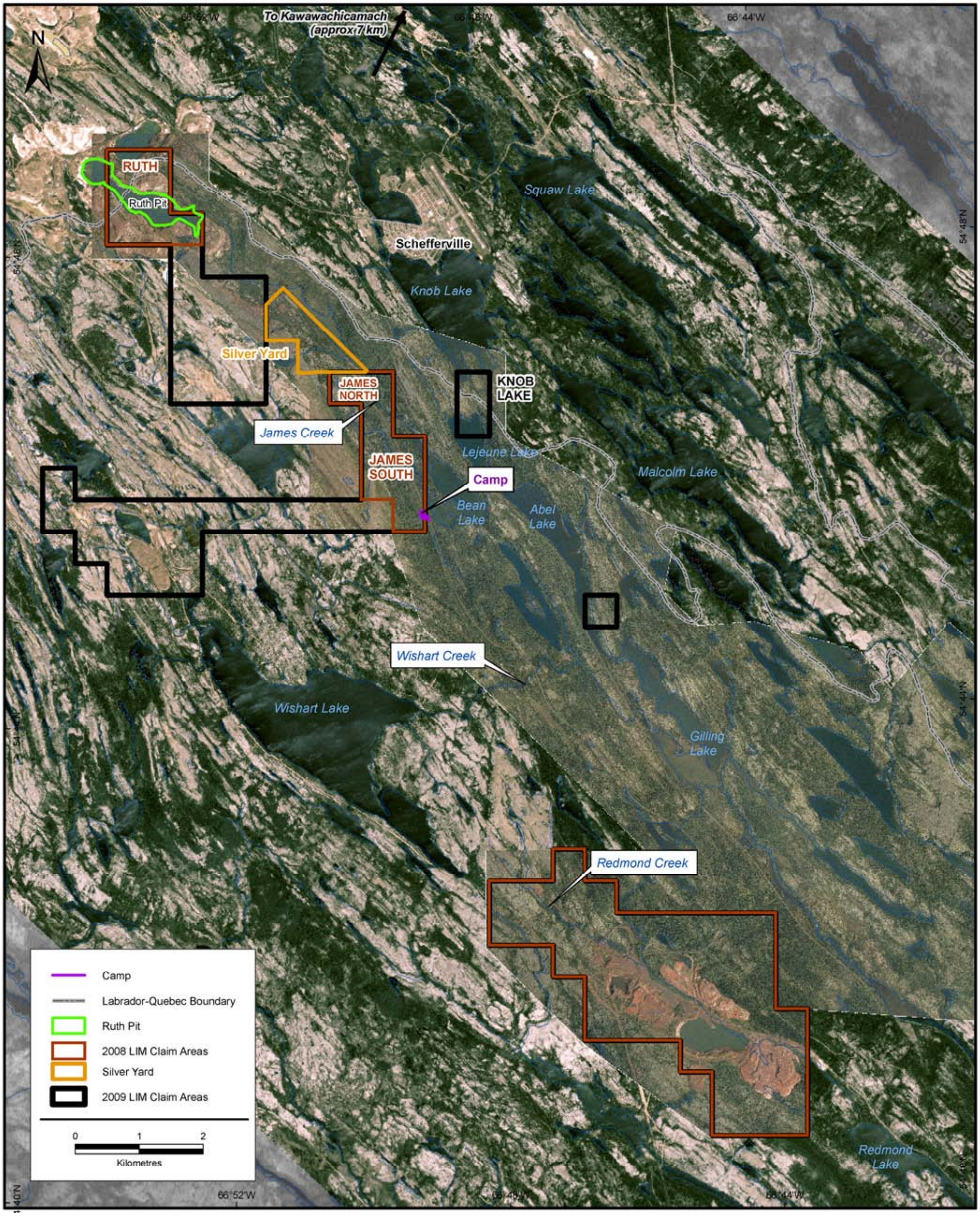


Figure 4.21 Lakes and Streams in the Project Area

4.2.4.2 Assessment Area Boundaries

Spatial and Temporal

The Project boundary includes surface water bodies in the subwatersheds that contain the Project. Temporal Project boundaries are seasonal for construction and operation, as there will be a winter shutdown of mining activities.

The ecological boundaries for the freshwater fish and fish habitat will align closely to the watershed boundaries. The Project lies within a set of subwatersheds that flow to a chain of narrow lakes stretching from the Project area southeast to Astray Lake in the upper Churchill complex of lakes and reservoirs.

Furthest north, the area of the Ruth Pit drains to James Creek, which in turn flows to Slimy Lake and then Bean Lake, east of the James Deposits (Figure 4.21). The outlet from Ruth Pit is a submerged culvert that is located in the southwest portion of the pit. Historical pit wall rock debris has partially blocked the pit-side end of this culvert, and the pit water level is approximately 2 metres above the top of the culvert. Water still flows through the culvert but more by infiltration rather than surface level flow due to the blockage. The discharge end of the culvert is perched approximately 1 m above the James Creek inlet. Water discharging from Ruth Pit is the origin of James Creek, however fish cannot enter Ruth Pit from James Creek because the culvert is perched and is blocked by the coarse rock.

There is also a small unnamed tributary that originates on the James Property that flows into Bean Lake. The flow from Bean Lake continues through Abel Lake, Gilling Lake, to Astray Lake, which are all to the south of the James deposit.

Drainage on the Redmond Property is via Redmond Creek, which flows southeast into Redmond Lake and then on to Astray Lake. Generally, the spatial boundary of the fish and fish habitat study area will be limited to the active mine sites, with limited or no downstream effects.

Administrative and Technical

The regulatory boundaries of the Project fall under provincial and federal jurisdictions. As in other areas of Newfoundland and Labrador, freshwater aquatic resources are regulated by several provincial and federal departments. The *Fisheries Act* is the primary federal legislation governing protection and management of fish and fish habitat in freshwater environments. The Department of Fisheries and Oceans (DFO) holds jurisdiction for fisheries and fish habitat protection in the Province. Similarly, DFO recreational and commercial regulations are in effect for the Project site. Environment Canada has responsibility for Section 36 of the *Fisheries Act,* which regulates the release of deleterious substances whereas DFO is responsible for sedimentation issues.

For the watersheds of the Project site, the Water Resources Division of Environment and Conservation oversee water quality and water quantity pursuant to the *Waters Resources Act* (2002). This *Act* regulates development within 15 m of a waterbody and provides regulations regarding development within wetlands and flood plains. This guidance under the *Water Resources Act* includes the Environment Control (Water and Sewage) Regulations that regulate discharges to a body of water.

Fish habitat on the Project site was assessed using the DFO fish habitat assessment guidelines for assessing lacustrine and riverine habitats. Detailed habitat mapping of the unnamed tributary on the James Property was completed to quantify fish habitat. In other areas of fish and fish habitat not expected to be directly impacted by the proposed mining operations, fish were assessed by qualitative measures that included rod and reel angling and trap netting.

Assessment Area

The Assessment Area for determining Fish and Fish Habitat are those waterbodies that may interact with the Project (Ruth Pit, James Creek, Slimy Lake, Bean Lake, Unnamed Tributary, Redmond Creek, Redmond Lake).

4.2.4.3 Results

Ruth Pit

Gillnetting surveys verified that the Ruth Pit has no sustained fish community, so fish habitat has not been characterized for the flooded pit. These survey results were submitted to DFO, which subsequently confirmed that it does not consider the existing flooded open pits to be fish habitat (Yetman 2008, email communication).

James Creek

James Creek is a small stream that originates from the Ruth Pit, as a result of water seepage from the flooded pit (Figure 4.7). Drainage occurs via a perched culvert, which is collapsed at the inlet end and fish are therefore prevented from entering the flooded pit. The stream section between Ruth Pit and Slimy Lake has an average wetted width of approximately 2.0 m and depths ranging between 0.2 m (riffles) and 0.8 m (pools). The stream section between Slimy Lake and Bean Lake increases to a wetted width of approximately 3.0 m with depths similar to the upstream section. Substrates of the stream consist largely of gravel and cobble, with minimal sediment deposition within main channel. All stream banks were observed as stable, with no erosion evident. Stream gradient was estimated at 2%.

Field surveys confirmed that James Creek contains brook trout (*Salvelinus fontinalis*) and sculpin sp. (*Cottus* spp.). Fish species within Slimy and Bean Lakes include longnose sucker (*Catostomus catostomus*), brook trout, lake whitefish (*Coregonus clupeaformis*), pearl dace (*Margariscus margarita*), white sucker (*Catostomus commersoni*), lake trout (*Salvelinus namaycush*), burbot (*Lota lota)*, sculpin, and spottail shiner (*Notropis hudsonius*). These species have access to James Creek, but only the presence of brook trout and sculpin were confirmed in the sampling program.

Slimy Lake

Slimy Lake has a surface area of approximately 13.8 ha, with a maximum depth of 8 m. Riparian vegetation consisted of alder thicket to the south and west, and sparse black spruce forest to the north and east. Sediments are predominantly fine particulates.

A quantitative fyke netting program (48 hours total) was conducted on Slimy Lake during 2008. This netting effort indicated that the fish community was dominated by longnose sucker (n = 99). Other species captured include: brook trout (20), lake whitefish (4), pearl dace (2), white sucker (1), and lake trout (1). Angling efforts resulted in the capture of six lake trout (1.5 – 2.5 kg) in 2 hours.

Bean Lake

Bean Lake has a surface area of approximately 54.7 ha, with an estimated maximum depth of 15 m. The riparian vegetation consists of black spruce forest along most of the shoreline, with the exception of alder thickets along the north eastern shore along the railway spur bed and also along the James to

Redmond Road, immediately adjacent to Bean Lake on the south western shore. The littoral sediment was dominated by gravel and sand along most of the lake, with the exception of fine sediments being identified at the inlets of James Creek and at the small bay immediately adjacent to the Redmond and James Road. Within the sediments identified near the James Creek inlet, aquatic macrophytes (*Potamogeton* spp.) were evident.

A fyke netting program (72 hours total) completed on Bean Lake during 2008 identified that the fish community is dominated by longnose sucker (n =302). Other species captured include: lake whitefish (90), white sucker (87) pearl dace (39), brook trout (31),) burbot (17), sculpin (3) and spottail shiner (1), and lake trout (1). Angling efforts captured six lake trout (1.5 – 2.5 kg) in 2 hours.

Unnamed Tributary - James Property

Within the James Property, a small first order tributary originates from two artesian sources (James North Spring and James South Spring) (Figure 4.7). James North Spring is located between James North and James South pits. This tributary is approximately 1000 m in length and flows in a south easterly direction and discharges into Bean Lake. Another small spring (James South Spring) originates from the southern end of the James South ore body and flows north easterly to the unnamed tributary, approximately half way between the tributary's origin and Bean Lake

Details of habitat characterization of the unnamed tributary are in a report that is included in Appendix N. The unnamed tributary consisted predominantly of flats and runs. Riffles and glides are also present but true pools were limited in number. The substrate in the riffles and runs is typically cobbles and gravels and in the flats, sand, silt and detritus dominated. In many flat sections however, gravels occurred under the fines, and during the fall 2007 survey, redds that had been excavated down to the gravel were observed in some of these flat sections. Cover for fish in flat sections was dominated by undercut banks and overhanging grasses. In the runs, the dominant cover was typically overhanging alders and willows.

The smaller tributary that flows into the unnamed creek has a mean wetted width of 1.0 m, which has margins choked with watercress, reducing the functional width to 0.5 m.

The approximate areas of available spawning, rearing, migration and adult resident habitat types are 351 m², 1227 m², 0 m² and 5716 m², respectively (See Table 1 in Appendix N).

There appeared to be a pronounced decrease in the volumes of water flowing from the springs during the winter months. Sampling for the James North Spring indicated that flows were markedly reduced, as it took over one minute to fill a 1 L bottle. Attempts to winter sample pool locations along the tributary found the pools were frozen solid to the substrate.

Visual surveys of the unnamed tributary identified brook trout and sculpin. The discharge of this creek into Bean Lake contains a perched culvert with 0.5 m drop, preventing access, by most species in Bean Lake, to this tributary. However, during the spring 2008 sampling program, it was noted the brook trout were swimming upstream from Bean Lake into the tributary; fish were observed jumping into the culvert and successfully moving upstream from the road crossing.

Wishart Creek

Wishart Creek flows east from Wishart Lake for approximately 4.5 km to Gilling Lake. The stream has an average wetted width of 5 to 6 m and depths ranging between 0.2 m (riffles) and 1.5 m (pools) within the vicinity of the existing road crossing. Substrates of the creek consist largely of gravel and cobble, with minimal sediment deposition within main channel. The stream banks were observed as stable, with no erosion evident. Stream gradient ranged between 1.5 to 3%.

Visual surveys of Wishart Creek identified the presence of brook trout and sculpin. Other resident fish species within the Wishart watershed also have access to the creek, but only these two species were confirmed as present.

Redmond Creek

Redmond Creek is a small stream that originates within the Redmond Property, as a result of surface and groundwater flows (Figure 4.13). For example, one source is a large spring located immediately adjacent to the Redmond 1 Pit. The creek also receives a diffuse flow from the area of the road and historic mine works. Observations indicated the channel has an average wetted width of approximately 1.5 m and depths ranging between 0.15 m (riffles) and 0.4 m (pools). The substrates of the creek consist largely of gravel and cobble, with minimal sediment deposition within the main channel. During electrofishing, disturbance of sediments resulted in the resuspension of reddish sediments. Riparian vegetation included a small section lined with alder, but the majority of the creek is adjacent to historic mining waste rock piles within the property boundaries. Stream banks were stable at low flows, but active erosion was noted along some channel sections, as represented by the presence of bare soils.

Electrofishing and qualitative visual surveys of Redmond Creek confirmed the presence of brook trout in the lower section of the creek situated on the Redmond Property. During the spring freshet, longnose sucker and white sucker were reported by a local contact to enter the creek to complete spawning. Other resident fish species within Redmond Lake (~ 2 km downstream from the property) also have access to the creek.

4.2.4.4 Current and Future Fisheries

This region of Labrador and adjacent region in Québec are known for abundant fish resources and the fisheries include recreational fisheries, commercial outfitter operations and a subsistence fishery by aboriginal peoples.

People fish anywhere they can obtain access to good locations. Access is provided by existing roads to old mine areas, exploration areas, and the Menihek hydroelectric facility. Adjacent to the Project site, locals angle brook trout in James Creek near the Silver Yard. Locations on James Creek are accessible by road. Less fishing is conducted on Slimy Lake as there is the perception, and evidence, that this lake was impacted by the past mining activities. All of the other Project areas are more distant from favoured angling streams and lakes.

There are several outfitter operations in the area. The closest outfitting camps are on Astray Lake to the south and Wishart Lake to the west. Most other camps are located in Québec, which are different watersheds. Access to many of the camps is restricted to floatplane and helicopter as the road network is limited.

The subsistence fishery is pursued on both sides of the border with seasonal gillnet fisheries. These focus on the larger lakes as they usually produce larger fish (i.e., lake trout).

4.3 Socio-economic

This section provides information on the existing socio-economic conditions, including demography, community infrastructure and services, and employment and business. The geographic extent of the discussion varies by subject. Most aspects of the socio-economic environment will be examined for the Assessment Area, which includes both western and central Labrador, defined geographically as the Hyron (Labrador West) and Central Labrador (Upper Lake Melville) Economic Zones (Figure 4.22). While all Project activity will occur in Labrador West, the baseline conditions in central Labrador and parts of Québec are included because Project labour, goods and services are also going to be drawn from these areas. The communities of Schefferville, Kawawachikamach and Matimekush are located in Québec in close proximity to the Québec-Labrador border and the Project. All three can be reached by air, through the Schefferville Airport, or by train from Sept-Iles. The Project will make use of accommodation camps, some municipal facilities and the airport, and will employ some workers and services located in these communities.

Baseline information is presented at the provincial, Labrador, and Assessment Area levels as appropriate, with further detail for communities within the Assessment Area provided where necessary. Selected data are also presented for Schefferville and other Québec communities adjacent to the Project site.

4.3.1 Methodology

The baseline data presented in this section were drawn from a wide range of secondary sources including:

- Statistics Canada and other agencies and departments of the Government of Canada;
- Newfoundland and Labrador Statistics Agency and other agencies and departments of the Government of Newfoundland and Labrador; and
- Municipal governments and local and regional authorities and boards.

Not all information is available for the same geographic areas. For instance, census data are available for some communities in the Upper Lake Melville Area (for example, Happy Valley-Goose Bay and North West River, which are located in Census Division 10, Subdivision C), but data for Sheshatshiu and Mud Lake are aggregated and classified as Census Division 10, Subdivision C, SUN. Other data are only available by Economic Zone and not for individual communities. The communities in Labrador West fall under Economic Zone 2 – Hyron Regional Economic Development Corporation and the communities of the Upper Lake Melville Area comprise Economic Zone 3 – Central Labrador Economic Development Board.

In addition to data from the above secondary sources, primary information was collected through personal and telephone interviews with key informants with groups and agencies at the community, regional and provincial levels.

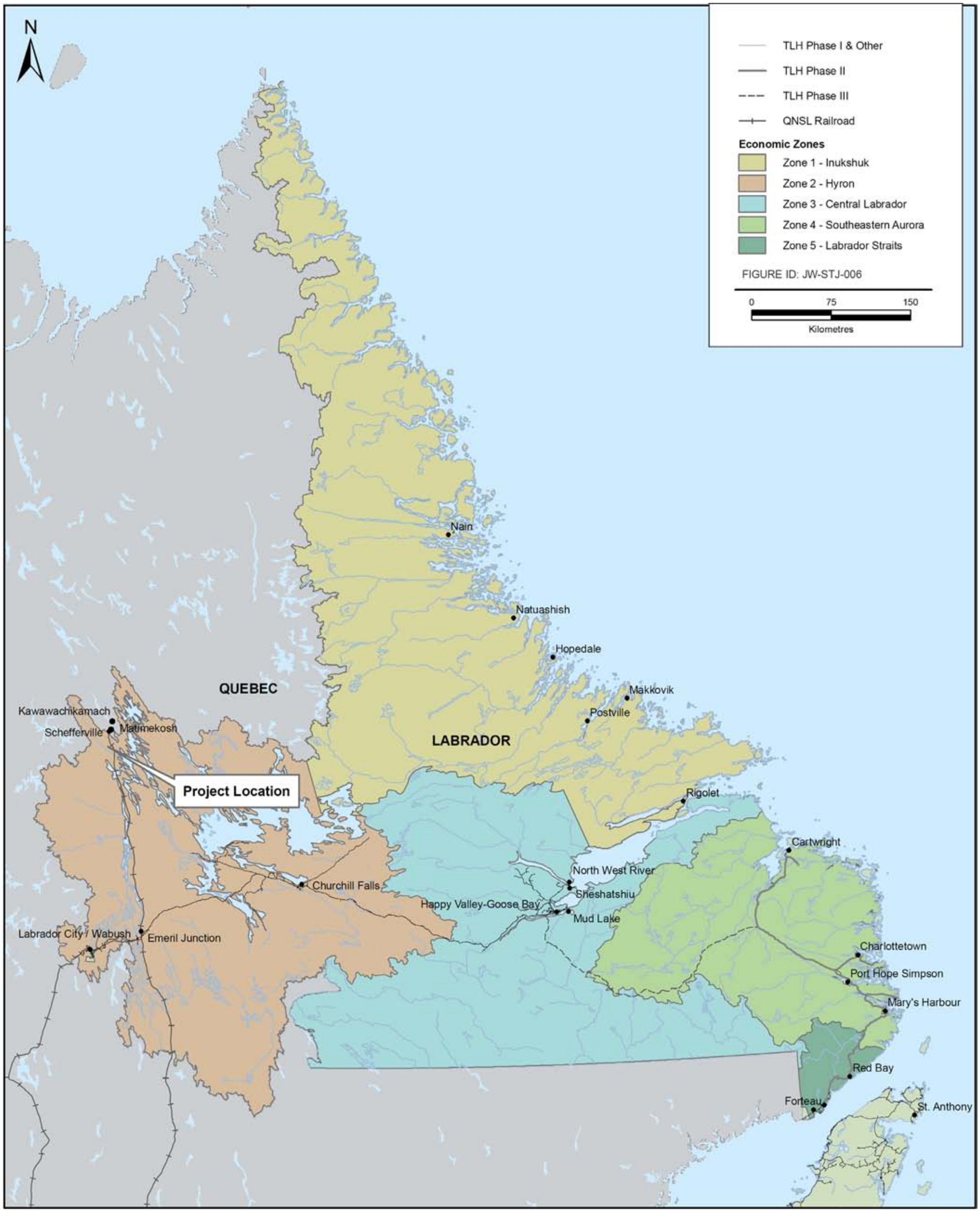


Figure 4.22 Study Area and Economic Zones of Labrador

4.3.2 Demography

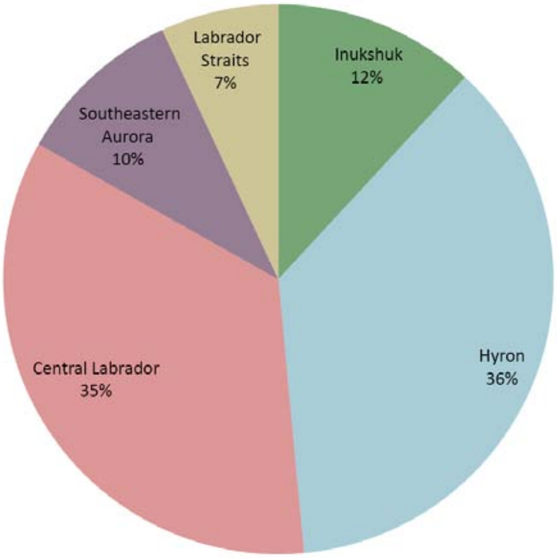
An understanding of the demographic structure and its potential for change without the Project provides a basis for determining Project-related changes. The following discussion focuses on the demography of western and central Labrador and, where relevant, that of Labrador and the Province. There is also an overview of the Québec communities in close proximity to the Project site.

4.3.2.1 Labrador

The 2006 Census reports that there are 26,364 people residing in 32 communities across Labrador, of which 50.7 percent are male and 49.3 percent are female. In 2006, Labrador's population made up 5.2 percent of the provincial total (Statistics Canada 2006). In Labrador and the Province in 2006, the majority of the population was between the ages of 35 and 64 (44.4 and 46.2 percent, respectively) Those aged 15 to 34 represented the smallest portion of the Province's population (6.1 percent), while the 65 plus age group represented the smallest portion of Labrador's population (6.3 percent) (Statistics Canada 2006). Thirty-five percent of the people living in Labrador have Aboriginal ancestry, self-identifying as Innu, Inuit or Métis (Newfoundland and Labrador Department of Labrador and Aboriginal Affairs [NLDLAA] 2006).

Between 1991 and 2006 Labrador's population fell by 13.1 percent, from 30,375 to 26,364. This was slightly greater than the overall provincial decline of 11.1 percent (Statistics Canada 2006).

For the purposes of economic analysis and planning, Newfoundland and Labrador is divided into 20 economic zones, five of which are in Labrador (Figure 4.23). In 2006, the economic zones in Labrador with the largest populations were those that are the focus of concern in this assessment: Hyron, comprised of Labrador City and Wabush, and Central Labrador, which comprises Upper Lake Melville with populations of 9,660 and 9,175, respectively (Figure 4.23). The zone with the smallest population was Zone 5 ('Labrador Straits') with 1,825 people (Newfoundland and Labrador Statistics Agency 2006).

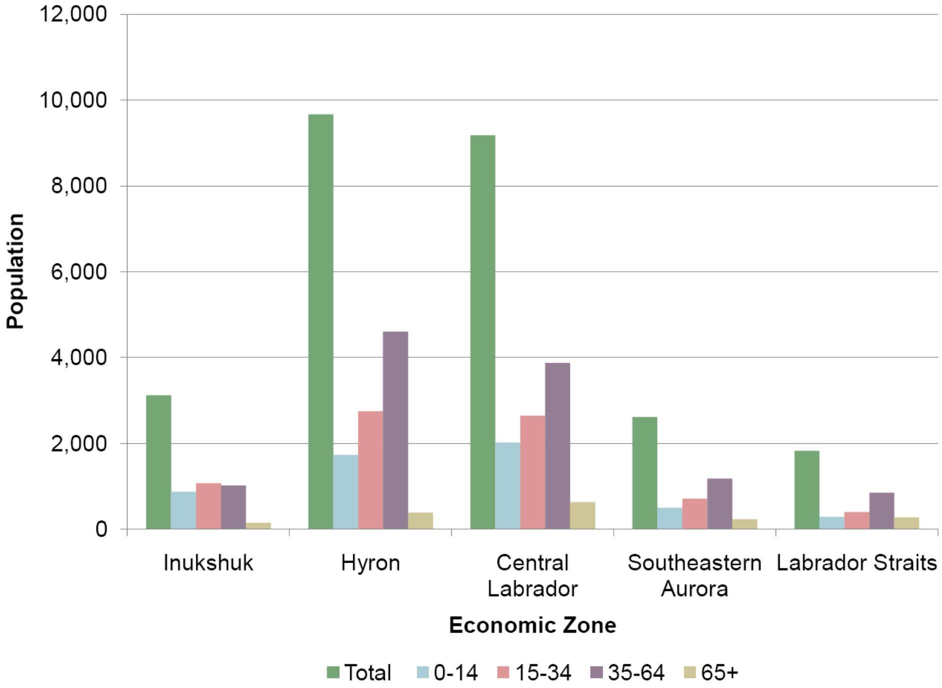


Source: Newfoundland and Labrador Statistics Agency 2006

Figure 4.23 Population by Economic Zone, as a Percentage of Labrador's Population, 2006

The populations of all but one of the economic zones in Labrador decreased between 1991 and 2006 (Newfoundland and Labrador Statistics Agency 2006). The greatest declines occurred in Hyron (Labrador West and Churchill Falls) and Labrador Straits. The population of Hyron fell by 20.8 percent, from 12,200 to 9,660, and Labrador Straits decreased from 2,185 to 1,825 (16.5 percent). Inukshuk (the North Coast of Labrador), however, increased by 4.5 percent from 2,985 to 3,120, but it too has declined between 2001 and 2006.

The age-structure of the populations of the economic zones is illustrated in Figure 4.24. Inukshuk is unique insofar as the proportion of younger people in the 0 to 14 and 15 to 34 categories is much higher than for the other zones (Newfoundland and Labrador Statistics Agency 2006).



Source: Newfoundland and Labrador Statistics Agency 2006

Figure 4.24 Population of Labrador Economic Zones by Age Group, 2006

4.3.2.2 Labrador West

In 2006, the population of Labrador West was 8,979, with the majority living in Labrador City (Table 4.10). The area represents 34.1 percent of Labrador's population with slightly more men (51.6 percent) than women (48.4 percent) (Statistics Canada 2006).

Table 4.10 Population of Labrador West, Upper Lake Melville, Labrador and Province, 2006

	Total Population	Male	Female
Labrador City	7,240	3,740	3,505
Wabush	1,739	895	845
Labrador West Total	**8,979**	**4,635**	**4,350**
Happy Valley-Goose Bay	7,572	3,740	3,835
North West River	492	240	250
Sheshatshiu and Mud Lake (Census Division 10, Subdivision C)	1,112	560	555
Upper Lake Melville Total	**9,176**	**4,540**	**4,640**
Labrador	**26,364**	**13,380**	**12,985**
Province	**505,469**	**245,735**	**259,735**
Source: Statistics Canada 2006			

Compared to other parts of Labrador, a relatively small proportion of the population of Labrador West is identified as Aboriginal. In 1996, Aboriginal people represented only 1.5 percent of the population. However, by 2006, this had increased to 6.6 percent (Statistics Canada 1991; 1996; 2001; 2006). Visible minorities (persons who are identified according to the *Employment Equity Act* as being non-Caucasian in race or non-white in colour, with the exception of Aboriginal people) made up only 1.2 percent of Labrador West population.

4.3.2.3 Upper Lake Melville

With a population of 9,176, Upper Lake Melville has 34.8 percent of the total population of Labrador (Table 4.10) (Statistics Canada 2006). In 2006, there were slightly more women (50.6 percent) than men (49.4 percent) living in the area and 82.5 percent of residents lived in Happy Valley-Goose Bay, the area’s largest community.

As in Labrador West, the population of Upper Lake Melville has been in decline. It fell from 10,050 in 1991 to 9,654 in 2001, a decline of 3.9 percent. By 2006, the population had decreased a further 5.0 percent to 9,176, with Happy Valley-Goose Bay and North West River experiencing declines of 12.0 percent and 6.8 percent respectively. However, Census Division 10, Subdivision C (Sheshatshiu and Mud Lake) experienced a population increase of 21.9 percent. It should be noted that Statistics Canada data combine information for Sheshatshiu (approximately 1,050 people) with that for the much smaller community of Mud Lake (approximately 60 people), and few disaggregated data are available.

Sheshatshiu is an Innu community, and many Innu, Inuit and Métis live in Happy Valley-Goose Bay, North West River and Mud Lake. The Aboriginal population of the Upper Lake Melville Area increased from 2,035 to 4,130 between 1991 and 2001 and then decreased to 4,095 in 2006. Most (66.4 percent) Aboriginal people in that area reside in Happy Valley-Goose Bay. Of the 1,112 people in Sheshatshiu and Mud Lake in 2006, 1,035 (93 percent) were Aboriginal. In North West River, 340 (68.7 percent) of the population were Aboriginal, as were 2,720 (35.9 percent) of those in Happy Valley-Goose Bay.

Visible minorities comprised only 0.4 percent of the 2006 population in Upper Lake Melville, all of them living in Happy Valley-Goose Bay (Statistics Canada 2006).

4.3.2.4 Québec Communities

In 2006, there were 1,315 people residing in the four communities near the Project that are located in Eastern Québec (Statistics Canada 2006) (Table 4.11). In contrast with most of Labrador, the population rose in these communities between 2001 and 2006 by 5.8 percent from 1252 in 2001 to 1315 in 2006 (Statistics Canada 2006).

Table 4.11 Population, Eastern Québec Communities, 2001 and 2006

	Kawawachikamach	Matimekush	Lac-John	Schefferville	Total
Population in 2006	569[1]	528	16	202	1315
Population in 2001	540	449	23	240	1252
2001 to 2006 population change (%)	5.37	17.59	-30.43	-15.83	5.03

Source: Statistics Canada 2001, 2006

[1] The total population of Kawawachikamach in March 2008 was 849 (NNK 2008)

The Naskapi Nation of Kawawachikamach is comprised of the Village of Kawawachikamach, approximately 16 kilometres northeast of Schefferville, and a larger uninhabited area to the northeast of the Village. Kawawachikamack is largest community in the area. With a population of 560 people, it contains 43.2 percent of the total population of the Québec communities (Statistics Canada 2006) (Figure 4.25).

In 2006, there were slightly more women (50.88 percent) than men (49.12 percent) living in the area. Of the 570 people in Kawawachikamach, 565 (99 percent) were Aboriginal. The population increased by 5.37 percent from 540 people in 2001 to 569 people in 2006 (Statistics Canada 2006).

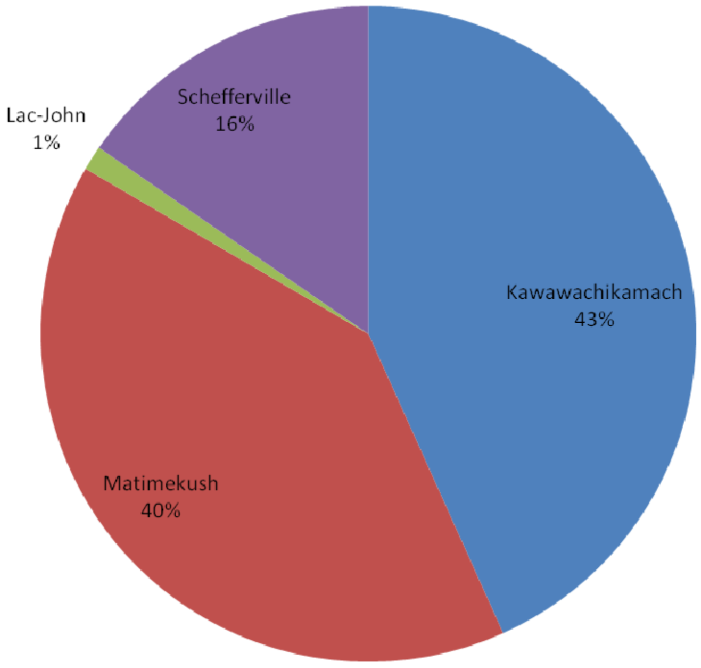


Figure 4.25 Percentage Population of Eastern Québec Communities, 2006

Matimekush Innu community has approximately 544 people (Statistics Canada 2006). It is divided into two territories: the reserve of Matimekush (528 people), on the edge of Pearce Lake adjacent to the Schefferville Municipality; and the reserve of Lac-John (16 people), which is 3.5 kilometres from Matimekosh and the centre of Schefferville. With a population of 528 people, Matimekush contains approximately 40 percent of the total population of the Québec communities (Statistics Canada 2006)

(Figure 4.25). In 2006 there were more women (52.83 percent) than men (47.17 percent) living in the area. Of the 528 people in Matimekosh, 495 (93 percent) were Aboriginal. Between 2001 and 2006, its population saw the largest increase in the Québec communities, growing by approximately 18 percent from 449 people in 2001 to 528 people in 2006 (Statistics Canada 2006).

Lac-John, which is located 3.5 kilometres from Matimekush, will be considered a part of the analysis for Matimekush due to information being suppressed due to confidentially issues. Where disaggregated data exist, Lac-John will be presented separately. It is the smallest of the four Québec communities with 16 people (Statistics Canada 2006). The population has decreased by 30 percent from 23 people in 2001 to 16 people in 2006.

Schefferville is approximately 2 kilometres from Labrador on the north shore of Knob Lake. It was established by IOC in 1954 to support mining operations in the area. The Municipality and Matimekush Reserve are adjacent and closely linked to it. With a population of 202, Schefferville contains approximately 16 percent of the total population of the Québec communities (Statistics Canada 2006) (Figure 4.25). In 2006, there were more men (55 percent) than women (45 percent) living in the area. Of the 202 people in Schefferville, 90 (44.5 percent) were Aboriginal. Between 2001 and 2006, its population decreased by approximately 15 percent from 240 people in 2001 to 202 people in 2006 (Statistics Canada 2006).

4.3.3 Employment and Business

4.3.3.1 The Mining Industry

Mining has provided a valuable foundation and cornerstone for economic development and growth in Labrador West, with a primary focus on iron ore. Large scale mining development projects are generally long term and capital intensive and often result in major economic and employment benefits similar to operations already existing in Labrador West (NLDLAA 2008).

Production mining is the main activity in Labrador West. IOC operates its Carol Lake Mine out of Labrador City, and Wabush Mines operates its Scully Mines from Wabush. The situation has not changed substantially since 1993 in terms of both mines being dependent on the fluctuations in the international market for steel and subsequently iron ore.

The Iron Ore Company of Canada (IOC) began production from the Carol Lake Mine in 1962. IOC is Canada's largest iron ore pellet producer and operates a mine, concentrator, and pellet plant at Carol Lake, port facilities in Sept-Iles, Québec and a 420-km rail line that links the mine and the port. Total resources at Carol Lake are estimated to be 5.5 billion tonnes. Proven and probable reserves are 1.4 billion tonnes; indicated and referred reserves are 4.1 billion tonnes. Annual mine production at the open pit operation is in the 35 to 38 million tonne range at an average grade of approximately 40 percent total iron. Annual production capacity is 18 million tonnes of concentrate of which 12.5 million tonnes can be pelletized. In 2005 and 2006, IOC shipped a total of 15 million tonnes of iron ore, up 30 percent from 2004 (AMEC Earth and Environmental Ltd and Gardner Pinfold 2008).

IOC announced a $500 million expansion in March 2008, and a further $300 million expansion in September 2008. However these plans, which would have increased production to 25 million tons per year by 2011, were postponed in December 2008.

Wabush Mines began mining iron ore from the Scully Mine in Labrador in 1965 and now operates a mine and concentrating plant at Wabush and a pellet plant and shipping facilities in Point Noire, Québec. All ore is mined by open pit and sent through the Scully Mine concentrator. The final concentrate is transported 443 kilometres by rail to the port at Pointe Noire for pelletizing and shipment. The majority of ore is loaded onto ships bound for the Canadian and US Great Lakes region while the remainder is loaded for the US East Coast, Europe and more recently China. In 2005, Wabush Mines shipped five million tonnes of concentrate, up almost 29 percent from 2004. In 2006 it shipped 4.2 million tonnes, a drop of 17.9 percent from the previous year. In 2006 it spent more than $18 million on capital projects (AMEC Earth and Environmental Ltd and Gardner Pinfold 2008). However, in December 2008, Wabush Mines cut its production target for 2009 in half, and announced it was eliminating 160 jobs in February 2009. Other materials of interest in Labrador West are aggregate, nickel, gold and graphite (AMEC Earth and Environmental Ltd and Gardner Pinfold 2008).

4.3.3.2 Employment and Labour Force

Labrador

In general, the employment situation in Labrador, prior to the current economic downturn, was better than in the rest of the Province, and the situation in Labrador West is better than Upper Lake Melville. Participation rates were higher, unemployment rates were lower, and the average annual income was higher in Labrador West in 2006 (Table 4.12).

Table 4.12 Labour Force Characteristics, Labrador, 2006

	Labrador City	Wabush	Total Labrador West	Upper Lake Melville	Labrador	Province
Total Population, 15 years and older	5,935	1,460	7,395	7,045	20,815	422,385
Labour Force	4,325	1,045	5,370	5,105	14,340	248,685
Participation Rate (%)	72.9	71.6	72.3	64.3	63.2	58.9
Unemployment Rate (%)	8.9	8.1	8.5	20.4	24.5	18.6
Median Income, 2005	$30,884	$36,091	$33,488	$24,196	$21,845	$19,573
Source: Statistics Canada 2006						

In 2006, the labour force (i.e., individuals who have, or are seeking employment) of Labrador West consisted of 5,370 individuals (Table 4.12), an increase from 4,395 in 2001. The participation rate, which is the percentage of the work-age population that is working or actively looking for employment, is much higher in Labrador West (72.3 percent in 2006, up from 67.5 percent in 2001) than in the Province (58.9 percent) or Upper Lake Melville (64.3 percent). Between 2001 and 2006, the unemployment rate in Labrador West fell from 9.1 to 8.5 percent.

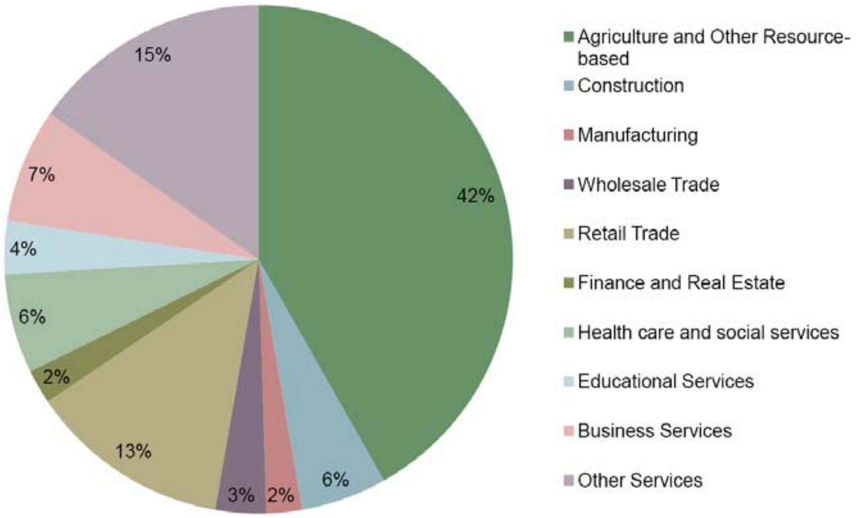
Wages in Labrador West are higher on average than in the rest of the Province. In 2005, the median income from employment for residents of Labrador West averaged $33,488, substantially higher than the provincial figure of $19,573, and the Upper Lake Melville average of $24,196 (Table 4.12) (Statistics Canada 2001; 2006).

The number of individuals in Labrador West receiving employment insurance (EI) benefits decreased by 6.3 percent between 1996 and 2006. During the same period, the number of EI beneficiaries in the Upper Lake Melville decreased by 10.9 percent and the provincial beneficiaries decreased by only 4.7 percent (Table 4.13).

Table 4.13 Beneficiaries of Employment Insurance, Labrador City and Wabush, 2002 to 2006

	1996			**2006**			***% Change***		
	Labrador West	**Upper Lake Melville**	**Province**	**Labrador West**	**Upper Lake Melville**	**Province**	**Labrador West**	**Upper Lake Melville**	**Province**
EI Beneficiaries (Individuals)	1,370	1,605	102,825	1,155	1,430	98,025	*-15.7%*	*-10.9%*	*-4.7%*
EI Incidence (% of labour force)	21.4%	28.8%	39.9%	18.0%	25.5%	35.5%	*-15.9%*	*-11.5%*	*-11.0%*
Source: Newfoundland and Labrador Statistics Agency 2008									

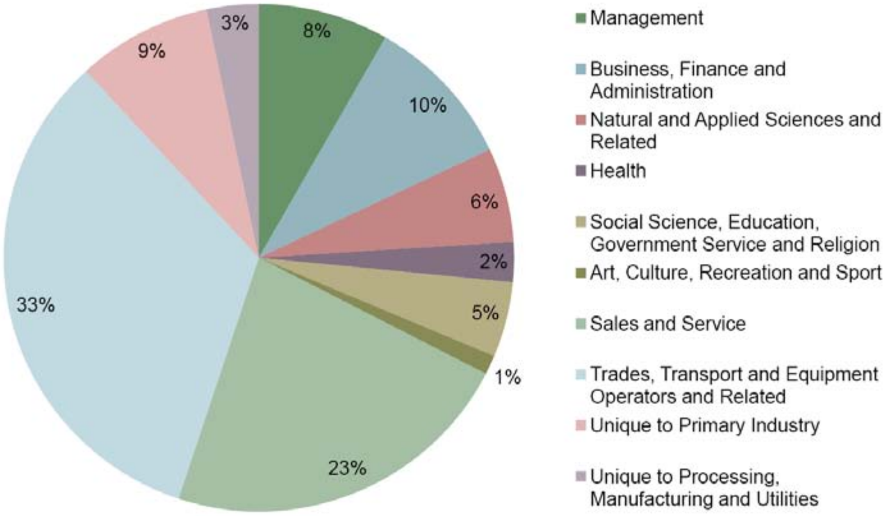
The occupational structure of Labrador is weighted toward goods-producing and seasonal industries. The main source of employment by industrial sector in 2006 was agriculture and other resource-based industries (including mining) which employed 42 percent of the area's population (Figure 4.26). Other services and retail trade employed 15 percent and 13 percent of the population, respectively, while health care and construction each employed 6 percent of the area's residents. Few Labrador West residents worked in wholesale trade (three percent), manufacturing (two percent) or finance and real estate (two percent) (Statistics Canada 2006).



Source: Statistics 2006

Figure 4.26 Labour Force by Industry, Labrador West, 2006

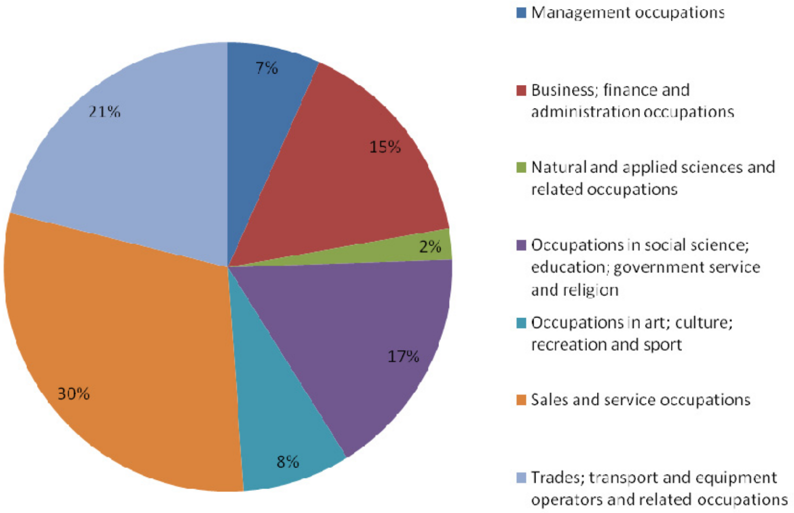
The main occupations of residents of Labrador City and Wabush are trades, transport and equipment operation (33 percent) and sales and service (23 percent) (Figure 4.27). Occupations unique to primary industry and positions in business, finance and administration are held by nine percent of the area's population (Statistics Canada 2006).



Source: Statistics 2006

Figure 4.27 Labour Force by Occupation, Labrador West, 2006

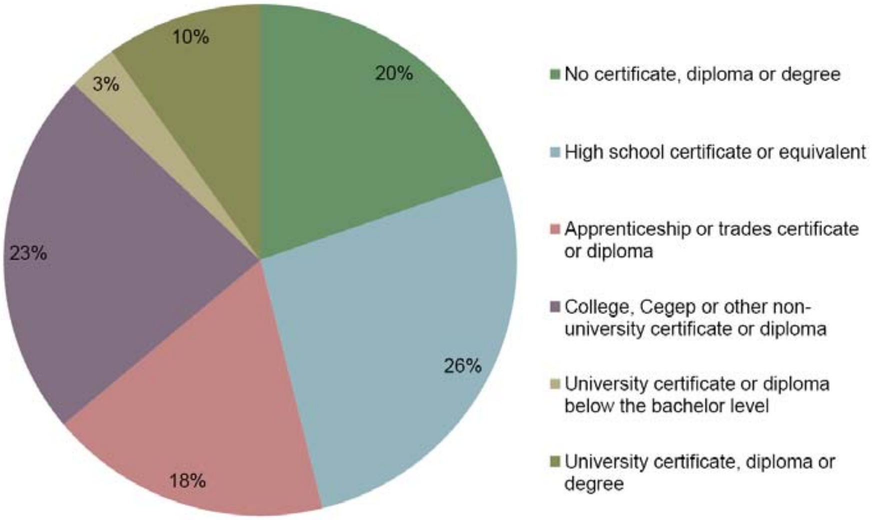
The main occupations of residents of Kawawachikush, Matimekush and Schefferville are sales and services (30 percent), and trades, transport and equipment operation (21 percent) (Figure 4.28). (Statistics Canada 2006).



Source Statistics Canada 2006

Figure 4.28 Employment by Industry Residents of Kawawachikush, Matimekush and Schefferville

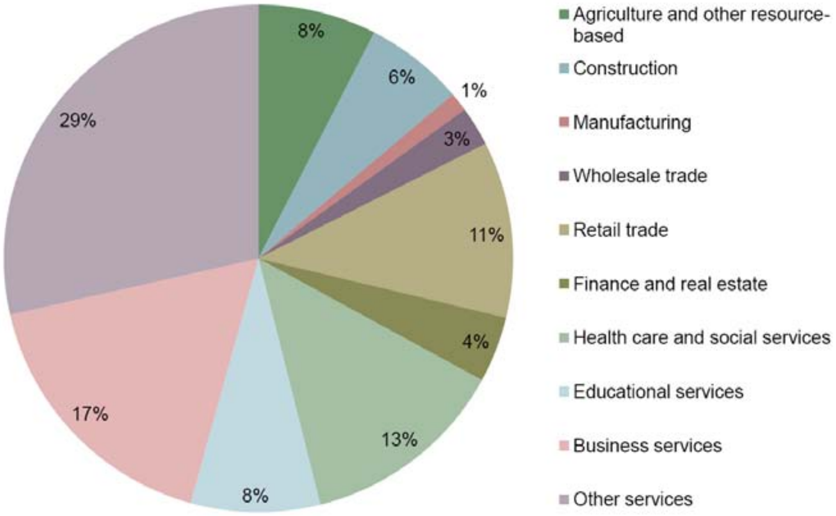
In Labrador West, approximately half of the population (54 percent) has some form of post-secondary training, while only 20 percent have less than a high school education (Figure 4.28). Thirteen percent of Labrador West residents have a university degree, and an additional 23 percent hold a post-secondary certificate or diploma. In Upper Lake Melville ten percent of the population holds a university degree, and 33 percent have not completed a high school education (Figure 4.28; Statistics Canada 2006).



Source: Statistics 2006

Figure 4.29 Education Level, Labrador West, 2006

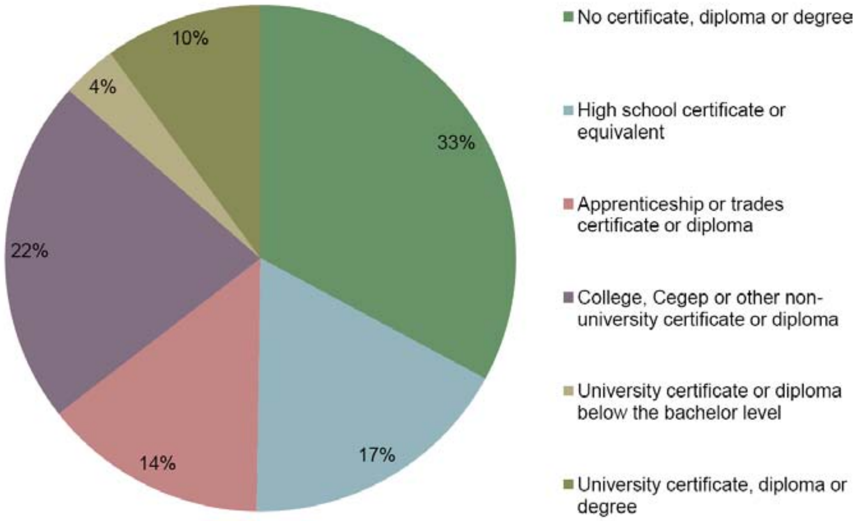
In 2006, 5,035 people aged 15 and over were employed in Upper Lake Melville. The main sources of employment, by industry (Figure 4.29), were Business Services, which employed 860 people, Health Care and Social Services (660), Retail Trade (565) and Other Services (1,435). There were few people employed in Finance and Real Estate (280), Wholesale Trade (125) or Manufacturing (60). The main occupations of Upper Lake Melville Area residents were Sales and Service (1,420), Trade, Transport, and Equipment Operation (970), and Business, Finance and Administration (875) (Statistics Canada 2006).



Source: Statistics 2006

Figure 4.30 Employment by Industry, Upper Lake Melville, 2006

In Upper Lake Melville ten percent of the population holds a university degree, and 33 percent have not completed a high school education (Figure 4.30).



Source: Statistics 2006

Figure 4.31 Education Level, Upper Lake Melville, 2006

Eastern Quebec

In the Eastern Québec communities (Kawawachikamach, Matimekush, and Schefferville), the 2006 labour force consisted of 855 people (Table 4.14). The participation rate is lower for the Eastern Québec towns (35.6 percent) when compared to Labrador West (72.3 percent) (Table 4.14). The unemployment rate for Eastern Québec is also higher at 19.4 percent compared to Labrador West, which is approximately nine percent (Table 4.14). Wages in Eastern Québec ($10,648) were also lower on average when compared to Labrador West ($33,488) (Table 4.14).

Table 4.14 Labour Force Characteristics, Eastern Québec and Comparison to Labrador West, 2006

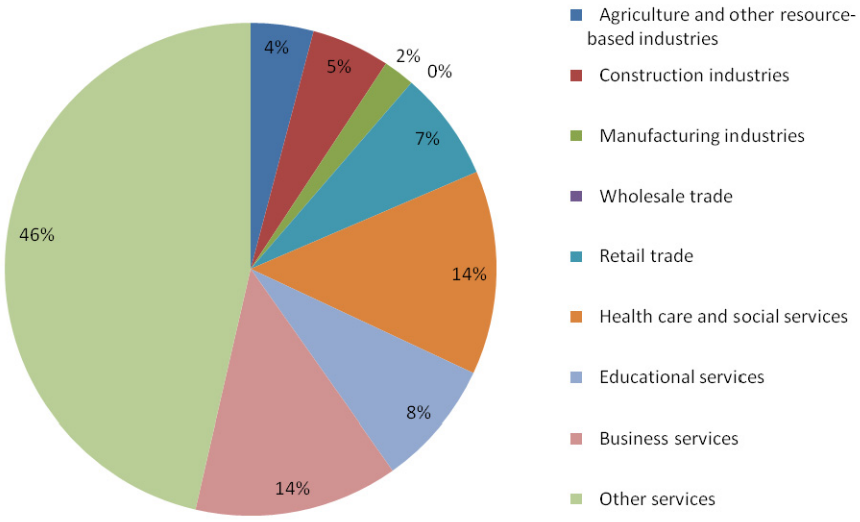
	Kawawachikamach	Matimekush	Schefferville	Québec Total	Labrador West Total
Total Population, 15 years and Older	360[1]	335	160	855	7,395
Labour Force	170	200	120	490	5,370
Participation Rate (%)	47.2	59.7	75	35.6	72.3
Unemployment Rate (%)	20.6	37.5	12.5	19.4	8.5
Median Income, 2005	$12,768	$8,528	$0.00[2]	$10,648	$33,488

Source: Statistics Canada 2006

[1] Kawawachikamach workforce was 512 in 2008 (NNK 2008)

[2] Data is suppressed. Statistics Canada suppresses income data in census areas with populations less than 250 persons, or where the number of private households is less than 40. All suppressed data and associated averages, medians and standard errors of average income are replaced with zeros, but are included in the appropriate higher-level aggregate subtotals and totals. This practice has been adopted to protect the confidentiality of individual respondents' personal information.

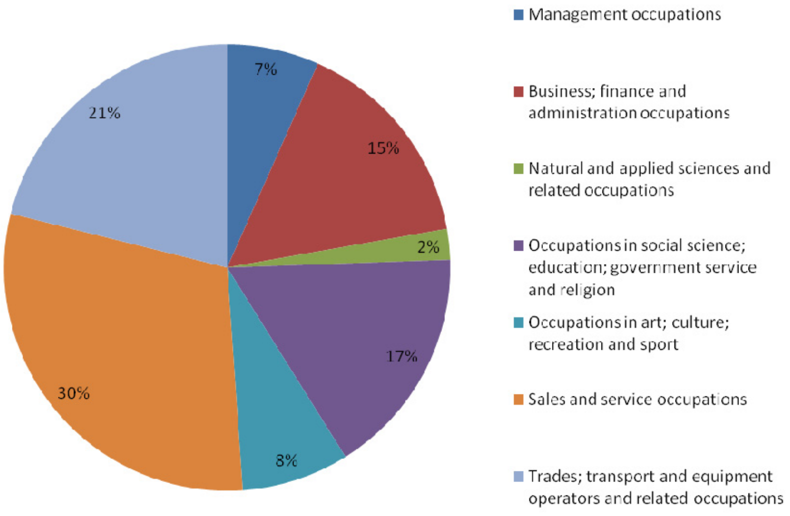
The occupational structure of Eastern Québec is weighted to other services. The main source of employment by industrial sector in 2006 was other services which employed 46 percent of the area's population (Figure 4.31). Health care and social services and business services employed 14 percent of the population, each, while education, retail trade and construction each employed eight, seven and five percent of the area's residents respectively. Few Eastern Québec residents worked in agriculture and other resource based industries (four percent), or manufacturing (two percent).



Source Statistics Canada 2006

Figure 4.32 Labour Force by Industry, Eastern Québec, 2006

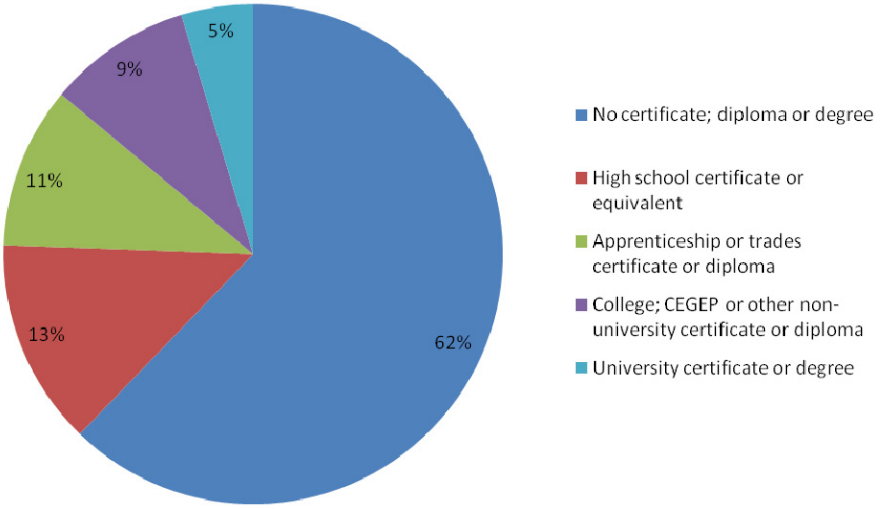
The main occupations of residents of Kawawachikush, Matimekush and Schefferville are sales and services (30 percent), and trades, transport and equipment operation (21 percent) (Figure 4.32) (Statistics Canada 2006).



Source Statistics Canada 2006

Figure 4.33 Labour Force by Occupation, Eastern Québec, 2006

In the Québec communities, over half of the population (62 percent) has less than a high school education, while approximately 30 percent has some form of post secondary education (Figure 4.33). Five percent of the Eastern Québec residents have a university degree, and an additional 20 percent hold a post-secondary certificate or diploma (Figure 4.33).



Source Statistics Canada 2006

Figure 4.34 Education Level, Eastern Québec, 2006

4.3.3.3 Business

Western Labrador

The business community of Labrador West includes 311 companies, approximately two percent of all businesses in the Province (Statistics Canada Business Register). Most of them have one to four employees (Table 4.15). These businesses, categorized by North American Industrial Classification System (NAICS) Industry Code, are presented in Table 4.16.

Table 4.15 Number of Businesses by Employment Size, Hyron Region, 2006

Number of Employees	Number of Businesses
1-4	139
5-19	121
20-99	43
Total	311
Source: Statistics Canada Business Register	

Table 4.16 Number of Businesses by Industry, Hyron Region, 2006

Industry Code	Number of Businesses
Agriculture, Forestry, Fishing and Hunting	X
Mining and Oil and Gas Extraction	6
Utilities	X
Construction	21
Manufacturing	7
Wholesale Trade	25
Retail Trade	64
Transportation and Warehousing	17
Information and Cultural Industries	5
Finance and Insurance	7
Real Estate and Rental Leasing	16
Professional, Scientific and Technical Services	10

Industry Code	Number of Businesses
Management of Companies and Enterprises	X
Administrative and Support, Waste Mgmt, and Remediation Services	16
Educational Services	X
Health Care and Social Assistance	26
Arts, Entertainment and Recreation	8
Accommodation and Food Services	27
Other Services (Except Public Admin.)	45
Public Admin	4
Total	**311**
Note: x = data not available Source: Economics and Statistics Branch (Newfoundland and Labrador Statistics Agency) http://www.stats.gov.nl.ca/Statistics/Trade/PDF/BR_Zone_NAICS_2006.pdf	

The major employers in Labrador West include IOC, which employs more than 2,000 individuals in Labrador City and Sept-Îles, Wabush Mines, with 300 to 400 employees, and the provincial government, including healthcare workers, education employees, and other government employees (B. Jerrett pers. comm.).

Upper Lake Melville

Upper Lake Melville is the government service centre for Labrador. Offices of many provincial and federal government departments are located and staffed in Happy Valley-Goose Bay. Regional governments and Aboriginal groups also provide opportunities for employment in the area. The main employers and number of employees for each are listed in Table 4.17.

Table 4.17 Major Employers and Number of Employees, Upper Lake Melville

Employer	Number of Employees
Regional Agencies	
Labrador-Grenfell Regional Integrated Health Authority	370
Labrador School Board and six public schools	192
College of the North Atlantic	125
Regional Governments and Aboriginal Groups	
Sheshatshiu Innu First Nation and Social Services	214
Town of Happy Valley-Goose Bay	51 permanent and 30 seasonal
Nunatsiavut Government	53
Labrador Métis Nation	12 permanent and 4 seasonal
Private Employers	
SERCO	350-400 full-time and seasonal
Vale Inco	250
Woodward's Group of Companies	200 full-time and seasonal
NorthMart and affiliated businesses	130
Terrington Consumers Co-operative	47
Labrador Friendship Centre	32 permanent and 40 seasonal
Source: CLEDB 2006.	

Historically, the main employer and most important driver of the economy in Upper Lake Melville has been 5 Wing Goose Bay, the military base. Currently, it employs approximately 400 civilians and 100 military personnel and in 2006-07, total wages and salaries were estimated at $14.9 million (AMEC Earth and Environmental Ltd. and Gardner Pinfold 2008). The largest employer associated with the base is SERCO, providing base operation services, including maintenance and catering. SERCO employs approximately 350 of the 400 civilians. Spending by those employed in base-related activities has also had beneficial employment multiplier effects on the local retail sector (CLEDB 2006).

As of 2006, there were 329 businesses in Upper Lake Melville (Table 4.18), representing 35.8 percent of businesses in Labrador. The majority of businesses in the Upper Lake Melville Area (145) were small, with one to four employees. There were 42 businesses with 20 to 99 employees (Newfoundland and Labrador Statistics Agency 2007a).

Table 4.18 Number of Businesses, Upper Lake Melville, 2006

Industry	Number of Businesses
Agriculture, Forestry, Fishing and Hunting	x
Mining and Oil and Gas Extraction	-
Utilities	-
Construction	40
Manufacturing	9
Wholesale Trade	10
Retail Trade	77
Transportation and Warehousing	14
Information and Cultural Industries	x
Finance and Insurance	6
Real Estate, Rental and Leasing	15
Professional, Scientific and Technical	16
Management of Companies and Enterprises	x
Administrative and Support, Waste Management and Remediation	9
Educational Services	6
Health Care and Social Assistance	50
Arts, Entertainment and Recreation	10
Accommodation and Food Services	34
Other Services	28
Public Administration	5

Source: Newfoundland and Labrador Statistics Agency 2007a
Note: x = data not available

The majority of businesses in the area fall into the in the same five sectors as for the Province and Labrador as a whole, with construction firms ranking third by number (Table 4.18). At least a quarter of all local firms are self-described as tourism businesses (CLEDB 2007).

Québec Communities

Retail businesses in Schefferville include the Northern Store, which employees 16 people on a part-time and full-time basis providing food, alcohol and general merchandise, as well as Duberco, Inc and Radio which both provide fuel services including aircraft and diesel. Both Duberco, Inc. and Radio employ one person full-time and hire up to an additional two seasonal workers. National Automobile Rentals are also located in Schefferville, employing a single person. There is also a hardware store and a convenience store, each with two employees, in Schefferville.

Within Kawawachikamach, the majority of businesses are owned, either wholly or through joint-ventures, by members of the Naskapi Nation or the Naskapi Band. These businesses include Naskapi Imuun Inc., a wholly-owned Naskapi company responsible for internet services and cellular telephone services, Garage Naskapi Inc. which operates a gas bar, and Kawawachikamach Energy Services Inc., which operates the Menihek Generating Station, manages utility billing to Schefferville region, and maintains the associated transmission lines (NNK 2008).

4.3.3.4 Communities and Services

This section describes the current situation and recent trends with respect to housing, health care, education, recreation, transportation, utilities and security services in Labrador West, Upper Lake Melville and the Eastern Québec communities.

4.3.3.5 Housing

Labrador West

In Labrador City, the number of occupied dwellings increased by 3.2 percent between 1991 and 2006, from 2,695 to 2,780. In 2006, 78.8 percent of these were owned and 21.4 percent were rented. The average value of a home in Labrador City in 2006 was $107,604 and the average monthly rent was $521 (Statistics Canada 2006).

Between 1991 and 2006, the number of occupied private dwellings in Wabush increased from 680 to 690 (1.5 percent). The majority (84.1 percent) was owned and 15.2 percent was rented in 2006. The average value of a home in Wabush was $86,216 in 2006 and average monthly rent was $401 (Statistics Canada 2006).

Upper Lake Melville

The number of occupied private dwellings in the Upper Lake Melville increased from 2,820 in 1991 to 3,130 in 1996, and rose again to 3,180 in 2001. In 2006, the number decreased to 3,130, of which 1,870 (59.7 percent) were owned and 1,145 (36.6 percent) were rented. Most occupied dwellings were in Happy Valley-Goose Bay and most of those were single detached homes (Statistics Canada 2006).

Happy Valley-Goose Bay had 2,725 occupied private dwellings, 59.4 percent of which were owned and 40.1 percent rented. Of the total occupied dwellings, 61.8 percent were single detached homes, 18.2 percent were semi-detached and 5.7 percent were apartments. In 2006 the average value of owned dwellings in Happy Valley-Goose Bay was $133,504 and median monthly rent was $611 (Statistics Canada 2006).

Québec Communities

In total, the Québec communities near the Project site contained 370 occupied dwellings in 2006 (Statistics Canada 2006). Of these, approximately seven percent were owned and 21 percent rented, with the remaining 72 percent being band housing (Statistics Canada 2006).

There is a shortage of housing in Kawawachikamach. The housing stock comprises approximately 154 single-family dwellings, duplexes, apartments, maisonettes, and cottages, including five units constructed in 2007-2008. All of these units are owned by the Naskapi Nation of Kawawachikamach (NNK) and maintained with funds from its operations and maintenance budget. They are allocated on a first-come-first-served basis. The NNK maintains a chronological list of housing requests, and at the close of the 2007-08 fiscal year, there were 96 names on this list, the oldest from January 1997 (NNK 2008).

In 2006, there were 197 private dwellings in Schefferville; however, only 95 were occupied, down from 110 in 2001, a decrease of approximately 14 percent. Of these occupied dwellings, 15 are privately owned with an approximate average value of $54,700, and 60 are rented (Statistics Canada 2001; 2006). Almost half (47 percent) of the dwellings in Schefferville are single-detached houses. The remaining housing consists of semi-detached houses (approximately 32 percent) and small apartment buildings (approximately 21 percent) (Statistics Canada 2006).

In 2006-2007, there were 172 residential units in Matimekosh and 12 in Lac-John (INAC Matimekush/Lac John First Nation 2008).

There are also three hotels with a total of 42 rooms in the Schefferville region (Table 4.19). The Hôtel Royale also offers a 200-person conference hall and 20-person meeting room (S. Fortier pers. comm.).

Table 4.19 Temporary Accommodations in Schefferville, 2008

Hotel	Number of Rooms
Hôtel Auberge	12
Hôtel-Motel Royale	24
Hotel-Bla-Bla	6

4.3.3.6 Healthcare

Labrador West

Facilities and Services

The Captain William Jackman (CWJ) Memorial Hospital, located in Labrador City, is a fully accredited health facility which serves Labrador West. It has 20 beds, six of which are designated long-term care beds for levels three and four nursing care. Fourteen beds are for acute care. Inpatient units provide care to medical, surgical, obstetrical, pediatric, respite, palliative and intensive care patients. Maternity care is provided by family physicians and nurses.

The hospital is served by six family physicians, a general surgeon, and an anaesthesiologist. There are also a number of visiting specialists who come to the hospital on a regular basis (Labrador-Grenfell Health 2007). There are two dentists in the area with one other who visits for two weeks each month (O. Simpson, pers. comm.).

The 2008 provincial budget includes plans to spend $59 million on construction of a new Labrador West Health Centre to replace the CWJ. This is expected to be complete in 2011 (NLDF 2008).

Wabush Medical Clinic

There is a Medical Clinic in Wabush which is staffed by one doctor, who is also the physician for Wabush Mines.

Community Service Programs

Labrador-Grenfell Health has a Child, Youth and Family Services office in Labrador West. It has the mandate to provide child protective intervention services, youth services, adoption services, family and rehabilitative services, community corrections, child care services and residential services (Labrador Grenfell Health 2007).

Mental Health Services are provided at the CWJ. It has two addictions counsellors, one addictions coordinator/officer, 4.5 mental health counsellors as well as the regional mental health and addictions clinical manager. Churchill Falls employs one part time mental health nurse. Wait times for mental health counselling in Labrador City are up to four to six weeks, as position vacancies are a challenge to the department (Aura Environmental Research and Consulting Ltd., 2008).

Shelters

Hope Haven, a shelter and resource facility for women and children escaping domestic abuse, opened in 2004. The building can accommodate up to 225 women and children each year. It was expected to expand with the addition of ten new affordable housing units during the summer of 2008, but plans were put on hold due to construction delays (CBC 2008).

Ambulance Service

Labrador-Grenfell Health operates a provincial air ambulance service out of St. Anthony. In addition, it operates road ambulances, has specialized equipment to facilitate medical evacuation by snowmobile and provides physician/nursing escorts and paramedic services (Labrador-Grenfell Health 2007).

IOC also services Labrador City and surrounding area with an industrial ambulance that serves as a back up to the town’s ambulance (A. Johnson, pers. comm.).

Upper Lake Melville

Facilities and Services

There is one hospital in Upper Lake Melville, the Labrador Health Centre in Happy Valley-Goose Bay. The Labrador Health Centre offers full diagnostic and rehabilitative services and it is the referral centre for the community clinics in North West River, Mud Lake and Sheshatshiu. It is equipped with 26 beds and has a 24-hour Emergency Department, as well as out-patient clinics. When fully staffed, the Labrador Health Centre has 12 full-time physicians.

Specialists at the hospital include a general surgeon, an anaesthetist, and an obstetrician and gynecologist. Special clinics offered by the hospital include a well-woman clinic and several clinics offered by visiting specialists (D. Rashleigh, pers. comm.).

There is one long-term care facility in Upper Lake Melville. The Harry L. Paddon Memorial Home in Happy Valley-Goose Bay offers Level 2, 3, and 4 nursing care to residents (T. Dyson, pers. comm.). The Paddon Home has 29 rooms, including seven single-occupancy, 20 double-occupancy, one respite and one special care. A senior citizens’ home located on the grounds of the Paddon Home is staffed by registered nurses, licensed practical nurses and personal care attendants on a 24-hour basis. Seniors’ care is supplemented by visiting doctors and other services are available from various visiting professionals (Healthy Newfoundland and Labrador ND). The Paddon Home is more than 30 years old and not designed for patients with high care needs. In 2003 a need was identified to construct a new long-term care facility in Happy Valley-Goose Bay (NLDLAA 2006) which is under construction and should be completed in 2009.

Mental health and addictions services are located in the Labrador Health Centre and are staffed by a regional director, an addictions counsellor, an addictions coordinator, four mental health counsellors, an adolescent services coordinator and a community youth network coordinator. The Happy Valley-Goose Bay office is primarily responsible for services in other communities in Labrador, with the exception of Labrador City and Wabush.

Shelters

Libra House, located in Happy Valley-Goose Bay, has 10 beds and provides support programs and safe shelter for women and children in Upper Lake Melville and those from North Coast communities. In Sheshatshiu, the Nukum Munik Shelter provides 24-hour service and is funded by Indian and Northern Affairs Canada, the CMHC, and is sponsored by the Sheshatshiu Innu Band Council. Both shelters are sufficient to meet current demand, but are frequently at capacity.

Public Health

The Public Health Unit in the Labrador Health Centre is responsible for providing health clinics to the public including childbirth education, postnatal, child health and school health. It employs three public health nurses. It also employs a discharge planner and community supports coordinator, a regional home nursing coordinator, and a full-time communicable disease control nurse. A full-time medical officer of health, a regional cervical screening coordinator, a regional health promotion coordinator and a regional director are also on staff. The Public Health Unit is presently recruiting another continuing care nurse due to increasing demands related to acute care services (T. Dyson, pers. comm.). Labrador-Grenfell Health, under the direction of the medical officer of health, also offers a variety of programs that are aimed at health protection. Programs include Environmental Health, Communicable Disease Control, and Health Emergency Management (Labrador-Grenfell Health 2007).

Emergency Services

The Labrador Health Centre in Happy Valley-Goose Bay has an Emergency Department that is open 24 hours a day, seven days a week. On average, the Emergency Room sees 60 clients in a 24-hour period and approximately one-third of these are seen during the day (S. Jesseau, pers. comm.). Labrador-Grenfell Health operates a provincial air ambulance service out of St. Anthony on the Northern Peninsula and the Labrador Health Centre has its own plane in Happy Valley-Goose Bay to move patients to and from the Labrador coast. Labrador-Grenfell Health also operates road ambulances, has specialized equipment to facilitate medical evacuation by snowmobile and provides physician and nursing escorts and paramedic services (Labrador-Grenfell Health 2007).

The Labrador Ambulance Service in Happy Valley-Goose Bay is privately owned and operates two vehicles that service Happy Valley-Goose Bay and Mud Lake (albeit, in the latter case, only once patients have been transported across the river). The Labrador Ambulance Service is staffed by nine emergency response technicians, two of whom are full-time. The Service responded to 743 calls in 2007, up from 685 calls in 2004. Labrador Ambulance Service personnel believe that they could support additional demands (J. Squire, pers. comm.; J. Stacey, pers. comm.).

North West River has one ambulance, which is operated by the Labrador Health Centre, to serve people in North West River and Sheshatshiu. 5-Wing Goose Bay also has an ambulance that responds only to airfield emergencies.

Québec Communities

Since 2001, healthcare and social services in Kawawachikamach have been provided by the Naskapi Local Community Service Centre (CLSC) (Naskapi Nation 2008 – Naskapi Corporate Organizations List; M-S Lapointe, pers. comm.). The CLSC is administered by a board of directors composed mainly of Naskapis, overseen by the Council of the Nation, and jointly funded by Health Canada and the Government of Québec (Naskapi Nation 2008 – Naskapi Corporate Organizations List).

The CLSC employs 18 staff, including six nurses, three part-time physicians and one part-time dentist (Table 4.20). It offers minor emergency services, sampling and diagnostic services, nurse/physician consultation, home care, childhood prevention and promotion services, pharmacological services, pre- and post-natal services, psycho-social services, immunization, medical transportation of patients, and specialist services for dentistry, opthamology, otorhinolaryngology, nutrition, psychology, ergotherapy, and occupational therapy.

Table 4.20 Staff Employed by the Naskapi Local Community Service Centre, 2008

Position	Number of Employees
Nurses, full-time	2 nurses
Nurses, part-time	4 nurses
Physicians, full-time	1
Physicians, part-time	3
Dentists, part-time	1
Social Workers	2
Other, full-time	1 physio-therapist,
Other, part-time	2 Secretarial, 3 Support staff
Source: Marcel Lortie, pers. comm.	

CLSC medical services are provided exclusively to the Naskapi. However, emergency services are provided to people outside of the community, with the cost for such services billed to the Québec provincial government (L.M. Lortie, pers. comm.). The CLSC's medical centre and social services currently operate at capacity, and the CLSC has incurred a deficit each year since 2007. Current staffing levels cannot accommodate the growth of Kawawachikamach, which is expected to see a doubling of population within 15 years (L.M. Lortie, pers. comm.).

Schefferville Aboriginal healthcare and social services have been provided by the Innu Local Community Service Centre (CLSC) (M-S Lapointe, pers. comm.). The CLSC is an incorporated body administered by a board of directors composed mainly of and jointly funded by Health Canada and the Québec provincial government. The Innu CLSC employs 16 staff (Table 4.21). The dispensary provides the following services for the Innu community: minor emergency services; pharmacological services; sampling and diagnostic services; pre- and post-natal services; nurse/physician consultation; psycho-social services; home care; immunization; childhood prevention and promotion services; medical transportation of patients; specialization in diabetes treatment and prevention; and specialist services for dentistry, opthamology, otorhinolaryngology, nutrition, psychology, ergotherapy, and occupational therapy.

Table 4.21 Staff Employed by the Innu Local Community Service Centre, 2008

Position	Number of Employees
Nurses, full-time	2
Nurses, part-time	2
Physicians, full-time	3
Physicians, part-time	1
Dentists, part-time	1 (up for 2 weeks at a time)
Social Workers	2 child protection services
Other, full-time	2 psychologists come up for 2 weeks per month
Other, part-time	3 support staff
Source: Marie-Sylvie Lapointe, pers. comm.	

The Dispensarie de Shefferville provides the non-Aboriginal community with the following health care services: minor emergency services; pharmacological services; sampling and diagnostic services; pre- and post-natal services; nurse/physician consultation; medical transportation of patients; and immunization. The Schefferville CLSC has six staff, including four nurses, one full-time physician and one part-time dentist, but no psychologists or child care workers (Table 4.22).

Table 4.22 Staff Employed by the Schefferville Local Community Service Centre, 2008

Position	Number of Employees
Nurses, full-time	3
Nurses, part-time	1
Physicians, full-time	1 (1 to 2 month full time rotation
Dentists, part-time	1 (up for 2 weeks at a time)
Social Workers	None listed
Source: Helen Littlejohn, pers. comm.	

4.3.3.7 Education

Labrador West

Childcare and Early Childhood Education

The one early child care facility in Labrador West is located in Labrador City. Wee College Childcare Centre accepts children aged 2 to 6 years and can accommodate 32 children on a part-time basis (NLDHCS 2004).

Primary, Elementary and High School

There are four schools in Labrador City and Wabush (Table 4.23). Three are managed by the Labrador School Board and one is managed through the Conseil Scolaire Francophone Provincial de Terre-Neuve-et-Labrador. Between the 2000-01 and 2007-08 school years, the total student enrolment in Labrador West increased by 8.9 percent, from 1,387 to 1,510. During that time, the number of full-time teacher equivalents increased by only 0.3 percent (Newfoundland and Labrador Statistics Agency 2008). The Labrador School Board has had problems with the recruitment and retention of teachers (The Aurora, 2007a).

Table 4.23 Schools, Enrolment and Number of Teachers, Labrador City and Wabush, 2007/08

School	Location	Grades	Enrolment 2007/08[A]	Full-Time Equivalent Teachers 2007/08	Pupil-Teacher Ratio	School Capacity
A.P. Low Primary	Labrador City	K-3	402	24.0	14.7	600[B]
Menihek High	Labrador City	8-12	594	35.5	17.1	800[C]
Centre Educatif L'ENVOL	Labrador City	K-8, 10, 12	31	4.0	7.8	
J. R. Smallwood Middle	Wabush	4-7	485	30.8	15.3	1000[D]
[A] T. Pye pers. comm. [B] S. Kennedy pers. comm. [C] L. Simmons pers. comm. [D] H. Costa pers. comm.						

Post-Secondary

Post-secondary education is available in Labrador West through the College of the North Atlantic, which has a campus in Labrador City. Approximately 200 full-time and part-time students are registered there each semester (Table 4.24). An additional 200 students participate in continuing education evening courses (College of the North Atlantic 2008). The Labrador West CNA campus is the only campus in the Province to offer a two-year Mining Technician program and has been designated CNA's Mining Centre of Excellence. In 2007, a millwright and an electrical program began to be offered. In 2008, a welder program was added to the campus' trades offerings.

Table 4.24 Enrolment by Program, College of the North Atlantic, Labrador City Campus, 2008/2009

Trade Program	Number of Seats	Capacity
Welder	15	15
Construction/Industrial Electrician	16	16
Industrial Mechanic (Millwright)	16	16
Mining Technician (1st-year)	33	60
Mining Technician (2nd year)	66	75
Adult Basic Education	18	18
CAS Transfer: College- University	20	60
Engineering Technology (First Year)	5	30
Total Number of Students	**189**	**290**
Source: R. Sawyer pers. comm.		

The Government of Newfoundland and Labrador has allotted $18.1 million to build a new facility for the College of the North Atlantic in Labrador City (Government of Newfoundland and Labrador 2008). The building of the new facility will begin in late spring or early summer 2009 and will be finished in September 2010.

There is one private training institution, RSM Safety Institute, Inc., in Labrador City. It is a subsidiary of RSM Mining Services and offers 40 to 50 occupational health and safety training services for the mining and construction industries. These include Accident Investigation, Forklift Operation and Safety, Excavation and Trenching Safety and Safety for Supervisors. Class sizes at the Institute range from one to 40 participants, depending on the type of course and time of year. Courses are offered on a monthly schedule but are also available on an as-needed basis and typically are no longer than two days. Courses are generally offered in English, and some are offered in French (K. McCarthy, pers. comm.; K. Lee, pers. comm.).

Upper Lake Melville

Primary, Elementary and High School

There are six primary and secondary schools in Upper Lake Melville, including one francophone school (Table 4.25). Four are in Happy Valley-Goose Bay, while North West River, Sheshatshiu and Mud Lake each have one. Kindergarten through Grade 12 is offered in all of the communities except Mud Lake, which provides only Kindergarten through Grade 9 (Our Labrador 2004). The schools in the area have a total enrolment of 1,901 and the physical capacity to accommodate 2,340 students (Table 4.25).

Table 4.25 Student Populations, Primary and Secondary Schools, 2006/2007

School	Location	Grades	Service Areas	Number of Registered Students	Physical Capacity of School	Number of Full-time Equivalent Teachers
Peacock Primary	Happy Valley-Goose Bay	K-3	Happy Valley-Goose Bay	394	500	25
Queen of Peace Middle School	Happy Valley-Goose Bay	4-7	Happy Valley-Goose Bay	425	525	29
Mealy Mountain Collegiate	Happy Valley-Goose Bay	8-12	Upper Lake Melville Area	594	700	36
Lake Melville School	North West River	K-12	North West River and Sheshatshiu	118	200	11
Mud Lake School	Mud Lake	K-9	Mud Lake	4	15[A]	1
Peenamin Mackenzie School	Sheshatshiu	K-12	Sheshatshiu	351	400	34.5
École Boréale de Goose Bay	Happy Valley-Goose Bay	K-12	Happy Valley-Goose Bay and Sheshatshiu	15	N/A	3
Total				**1,901**	**2,340**	**139.5**

Note:
[A] The capacity of the school is 15 students, depending on the number of grades being taught in a given academic year.
Source: Newfoundland and Labrador Statistics Agency 2008.

The 2007 provincial budget includes $4 million to construct a new school in Sheshatshiu and $1.3 million to replace the francophone school in Happy Valley-Goose Bay (NLDF 2007).

Post-Secondary

Each year, the Happy Valley-Goose Bay campus of the CNA admits approximately 300 full-time students in a variety of programs, including Adult Basic Education, Automotive Service Technician and Office Administration (Table 4.26).

The CNA has recently expanded its Happy Valley-Goose Bay campus by adding six classrooms and a new library. The Labrador Institute is also co-located on the CNA campus. These changes will allow CNA to accommodate 200 additional students and will add to its overall service capacity to the Upper Lake Melville area (W. Montague, pers. comm.).

Table 4.26 College of the North Atlantic, Enrolment by Program, Happy Valley-Goose Bay Campus, 2005/2006

Program	Number of Students
Adult Basic Education	51
Office Administration	12
Office Administration (Executive)	10
Computer Support Specialist	5
Early Childhood Education	10
Millwright/Industrial Mechanic	16
Welding	15

Program	Number of Students
Automotive Service Technician	16
Heavy Duty Equipment Technician	17
Carpentry	10
Construction/Industrial Electrical	14
Integrated Nursing Access	17
Comprehensive Arts and Sciences: Transition [A]	31
Comprehensive Arts and Sciences: College University Transfer	32
Orientation to Trades and Technology	15
Total [B]	**271**

Source: S. Cochrane, pers. comm.
Notes:
[A] This program is for students that graduate from high school but may not have the requirements to get into a program
[B] These do not include figures for Adult Basic Education for the coastal Learning Centres, other contract programs, or advanced trades training.

Québec Communities

The Sachidun Childcare Centre in Kawawachikamach has Naskapi as its operational language and delivers the Aboriginal Head Start program. Funded by Health Canada, it prepares Aboriginal children for school by meeting their emotional, social, nutritional, and psychological needs (NNK 2008). The Centre is administered by a Board of Directors and employed more than 15 individuals, including six permanent educators, during 2007-08 (NNK 2008). It is presently operating at its capacity of 26 children, including two spaces reserved for emergency cases referred by Social Services (NNK 2008; M. Mameanskum pers. comm.).

The Garderie Matimekush daycare is located in Schefferville within the reserve of the Matimekush/Lac John Nation and currently provides places for 26 Innu children, which is its legal capacity. The Garderie employs five early childhood educators and two support staff.

Two schools, both managed by the Central Québec School Board, serve the Québec communities (Table 4.27).

Table 4.27 Schools, Enrolment and Number of Teachers, Eastern Québec, 2007/08

School	Location	Grades	Enrolment 2007/08	Full-Time Equivalent Teachers 2007/08	Pupil-Teacher Ratio
Jimmy Sandy Memorial School	Kawawachikamach	K-11	238	23.0	10.34
École Kanatamat Tahitipetetamunu	Schefferville	K-11	130	23	5.7

Table 4.28 Staff Employed by Jimmy Sandy Memorial School, Kawawachikamach, 2008

Position	Number of Employees
Teachers	23
Guidance Counsellor	1
Librarian	1
Liaison Officer	2
School Administration	6
Bus Transportation	2
Janitorial	2
Total	37

There are 238 students attending the school, providing an average of 10.34 students per teacher. The school also employs a special education teacher (NNK 2007: 92-93). The Government of Québec has approved further funding for the Adult Education Programme, which will facilitate the addition of more adult education resources (NNK 2007: 92).

Matimekush/Lac-John is served by a single K-11 school, École Kanatamat Tahitipetetamunu, in Schefferville (Table 4.29). During the 2007/08 academic year its enrollment was 130, an increase from 115 students in 2006/07 (C. Basque pers. comm.; INAC 2008 – Matimekush/Lac John First Nation). The school has 23 teachers, with a student-teacher ratio of 5.7:1 (Table 4.28). There is also a resource specialist, an administrator serving as Principal and Vice-Principal, a secretary, and two psychologists. The Principal has stated that the school structure could accommodate up to an additional 50 students (C. Basque pers. comm.).

Almost all of the École Kanatamat Tahitipetetamunu students are Innu; only two are non-Aboriginal. The languages of instruction are French and Innu, in keeping with the mandates of the provincial education authority (C. Basque, pers. comm.). The school currently has 30 adolescents who have dropped out without achieving Secondary 3 (M. Beaudoin, pers. comm.).

Table 4.29 Staff Employed by École Kanatamat Tahitipetetamunu, Schefferville, 2008

Position	Number of Employees
Teachers	23
Resource Specialist	1
Psychologists	2
Secretary	1
Principal/Vice-Principal	1
Bus Transportation	1
Janitorial	1
Total	30

4.3.3.8 Recreation

Labrador West

There are a number of indoor recreational facilities in Labrador City and Wabush. The Labrador City Arena is a gathering point for recreation in Labrador City. The building can accommodate 1,800 people and it has one rink which hosts large tournaments, games and activities. It has five dressing rooms, a meeting room and is also home of the Polaris Figure Skating Club and Labrador West Minor Hockey Association. Wabush also has an arena that is used by the Wabush Figure Skating Club, Labrador West Minor Hockey, Recreational and Olympic Hockey (Labrador West 2008). Other indoor recreational facilities in Labrador City and Wabush include the Carol Lake Curling Club and the Mike Adam Recreation Complex.

Outdoor activities are also popular in Labrador West as it has a number of walking trails, softball fields, soccer pitches and Labrador’s only 18-hole golf course. The Jean Lake recreational area in Wabush is used extensively by local organizations for their outings. Outdoor sport clubs in the area include the Menihek Nordic Ski club and the White Wolf Snowmobile Club (Labrador West 2008).

Upper Lake Melville

Happy Valley-Goose Bay has indoor and outdoor recreation facilities. NLDTCR operates the Labrador Training Centre in the town which houses the only swimming pool in Eastern Labrador, a gymnasium which is used for numerous community activities, a fitness room, and a judo room. Other sport facilities in Happy Valley-Goose Bay include a 1,000 seat arena, soccer and softball fields operated by the Town Council and four school gymnasiums (DND 2008). The Amaruk Golf and Sports Club operates a nine-hole golf course in the Summer.

5 Wing Goose Bay also has recreational facilities, including a full-scale gymnasium, an exercise room, two squash courts, a fully equipped weight room and two sauna baths. Other recreation facilities administered by the Base include a 10-bay auto hobby shop, a wood hobby shop and a softball field. Cultural recreation opportunities have also been increased with the development of a new theatre located adjacent to the new high school.

Québec Communities

The Kawawachikmach Recreation Facility provides an indoor pool (supervised), supervised indoor gym, and a snack bar. It provides employment to 13 staff including one recreation and sports coordinator, one manager, two lifeguards (two trainees), four games room attendants, and two janitors.

The community centre (NNK 2007) provides space for clubs to meet, community feasts and gatherings, family reunions, dances and fundraising activities. The centre has a multi-purpose room, a community library, a youth centre with couches, pool table, ping-pong table, big-screen television, a stereo and board and electronic games and three public-use computers with Internet access. It provides employment to 14 staff.

Other recreation facilities in the Kawawachikmach area include an open area hockey rink, basketball court and softball field.

The only recreation facility in Schefferville is an arena that is paid for by the Town and the Nation Innu Matimekush-Lac John. It provides ice hockey and skating on the indoor rink, with a snack bar and change rooms, and employs a recreation director and a support/maintenance person.

4.3.3.9 Transportation

Labrador West

Roads

The Trans Labrador Highway (TLH) is the primary public road in Labrador. Phase I of the TLH (Route 500) runs between Labrador West and Happy Valley-Goose Bay. In Labrador West it connects with Québec Route 389, which runs 570 kilometres north from Baie-Comeau to the Québec-Labrador border. This section of the TLH is a two-lane gravel highway between Labrador City and Happy Valley-Goose Bay. It has a service level of “A” (free-flowing traffic), with a capacity to carry 1,000 vehicles per hour. Currently, the highway carries 200 vehicles per day (D. Tee, pers. comm.).

The 2007-08 provincial budget allocated $15 million to commence hard-surfacing of Phase I of the TLH. In June 2007, tenders were issued to widen three sections of road in preparation for hard-surfacing, including a section in Labrador West and a section from Churchill Falls to the Churchill Falls Airport. Crews managed to widen 37 kilometres of road and complete 1.8 kilometres of hard-surfacing by March 31, 2008 (NLDTW 2008).

Airport

Labrador City and Wabush are serviced by the Wabush Airport, which is located within 5 kilometres of each town's centre. A number of air carriers operate scheduled flights, including Air Labrador, Air Canada Jazz and Provincial Airlines Ltd. (Labrador West 2008). The paved runway strip is 1948 m in length.

In 2006, Wabush Airport reported the highest percentage gain in airport passenger movements (16 percent) mainly due to a rise in mining activity. Between 2006 and 2007, the number of passenger movements at the airport in Labrador West increased by 6.2 percent, from 67,180 to 71,344 (NLDTCR 2007).

Railway

IOC operates the 420-km Québec North Shore and Labrador Railway (QNS&L), which IOC built to move iron ore to Sept-Îles. It also provides regularly scheduled, year-round, passenger service (NLDTW 2006). In 2005, Tshiuetin Rail Transportation Inc. (TRH) acquired the northern section of the QNS&L Railway line (the Menihek Subdivision), which runs between Emeril Junction, situated on the Trans Labrador Highway, 63 kilometres from Labrador West, and Schefferville, Québec. TRH now operates this portion of the rail line for passenger and freight rail services (Labrador West 2008).

Upper Lake Melville

Roads

The local road system in Upper Lake Melville links Happy Valley-Goose Bay with North West River and Sheshatshiu. Mud Lake is not accessible by road but can be reached by boat in summer and by snowmobile in winter. The roads in Happy Valley-Goose Bay are paved, as are some in North West River, but those in Sheshatshiu are not.

Construction on Phase III of the TLH, a 280-km section connecting Cartwright Junction and Happy Valley-Goose Bay, is scheduled to be completed in 2009. As a result of these road improvements, established trucking companies may face increased competition from other companies moving into the area (AMEC Earth and Environmental Ltd. and Gardner Pinfold 2008).

Ports

The Port of Goose Bay is on the western end of Lake Melville in an area known as Terrington Basin and has two industrial docks. Infrastructure includes storage sheds, asphalt and fuel tanks and a transshipment warehouse. There is also a substantial area of laydown space. There is a large area of land within easy access of these docks that could be converted to suit a variety of industrial needs.

Terrington Basin cannot handle large freight or passenger vessels and would require significant dredging for expansion of services (CLEDB 2006). The dock receives three to four oil tankers each year and one freighter every two weeks between mid-June and mid-November, which is the current operating season (D. Tee, pers. comm.).

Airports

Both civilian and military aircraft use the Goose Bay Airport, at 5 Wing Goose Bay. Operated by the Goose Bay Airport Corporation, it is one of the largest airports in eastern Canada. A number of air carriers operate scheduled flights, including Air Labrador, Air Canada Jazz and Provincial Airlines Ltd.

(which operates Innu Mikun Airlines), as well as Universal Helicopters and Canadian Helicopters (NLDTW 2006).

The airport has two runways, 3,367 m and 2,920 m in length, both capable of handling large aircraft. DND spent approximately $20 million on resurfacing and concrete replacement during the summer of 2006. The airport terminal was constructed in 1972 and has a design capacity of 32,000 people per year, but it is now handling more than three times this capacity. The number of passengers flying into the Goose Bay Airport in 2003 was 83,430 and in 2005, the number increased to 104,612, an increase of 15.1 percent. However, in 2006, only 94,422 passenger movements were recorded for the Goose Bay Airport, a decrease of 9.7 percent from 2005. They increased again in 2007 by 1.6 percent to 95,921 (NLDTCR 2007).

The Goose Bay Airport Corporation has hired a design and engineering firm to complete the plans for an improved and expanded terminal facility at its current location. Construction of the new terminal will begin in April 2009 and should be completed by the fall of 2010. The new facility will be able to accommodate an annual flow of 100,000 passengers, with further expansion capabilities incorporated into the design (G. Price, pers. comm.).

Québec Communities

Schefferville has an 8 km municipal road network, including access roads to such transport infrastructure as the airport and railway station. A municipal road also connects to the provincial highway, giving access to the community of Kawawachikmach. The municipal limits also contain approximately 200 kilometres of former mining roads constructed by IOC. These are on government land and give access to resources mostly in Labrador. They also lead to the resort area of Squaw Lake, Chatal Lake and Maryjo Lake. The municipality has no obligation to maintain these access roads (M. Beaudion, pers. comm.).

Several companies fly into Schefferville Airport, including Air Saguenay, Aviation Québec, Air Labrador and Air Inuit. The airport has a 1500 m runway, and employs four people. It is owned by Transport Canada and managed by the Societe aeroportuaire de Schefferville, representing the Naskapi Nation of Kawawachikamach, the Municipality of Schefferville and the Innu Nation of Matimekosh Lac-John (M. Beaudion, pers. comm.)

Schefferville is also served by the Menihek subdivision of the Québec North Shore and Labrador Railway, which delivers most of the freight that comes into the community, because there are no roads linking it to external communities.

4.3.3.10 Water, Sewer, Solid Waste, Power and Communications

Labrador West

Water

Beverly Lake, which is located northeast of Labrador City, is the Town’s only municipal water supply.

The municipal water supply in Wabush comes from Ouananiche Lake, which is located south of the town. The Town of Wabush has a grid distribution network which services approximately 700 households and businesses (Labrador West 2008).

Sewer

The Town of Labrador City maintains two separate primary Sewage Treatment Plants and three sewage lift stations (Labrador West 2008).

The Town of Wabush maintains one primary Sewage Treatment Plant. The town is in the process of upgrading the plant to better serve the residents of Wabush.

Solid Waste

The garbage from both towns is currently sent to an incinerator, however, in accordance with the Province's waste management plan it is scheduled to close by December 21, 2008. A study was commissioned in early 2008 to determine whether Labrador should develop one super-site to accommodate all of the garbage from Labrador West and Labrador East. In the meantime, the Labrador West regional waste management committee is considering setting up a temporary landfill at an old dump site (Morrissey 2008).

Power and Communications

Power is provided to Labrador West by Newfoundland and Labrador Hydro. Labrador City and Wabush are equipped with technological and telecommunications infrastructure with advanced fibre optic cables throughout communities and industrial sites. Internet service is provided to the communities by Sympatico and CRRS (Labrador West 2008).

Upper Lake Melville

Water

Happy Valley-Goose Bay, North West River and Sheshatshiu have piped water systems, while Mud Lake has ground wells that are fed by seepage from the Churchill River. Happy Valley-Goose Bay receives its water from two sources: the Water Treatment Plant and Spring Gulch, each of which provide 50 percent of the water to the town (Town of Happy Valley-Goose Bay 2001). The water system can support a population of about 12,000 people, but is currently serving only approximately 9,150 (S. Normore, pers. comm.).

Sewer

Happy Valley-Goose Bay and North West River have piped sewage systems that serve all dwellings. Most houses in Sheshatshiu and Mud Lake have septic systems. (S. Normore, pers. comm.)

Solid Waste

The landfill in Happy Valley-Goose Bay (3 kilometres north of Goose Bay Airport) has the capacity to last another 12 to 15 years at current use levels. Sheshatshiu and North West River have their own garbage collection services, but use the landfill in Happy Valley-Goose Bay. This may change in the future as the provincial government is in the process of setting up regional landfill sites (S. Normore, pers. comm.).

Power and Communications

Newfoundland and Labrador Hydro provides electricity to all communities in Upper Lake Melville with power generated at Churchill Falls. The communities of Mud Lake, North West River and Sheshatshiu are all part of the Happy Valley-Goose Bay interconnected service area. Aliant Telecom (Aliant) provides telephone service to Labrador through a microwave radio network.

Québec Communities

Waste Disposal

The present landfill opened in 1997 and services the three communities of Kawawachikamach, Lac-John and Schefferville. The lifespan of the landfill was originally 21 years although due to an absence of a waste management plan for discarded electrical appliances and other scrap metals, the life span has been reduced to approximately 15 years. Under Québec legislation, waste materials generated outside Québec cannot be disposed of in a landfill in Québec. Consequently, mining companies operating in Labrador have to have their own management plan for the disposal of all waste material including vehicles, tires of all size and scrap metals (M. Beaudoin. pers. comm.).

Water Supply and Sewage

In Schefferville, drinking water is taken from Lac Knob which lies within the municipal boundary. The chlorination and pumping station is gravity fed, with water being distributed to the community at large via waterlines that serve both Schefferville and the Matimekosh reserve. The sewer and water systems were both originally installed in 1955. A physico-chemical wastewater treatment system was installed in 1999.

In Kawawachikamach, water is supplied to households from two community wells with a pump station, while sewage is pumped to a community septic tank and lagoon.

4.3.3.11 Police and Emergency Response Services

Labrador West

Police services are provided to Labrador City and Wabush by the Royal Newfoundland Constabulary (RNC). In 2007, there were 22 police officers in Labrador West, 18 of whom were male and four of whom were female (Statistics Canada 2007).

The Labrador City Fire Department provides fire protection services to that community and answers an average of 60 calls each year (Labrador West 2008). The Town of Wabush operates a volunteer fire department consisting of 28 firefighters. They protect the residents of Wabush and offer backup to the Town of Labrador City. This department also provides services to Wabush Mines and the Wabush Airport.

Upper Lake Melville

The Royal Canadian Mounted Police (RCMP) is responsible for policing Upper Lake Melville and other parts of Labrador, with the exception of Labrador West. The Labrador District RCMP Headquarters in Happy Valley-Goose Bay has a staff of three. The Happy Valley-Goose Bay detachment is staffed by a Sergeant, two Corporals, 11 General Duty Constables, a District Support Services member, two General Investigation Section (GIS) Investigators and a Community Constable. Sheshatshiu is policed by the RCMP with consultation with and input from the community (RCMP 2008).

There are three fire departments in Upper Lake Melville. There is a municipal department in Happy Valley-Goose Bay with 34 firefighters, 30 of whom are volunteers and four of whom are full-time firefighters (D. Webber, pers. comm.).

5-Wing Goose Bay also has a fire department operated by DND and staffed by 39 paid firefighters. It provides 24-hour crash and emergency rescue services and general fire protection services for the Base.

Québec Communities

As for other remote areas of Québec, police services are ensured by the Surete du Québec through an outpost station. Of the four positions allocated for Schefferville, there are usually only two full-time police officers at the station considering assignments, training and vacation benefits. Upon request, they provide support to the native police forces of NIMLJ and Kawawachikmach (M. Beaudoin, pers. comm.).

For Schefferville and Matimekush-Lac John, policing is provided by the Surete du Québec, with an agreement to co-ordinate with the Naskapi police of Kawawachikamach when necessary. There are five employees including one support worker, three officers on patrol with one exchange person. At least two of the officers are available specifically to provide police services for the Innu reserve. For Kawawachikamach, policing is provided by the Naskapi Police Force. It has nine employees, including a director, an assistant director, five full-time officers, and a secretary/janitor.

For Schefferville and the Nation Innu Matimekush-Lac John, fire services are administered by the Town of Schefferville (Boudreau, pers. comm. and Securite Publique Québec website). There is a part-time fire chief as well as 15 volunteer firefighters. In Kawawachikamach, the Fire Department provides fire suppression and rescue, fire prevention and public fire safety education. It employs a full-time fire chief, one deputy fire chief, three team captains and 11 volunteer firefighters.

All ambulance services for Schefferville, Innu Matimekush-Lac John reserve and Kawawachikamach are handled by Ambulance Porlier, which provides continual coverage via dispatch for ambulance services throughout Eastern Québec. It employs three dispatchers and on-call drivers using two ambulances on rotation.

4.3.3.12 Local Government

Labrador West

Both Labrador City and Wabush are municipalities, each with a mayor and a town council.

Upper Lake Melville

Happy Valley-Goose Bay is an incorporated municipality administered by a mayor, town council and town manager. Mud Lake, 5 kilometres east of Happy Valley-Goose Bay, is a small unincorporated community of around 60 residents administered by a volunteer Local Improvement Committee.

North West River is 33 kilometres northeast of Happy Valley-Goose Bay. It is an incorporated municipality administered by a mayor, town council and town manager or clerk.

Sheshatshiu is approximately 25 kilometres northeast of Happy Valley-Goose Bay and adjacent to the settlement of North West River. It is an Innu community which acquired Federal Reserve status in 2006 and is administered by a Band Council.

Québec Communities

The Innu Nation community of Matimekush-Lac John is governed by an elected Band Council consisting of a Chief and Councillors. The community of Kawawachikamach is administered by the

Band Council, consisting of an elected Chief and Councillors. Schefferville is part of the regional county municipality of Caniapiscau; the regional county municipality seat is Fermont.

4.4 Data Availability and Gaps

The data and information used to describe the existing environmental conditions in the Project area and to inform the environmental effects assessment were obtained by a combination of literature searches and reviews of previous studies, on-site data collection and fieldwork by the Project team, and interviews with experts and local contacts. In general, the information gathered for this assessment is adequate for the purpose of assessing environmental effects and their significance according to the EIS Guidelines as set out by the Government of Newfoundland and Labrador. Environmental issues and controls associated with the proposed Project are well understood due to the knowledge accumulated from the previous mining operations at the site as well as the proposed use of proven mine technology and design. Residual environmental effects can therefore be predicted with a generally high degree of confidence. Additional information gathered during the aerial survey completed in May 2009 (LIM and NML 2009), and subsequent information to be collected (e.g., monitoring of telemetered caribou, genetics analyses) will assist LIM in refining mitigative measures and management plans.

4.5 Future Environment

The following describes the likely future environmental conditions in the proposed Project area if the Project did not proceed. This information is provided to help distinguish Project-related environmental effects from environmental change due to natural and/or other anthropogenic processes and trends in the Project area.

No substantial changes are expected to occur in the Project area with respect to the existing biophysical environment as a result of natural processes. The Project area has been heavily disturbed by past mining operations (up to 50 percent of the landscape on the James North and James South sites, and up to 90 percent of the landscape disturbed on the Redmond site). Without the Project, this landscape would continue to be a heavily disturbed site with flooded abandoned mine pits, a former rail bed, turning yards and stockpiles of mine waste and uneconomical ore materials. The area has remained heavily disturbed since mining on the site halted in 1982, and it is expected that landscape conditions would remain heavily disturbed in the absence of the Project. Given the reclamation plans (revegetation of the site, grading, removal of infrastructure, etc.), the future environment without the Project could actually contain a more heavily-disturbed landscape than if the Project were to go forward through and including land reclamation.

Some wildlife species in the Project area are subject to natural cycles and will likely undergo some natural changes over the designated time period in the absence of the Project. In the absence of the Project, it is expected that present caribou population trends will continue. Air quality in the area is generally good, and in the absence of the Project, air quality could be expected to remain generally the same, perhaps with some marginal improvements resulting from improved air quality regulations and controls in other parts of Canada and the United States that provide some long-range transport of airborne contaminants to the Project area. The effects of climate change on the Project area (as described in Section 7.7.1) will likely result in changes to the existing environment whether or not the Project goes forward.

Without the Project, current trends in the region’s socio-economic environment will continue. The populations of the local area communities will continue to decrease (in the absence of other influences or projects), as has been the trend in recent years.

The construction and expansion of other projects in the region are expected to continue with or without the Project. The environmental effects analyses presented in Chapter 7 of this EIS include consideration of the likely future condition of the environment as a result of these other activities in assessing and evaluating cumulative environmental effects.

5.0 PUBLIC CONSULTATION AND ISSUE SCOPING

The Newfoundland Environmental Assessment Regulations require that, during the preparation of an EIS, the Proponent must meet with interested members of the public in the local area to provide information on the proposed undertaking, and to record and respond to any concerns regarding the environmental effects of the Project. In accordance with this requirement, and as specified in the EIS Guidelines, public information sessions were held as part of the scoping exercise. These were the culmination of a comprehensive program of community engagement initiated by LIM in 2005, prior to the start up of any exploration or development work on the Project (Appendix O).

5.1 Public Information Sessions

5.1.1 Session Schedule

Public information sessions were held from November 26 to 28, 2008 (Table 5.1). As specified in the EIS Guidelines, this saw a session in Labrador West and, as recommended in the Guidelines, one in Schefferville, Québec. In addition, LIM held a session in Happy Valley-Goose Bay.

Table 5.1 Public Information Session Schedule

Date	Location	Venue
November 26, 2008	Happy Valley-Goose Bay	Hotel North 2, Goose Bay
November 27, 2008	Labrador West	Wabush Hotel, Wabush
November 28, 2008	Schefferville	Community Centre

During the course of its community consultation process since December 2005, the Proponent has held many other public information sessions, and meetings with community and business leaders, in Wabush, Labrador West, Happy Valley-Goose Bay, Schefferville, Sept-Iles and Kawawawachikamach.

Aboriginal consultations are discussed in Section 5.2 and in Section 6.

5.1.2 Public Notifications

As required under the provisions of the Newfoundland Environmental Assessment Regulations, and as specified in the EIS Guidelines, the public information sessions were advertised in local newspapers. Public notifications for the session in Labrador West appeared in the Aurora newspaper on November 24, 2008, and for the session in Happy Valley-Goose Bay in the Labradorian newspaper on November 24, 2008. In addition, public notifications of the Labrador sessions were posted in the Town Halls of Wabush, Labrador City and Goose Bay, as well as at a number of other prominent public areas.

The public notices described the nature and purpose of the information sessions, and stated the date, location, and time of the events. These advertisements also included contact information for the Proponent so that interested members of the general public who were not able to attend could forward any questions or comments that they might have about the Project (Appendix P).

5.1.3 The Sessions

The public information sessions provided an opportunity for local residents to obtain information on the Project, and to ask questions and raise any issues or concerns that they might have directly with the Proponent. Project representatives in attendance included Terence McKillen (Executive Vice-President, LIM), Linda Wrong (Vice-President Environment and Permitting, LIM) and Joseph Lanzon (Manager Government and Community Affairs, LIM). Mr. Lanzon and Ms. Wrong coordinated the sessions, distributed handouts and recorded any questions and comments raised. Mr. Paul Rideout (Newfoundland and Labrador Department of Environment and Conservation), Chairperson of the Environmental Assessment Committee, was present at the Happy Valley-Goose Bay, Labrador City-Wabush and Schefferville meetings to address questions related to the environmental assessment process.

Each of the sessions began at 7:00 p.m. The sessions in Labrador were conducted in English, while that in Schefferville was conducted in French. Visitors were requested to sign a guest book as they entered the venue, and were given a handout consisting of a summary of the Project (Appendix Q). Participants were encouraged to call the Proponent using a toll-free number or to write by email, mail or fax with any comments, questions or concerns relating to the Project.

The sessions featured a PowerPoint presentation by Mr. McKillen and a series of display panels which provided information on the proposed Project (including its location and development schedule, design details, mining and processing methods, and employment), the environmental assessment process and the existing aquatic, terrestrial and marine environments (Appendix R). This was followed by an informal question and answer session. Following this, attendees were invited to view the information panels, and to ask questions and provide comments on the Project to any of the LIM representatives in attendance. Refreshments were provided at each of the sessions. The sessions continued for as long as members of the public remained.

A debriefing session for the Project representatives was held at the end of each public information session. This gave the team members an opportunity to review discussions from the session, and ensured that all issues, concerns, and questions were recorded.

5.1.4 Attendance

Table 5.2 summarizes the attendance at the information sessions. The number of completed comment sheets includes those completed during the sessions, and those received by e-mail, fax or mail following the events.

Table 5.2 Public Information Session Attendance

Community	Visitor Count	Comments Received
Happy Valley-Goose Bay	25*	Positive interest expressed in: • procurement; • business opportunities; • contracting; and • potential employment.
Wabush-Labrador City	12*	Statement of positive support from the Mayor of Wabush: • hopes that the provincial government approves the Project in a timely manner; and • attended by miners from Wabush Mines interested in potential work opportunities to offset layoffs.
Schefferville	15*	Statement of positive support by Administrator of Schefferville: Identified opportunity for Schefferville to be a positive support to the Project while recognizing that it is a Newfoundland and Labrador Project.
Total	52	
*Some visitors attended the sessions without signing the guest book.		

5.1.5 Issues and Questions Raised

The issues and questions raised during each of the public information sessions are summarized below.

5.1.5.1 Happy Valley-Goose Bay

Attendees at the Happy Valley-Goose Bay public information session included representatives from the business community, representatives from the Innu Development Corporation, and representatives of individual Innu business. There were a number of questions regarding the business opportunities that might be available to residents of Upper Lake Melville. There were no negative comments made and the general impression received was one of support.

5.1.5.2 Wabush-Labrador City

Attendees at the Labrador West public information session included the Mayor of Wabush, a representative from the Economic Development Bureau, representatives from the business community and individual residents. There were questions regarding the employment and business opportunities that might be available to residents of Labrador West. The Mayor made a very supportive statement for the Project. There were no negative comments and the general impression was one of support.

5.1.5.3 Schefferville

The attendees included the Administrator of the Municipality of Schefferville and representatives from the business community and individual residents. There were questions regarding the business opportunities that might be available to residents of Schefferville. The Municipal Administrator noted that the community wanted to indicate its support of the Project and to advise LIM that, subject to discussion and planning, it was prepared to provide municipal services to the Project.

5.1.6 Summary

The public information sessions indicate that the proposed Project is generally viewed as a positive development for Western and Central Labrador, and in Schefferville. Most of the attendees were relatively well informed about mining in general and about the history of the Project. The majority of the questions asked during the sessions related to the employment and business opportunities, and the specifics of the mining, beneficiation and transportation processes. No bio-physical environmental issues were raised and the potential socio-economic benefits associated with the proposed Project were favourably received.

5.2 Aboriginal Consultations

As part of the consultation process, extensive consultations were held with the Aboriginal communities in the Québec-Labrador Peninsula. These communities have overlapping land claims issues or traditional rights issues covering this part of western Labrador. Consultations with the aboriginal communities also started in 2005 (Appendix O). They were conducted with:

- The Innu Nation of Labrador representing the Sheshatshiu Innu First Nation and the Mushuau Innu First Nation, respectively located at the communities of Sheshatshiu and Natuashish, Labrador;
- The Innu Nation of Matimekush-Lac John, located at Schefferville, Québec;
- The Naskapi Nation of Kawawachikamach, located at Kawawachikamach, Québec; and
- The Innu Nation of Takuaikan Uashat Mak Mani-Utenam, living in the communities of Uashat and Maliotenam, near Sept-Îles, Québec.

In July 2008, LIM entered into an IBA with the Innu Nation of Labrador, replacing an earlier Memorandum of Understanding. This life of mine agreement establishes the processes and sharing of benefits that will ensure an ongoing positive relationship between the LIM and the Innu Nation. In return for their consent and support of the Project, the Innu Nation and their members will benefit through training, employment, business opportunities and financial participation in the Project.

LIM has also entered into memoranda of understanding with the Innu Nation of Matimekush-Lac John and the Naskapi Nation of Kawawachikamach, and is in discussion with the Innu Nation of Takuaikan Uashat Mak Mani-Utenam respecting a similar memorandum of understanding. These memoranda relate to the development of an ongoing positive relationship between LIM and each First Nation relating to the development and operation of the Project.

A full description of all aspects of the Aboriginal consultation conducted in association with this Project is provided separately in Chapter 6.

5.3 Other Consultation

During the course of its community consultation process since December 2005, the Proponent held many other public information sessions, and meetings with community and business leaders, in Wabush, Labrador West, Happy Valley-Goose Bay and St. John's. Similar consultations took place in Schefferville, Matimekush-Lac John, Kawawawachikamach, Sept-Iles, and Uashat Mak Mani-Utenam in Québec.

5.4 Selection of Valued Environmental Components

Based on the results of the issues scoping exercise described above, a thorough understanding of the Project activities and the existing environment, the requirements of the EIS Guidelines and the professional judgment of the Study Team, the following VECs have been selected for consideration in this environmental assessment:

- **Fish and Fish Habitat**: This includes the physical and biological components of the freshwater environment such as substrate type, water depth, and fish species composition and distribution. Fish habitat has the potential to be adversely affected by Project activities resulting in physical disturbance of the water bodies or through Project effluents. As DFO requires loss of fish habitat to be compensated, a full assessment of the nature and extent of potential Project effects is required.
- **Caribou**: This will include consideration of woodland and/or migratory caribou and habitat in Newfoundland and Labrador and Québec. Woodland caribou are protected under both federal and provincial legislation, and any potential Project effects will require full assessment.
- **Employment and Business**: This will include consideration of hiring policies, training initiatives, employment of under-represented groups, potential for effects on existing industry and services and the ability of existing infrastructure to service the proposed construction and operation. The provincial government has requested that the Proponent demonstrate a goal of maximizing industrial benefits for the Province and the discussion around this VEC will be important in demonstrating this commitment.
- **Communities**: This will include the social and physical infrastructure and services of Labrador communities. As required by the EIS Guidelines, this EIS also provides a focus on healthcare.

A description of the environmental assessment methods used to assess the environmental effects of the Project is provided in Appendix S.

6.0 ABORIGINAL CONSULTATIONS

The Aboriginal groups of the Québec -Labrador Peninsula most directly affected by the Project are the Innu Nation of Labrador, the Naskapi Nation of Kawawachikamach (NNK), the Innu Nation of Matimekush-Lac John (MLJ), and the Innu Nation of Takuaikan Uashat Mak Mani-Utenam (ITUM) (Figure 6.1). These four groups may have overlapping land claims issues or traditional claims covering western Labrador.

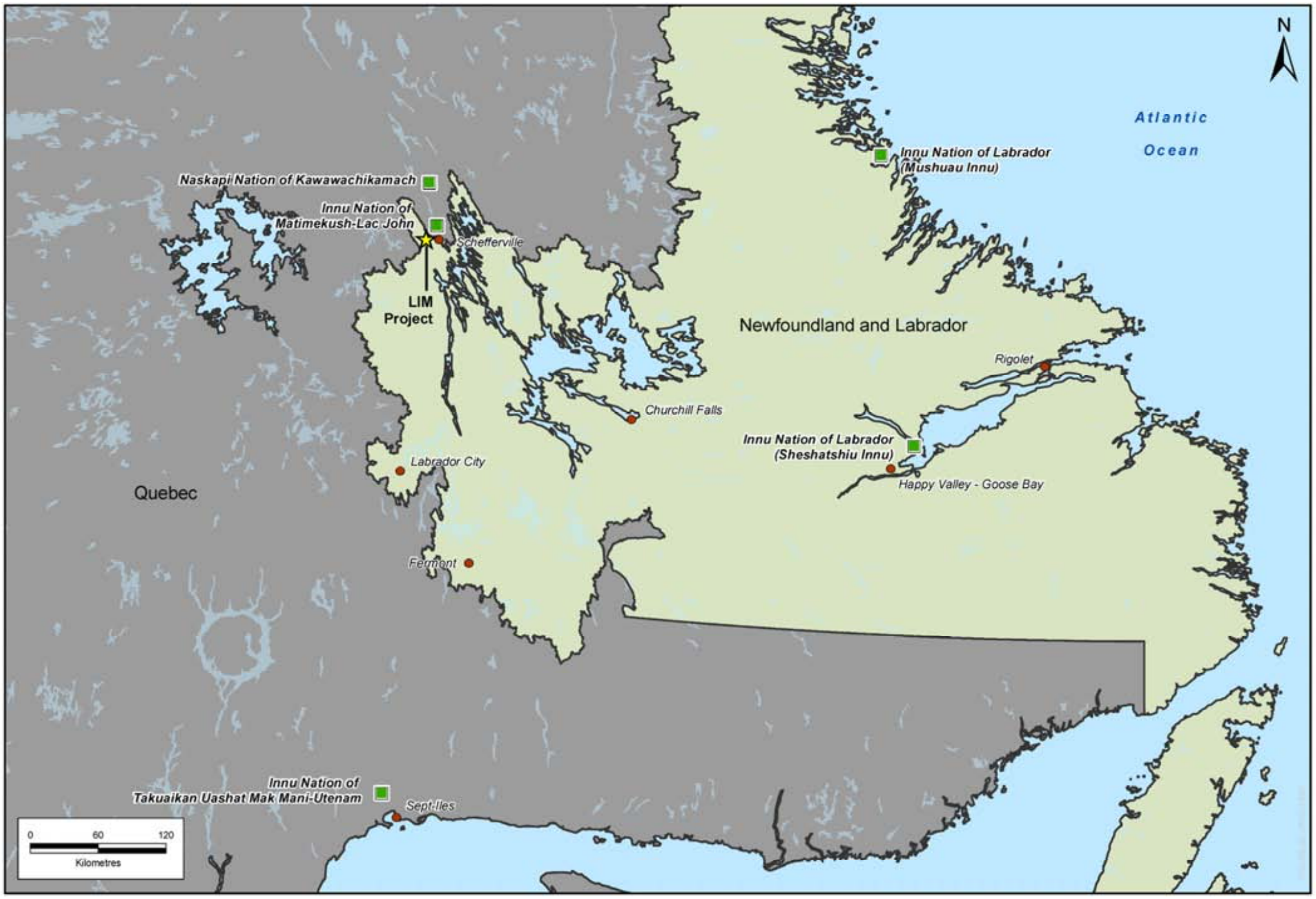


Figure 6.1 Aboriginal Communities

LIM has pursued an extensive and proactive engagement with all of the Aboriginal communities living close to the Project location or having traditional claims to the surrounding territory. LIM commenced consultations respecting the Schefferville Area Iron Ore Mine (Western Labrador) Project with a meeting between LIM and Naskapi Nation in Kawawachikamach in May 2005. Between May 2005 and July 2009, numerous consultation meetings were held in Newfoundland and Labrador (Labrador City/Wabush, Happy Valley-Goose Bay and St. John’s), Nova Scotia (Halifax), Québec (Schefferville, Kawawachikamach, Uashat, Matimekush, Montreal and Québec City) and Ontario (Ottawa and Toronto). Participants and summaries of each meeting are provided in Appendix O.

These consultations have resulted in the signing of an IBA with the Innu Nation of Labrador and Memoranda of Understanding with two Aboriginal groups in Québec. These memoranda relate to the establishment of a positive ongoing relationship between LIM and these First Nations relating to the development and operation of the Project.

6.1 Innu Nation of Labrador

The Innu of Labrador live primarily in two communities in central and coastal Labrador: the coastal community of Natuashish (formerly located on Iluikoyak Island/Davis Inlet), and the Upper Lake Melville community of Sheshatshiu. Residents of Natuashish are known as the Mushuau Innu, and residents of Sheshatshiu as Sheshatshiu Innu. Each community is administered by an elected Chief and Band Council. Politically, the two communities are represented by the Innu Nation, which is led by an elected Grand Chief.

The Labrador Innu claim Aboriginal rights and title to most of Labrador, referring to it as Nitassinan. Their land claim was accepted for negotiation by the federal and provincial governments, with formal negotiations beginning in 1991. An Agreement-in-Principle is presently being negotiated.

In 1998, the Mushuau and Sheshatshiu Band Councils formed Innu Development Limited Partnership, a for profit corporation registered with the Province. It is committed to creating opportunities for employment and economic development for private Innu businesses by creating and managing equity ownership and partnerships in strategic industries.

The Honourable Danny Williams, Premier of Newfoundland and Labrador, and Mark Nui, Grand Chief of Innu Nation, announced on September 26, 2008 the signing of the Tshash Petapen Agreement (The New Dawn Agreement). This Agreement resolves key issues relating to matters between the province and Innu Nation surrounding the Innu Rights Agreement, the Lower Churchill IBA and Innu redress for the upper Churchill hydroelectric development. This is described more fully below; however, final agreements based on the Tshash Petapen Agreement will be subject to ratification by the Innu people.

The agreement lays out the areas and location of Innu lands, and establishes economic areas to assure Innu participation in resource projects in the region. The agreement also provides compensation to the Labrador Innu for impacts associated with the Churchill Falls development. This Agreement settles the outstanding grievance of Innu Nation with respect to damages suffered to Innu lands and properties as a result of the flooding caused by the upper Churchill River development in the 1960s. The Agreement also contains the details of the commercial terms of the Lower Churchill IBA, which include a structured royalty regime and implementation funding to support Innu Nation's involvement in the Project during construction. Negotiations will continue in order to execute formal agreements. Once final agreements have been reached, Innu Nation will present the details to the Innu people for ratification, which is planned for 2009.

6.1.1 Issues

The main issues raised by the Innu Nation of Labrador regarding the Project are:

- Economic benefits and revenue sharing;
- Provision of sustainable economic development within the region in order to provide employment and business opportunities for its members. ;
- Protection for the environment;

- Training and education programmes so that Innu Nation members might fully participate in available opportunities; and
- Cultural and heritage protection and development.

Through discussion and negotiation during the Memorandum of Understanding and IBA process, the parties have reached satisfactory agreement on all of these issues, including the processes for implementation, coordination and oversight of mitigation strategies to address these issues. The communities will directly participate and/or be actively consulted as follows:

- Implementation committee;
- Community collaboration committee;
- Training and education committee;
- Establishing employment and workplace conditions;
- Business and contracting opportunities;
- Environmental monitoring committee;
- Traditional knowledge collection;
- Heritage resource and cultural protection; and
- Financial participation

6.1.2 Impact Benefits Agreement

In July 2008, LIM entered into an Impact Benefits Agreement with the Innu Nation of Labrador, replacing an earlier Memorandum of Understanding. This life-of-mine agreement establishes the processes and sharing of benefits that will ensure an ongoing positive relationship between the LIM and the Innu Nation. In return for their consent and support of the Project, the Innu Nation and their members will benefit through training, employment, business opportunities and financial participation in the Project.

6.2 Innu Nation of Matimekush-Lac John

The Innu Nation of Matimekush-Lac John, also known as the Montagnais Innu, live primarily in the northeastern Québec towns of Matimekush and Lac-John, near Schefferville. The community is governed by an elected Band Council consisting of a Chief and Councillors.

The Montagnais Innu of Matimekush and Lac-John voluntarily moved to the Schefferville region from Sept-Iles in the early 1950s when the Québec North Shore & Labrador (QNS&L) Railroad was completed. Initially they shared the community at Lac-John with the Naskapi, who arrived in the region at the same time. The Montagnais have historical and traditional interests in the region, having historically travelled to the region from Sept-Iles to trap and hunt. The community includes the reserve of Matimekush, adjacent to Schefferville, and the reserve of Lac-John, 3.5 kilometres from Matimekush and including the centre of Schefferville. When the Schefferville IOC mines closed in the early 1980s, the Montagnais extended the reserve of Lac-John into the town of Schefferville, to avail of the existing infrastructure no longer in use by the town (sewer and water system, school, arena).

The Montagnais Innu's comprehensive land claim, filed in association with the Atikamekw of southern Québec, was accepted federally in 1979 and provincially in 1980. The two Aboriginal groups were represented by the Atikamekw-Montagnais Council (AMC) until 1994. After dissolution of the AMC, the Montagnais Innu formed three negotiation groups: the Mamuitun mak Natashquan Tribal Council, the Mamu Pakatatau Mamit Assembly, and the Ashuanipi Corporation. The Ashuanipi Corporation presently represents the Innu communities of Matimekush-Lac John and Uashat Mak Mani-Utenam in comprehensive land claim negotiations.

Together with the NNK and Innu Nation of ITUM, the Montagnais Innu have acquired in interest in Tshiuetin Rail Transportation Inc (TSH), an aboriginal-owned corporation which owns and operates the northern portion of the QNS&L between Ross Bay Junction and Schefferville. Operations include passenger service twice weekly and weekly freight service between Schefferville and Sept-Iles. The Montagnais Innu are also partially responsible for maintenance at the Schefferville Airport and operate construction businesses.

Gestion Innu is an incorporated Canadian company. The main function of Gestion Innu is to run the day to day garage operations, snow removal contracts, and business development support for the Band office of Matimekush Lac-John. Gestion Innu has a board of directors and a President appointed from the Band Council and a regular community member.

6.2.1 Issues

The main issues raised by the Innu Nation of Matimekush-Lac John regarding the Project are:

- Sustainable economic development in order to provide employment and business opportunities for its members. The community comprises a significant un- or under-employed young population with little or no available employment base;
- Economic benefits;
- Environmentally and culturally sustainable development;
- Desire to see the commercial development of TSH Railway without impact on the existing passenger service; and
- Training and education programmes so that members of the community might fully participate in available opportunities.

Through discussion and negotiation during the Memorandum of Understanding process, the parties have openly discussed all of these issues and a cooperation and impact agreement currently being negotiated will include the processes for implementation, coordination and oversight of mitigation strategies to address these issues. It is expected that the communities will directly participate and/or be actively consulted as follows:

- Implementation committee;
- Community collaboration committee;
- Training and education committee;
- Establishing employment and workplace conditions;
- Business and contracting opportunities;
- Environmental monitoring committee;

- Traditional knowledge collection;
- Heritage resource and cultural protection; and
- Economic benefits.

6.2.2 Memorandum of Understanding

In March 2008, LIM signed a Memorandum of Understanding with the Innu Nation of Matimekush-Lac John and current discussions are underway for the development of an Impact and Benefits Agreement with the Nation.

6.3 Naskapi Nation of Kawawachikamach

The Naskapi Nation of Kawawachikamach was originally a small nomadic tribe, settling in Fort Chimo in the mid-1800s, before moving to Schefferville in the 1950s. The Naskapi relocated to the present site of Kawawachikamach, approximately 16 kilometres north of Schefferville in the 1980s following the James Bay Settlement.

Between 1981 and 1984, self-government legislation was negotiated with the federal government. These negotiations resulted in the *Cree-Naskapi (of Québec) Act* and led to the formation of the Naskapi Band of Québec in 1984. The Naskapi Band of Québec was one of the first self-governing Bands in Canada. The name was changed to Naskapi Nation of Kawawachikamach in 1999.

The community of Kawawachikamach is administered by the Band Council, consisting of an elected Chief and Councillors. In addition to typical municipal duties, the Band Council is responsible for maintaining the local police force, the local volunteer fire department, local childcare centre, and local school.

The Naskapi Nation, through the Band Council, operates several corporate entities within Kawawachikamach and Schefferville including the Naskapi Landholding Corporation, Garage Naskapi, Kawawachikamach Energy Services Inc., Naskapi Imun Inc (an internet service and software company), Naskapi Caribou Meat Inc., and Naskapi Development Corporation. In addition, they hold contracts for maintenance of the Schefferville Airport, local road maintenance, and own interests in Tshiuetin Rail Transportation Inc.

6.3.1 Issues

The main issues raised by the Naskapi Nation of Kawawachikamach regarding the Project are:

- Economic benefits;
- Provision of sustainable economic development in order to provide employment and business opportunities for its members. The community comprises a significant un- or under-employed young population with no significant employment base;
- Environmentally and culturally sustainable development including specific emphasis on the protection of any caribou observed;
- Training and education programmes so that its members might fully participate in available opportunities;

- Interest in the commercial development of TSH Railway; and
- Cultural and heritage protection and development.

Through discussion and negotiation during the Memorandum of Understanding process, the parties have openly discussed all of these issues and a cooperation and impact agreement currently being negotiated will include the processes for implementation, coordination and oversight of mitigation strategies to address these issues. It is expected that the community will directly participate and/or be actively consulted as follows:

- Implementation committee;
- Community collaboration committee;
- Training and education committee;
- Establishing employment and workplace conditions;
- Business and contracting opportunities;
- Environmental monitoring committee;
- Traditional knowledge collection;
- Heritage resource and cultural protection; and
- Economic benefits.

6.3.2 Memorandum of Understanding

In April 2008, LIM signed a Memorandum of Understanding with the Naskapi Nation of Kawawachikamach and current discussions are underway for the development of an Impact and Benefits Agreement. On April 3, 2009, representatives of the Naskapi Nation met with LIM representatives to discuss the EIS and their environmental concerns with the Project. LIM representatives addressed all of the concerns expressed at this meeting.

6.4 Innu Nation of Takuaikan Uashat Mak Mani-Utenam

The Innu Nation of Takuaikan Uashat Mak Mani-Utenam are closely related to the Montagnais Innu of Matimekush-Lac John. They have historical and traditional interests in the Project area, having traditionally used the area for hunting and trapping. They are one of the largest Innu communities in Québec, living in two settlements within their reserve, Uashat and Maliotenam, both on the Québec North Shore, near Sept-Iles. The communities are administered by a Band Council comprised of an elected Chief and Councillors. In addition to typical administrative duties, the Band Council also operates the local police force.

The Innu of Takuaikan Uashat Mak Mani-Utenam joined the Matimekush-Lac John Innu in 2005 to create the Ashuanipi Corporation to represent them in comprehensive land claims negotiations. This corporation also pursues economic development opportunities and has entered into joint ventures and local partnerships with other businesses.

6.4.1 Issues

The main issues of concern to the Innu Nation of Takuaikan Uashat Mak Mani-Utenam are:

- Economic benefits;
- Employment and business development opportunities for its members;
- Commercial development of TSH Railway;
- Environmentally and culturally sustainable development;
- Protection of the trapping activities of the Uashaunnaut families holding Beaver Lots in the region; Training and education programmes so that its members might fully participate in available opportunities; and
- Cultural and heritage protection and development.

The parties have openly discussed all of these issues and are currently working on a cooperation and impact agreement which will include the processes for implementation, coordination and oversight. It is expected that the community will directly participate and/or be actively consulted as follows:

- Implementation committee;
- Community collaboration committee;
- Training and education committee;
- Establishing employment and workplace conditions;
- Business and contracting opportunities;
- Environmental monitoring committee;
- Traditional knowledge collection;
- Heritage resource and cultural protection; and
- Economic benefits.

6.4.2 Impact and Benefit Agreement

Negotiations toward an IBA between LIM and the Innu Nation of Takuaikan Uashat Mak Mani-Utenam have been ongoing since September 2005. It is anticipated that the IBA will be signed by both parties in 2009.

7.0 ENVIRONMENTAL EFFECTS ASSESSMENT

The environmental assessment (EA) methods employed in this EIS are intended to:

- focus on issues of greatest concern;
- address regulatory requirements, including those identified through the Project-specific EIS Guidelines;
- address issues raised by the public and other stakeholders during Project-specific consultation; and
- integrate engineering design, mitigation, and monitoring programs into a comprehensive environmental management planning process.

The approach and methods used for the EIS are based largely on the work of Beanlands and Duinker (1983), the CEA Agency (1994; 1999), and Barnes et al. (2000), as well as the study team's experience in conducting environmental assessments. The EA methods provide a systematic evaluation of the potential environmental effects that may arise from each Project phase (construction, operation, and decommissioning) as well as malfunctions and accidents, with regard to each of the identified VECs. Project related environmental effects are assessed within the context of temporal and spatial boundaries established for each VEC. The evaluation of potential cumulative environmental effects includes past, present and likely future projects and activities that may interact with Project-related environmental effects. The specific steps involved in the environmental assessment for each VEC include:

- determination of the assessment boundaries;
- description of the existing conditions for each VEC;
- identification of potential Project-VEC interactions;
- overview of existing knowledge and mitigation or effects management measures;
- definition of the significance criteria for residual environmental effects;
- assessment of the environmental effects and mitigations or effects management measures;
- determination of the significance of Project residual environmental effects;
- cumulative effects assessment; and
- identification of any monitoring or follow-up requirements.

Additional information on the methods used to assess potential environmental effects of the Project to the VECs are presented in Appendix S.

7.1 Fish and Fish Habitat

Many of the waterbodies onsite comprise fish habitat and several species of fish are present in the lakes and streams on and adjacent to the James, Silver Yard, Redmond locations and the interconnecting access roads for the Project. Some of the riparian habitats adjacent to these waterbodies have been modified by previous mining activities.

Despite historical mining, some areas of fish habitat support fish communities that sustain themselves and interconnect with other communities downstream in the same watersheds. Surveys have identified the current distribution of these species in the waterbodies and riparian habitats associated with the James and Redmond mining activities.

7.1.1 Environmental Assessment Boundaries

Assessment area boundaries for fish and fish habitat are discussed in Section 4.2.4.2.

7.1.2 Existing Fish and Fish Habitat Environment

Section 4.2.4 summarizes the existing conditions for fish and fish habitat and the existing fisheries in the Project area. The assessment in this section focuses on fish and fish habitat that may be affected by the Project.

7.1.3 Potential Project-Fish and Fish Habitat Interactions

The potential Project interactions with fish and fish habitat are expected to be very limited as there is no direct construction or operation related impacts to fish-bearing waterbodies if standard and enhanced mitigations are applied. Potential interactions that could have an adverse effect on fish and fish habitat by the Project phases are summarized below.

7.1.3.1 Construction

Site clearing and construction activities near waterbodies have the potential to disturb riparian vegetation and resulting erosion or dust could introduce sediment into fish-bearing waters.

No new stream crossings are required for the construction and operation phases. No infilling of fish-bearing waterbodies are required. No materials (waste rock or reject fines) are to be deposited into areas of direct fish habitat.

While discharges to fish habitat have the potential to contain deleterious substances, such as hydrocarbons, suspended solids, and various potentially toxic substances (e.g., metals, solvents, or concrete products), no such discharges are planned.

7.1.3.2 Operation

Again, operational discharges are similar to those outlined for the construction period, with the addition of substances related to operation (e.g., reject fines and blast residue (ammonia)). The potential for acid rock drainage has been determined through testing to not be present in the Project area (Section 4.1.3.6).

Water withdrawal from fish-bearing waters has the potential to dewater habitats and affect survival or migration. There are no plans to withdraw water from the naturally-occurring surface water systems in the Project area. The groundwater dewatering system at the James Deposit is designed to pull the water table down enough to reduce groundwater accumulation in the active pits. This will also affect the water table, which feeds the two springs that maintain flows in the unnamed tributary on the James Property. The tributary downstream of the Project development footprint contains fish habitat (See Appendix N).

Beneficiation washwater will be directed to the historical Ruth Mine Pit, which will serve as a settling pond. Currently, existing pit water from Ruth Pit flows to, and is the origin of, James Creek. As shown in Figure 3.8 the added volume to Ruth Pit is an estimated 20 percent of the baseflow in James Creek and will only be added during the seven months of operation each year for an estimated total operation period of 5 years. This increase in flow is not expected to affect fish habitat in James Creek.

Blasting near fish-bearing waters has the potential to injure fish or developing eggs and fry; however, none is planned during the construction phase of the project and minimal blasting is expected during mine operation due to the presence of soft rock in the Project area. Should localized blasting be required during operations, it will be conducted to minimize potential impacts on any nearby surface water systems and work will be conducted in accordance with DFO's Guidelines for Protection of Freshwater Fish Habitat in Newfoundland and Labrador (Gosse et al. 1998).

7.1.3.3 Decommissioning

Decommissioning activities, including the removal of facilities and equipment, grading, and site revegetation, will have limited interaction with fish and fish habitat. Buffer zones of 15 metres will have already been established to protect fish habitat during operations as required by the Province. Revegetation of the site during decommissioning will provide additional buffering and erosion control for adjacent water bodies. No new stream crossings are required for the decommissioning phase and no infilling of fish-bearing waterbodies is required. No materials (waste rock or reject fines) are to be deposited into areas of direct fish habitat during decommissioning.

7.1.3.4 Summary

A summary of the potential interactions between the Project and fish and fish habitat is shown in Table 7.1.

Table 7.1 Potential Project-VEC Interactions for Fish and Fish Habitat

Project Activities and Physical Works	Potential Environmental Effects	
	Stress, Avoidance, or Mortality	Degradation of Habitat
Construction (Project activities in 2009)		
Site Preparation (grubbing, clearing, and excavating)	X	X
Placement of Infrastructure (reinstatement of rail spur, utilities)		
Placement of Equipment and Buildings		
Operations (on-site power generation, solid waste, grey water, human presence, and transportation)	X	X
Employment and Expenditures	X	
Operation (Project activities starting in 2010)		
Iron Ore Extraction (excavation – mechanical, blasting)	X	X
Iron Ore Beneficiation (crushing, washing, screening, stockpiling, hazardous and mining waste disposal)	X	X
Stormwater and Washwater Management	X	X
Transportation (on-site trucking, rail loading)		
Operations (on-site power generation, solid waste, grey water, human presence)	X	X
Employment and Expenditures	X	
Decommissioning		
Removal of Facilities and Equipment		
Site Reclamation (grading, re-vegetation)	X	X

7.1.4 Existing Knowledge and Mitigations

DFO has issued Guidelines for Protection of Freshwater Fish Habitat in Newfoundland and Labrador (Gosse et al. 1998), which provides a concise summary of the effects of poor environmental practices and the protective measures, or mitigations that protect fish habitat by limiting adverse effects from construction, operations, and decommissioning near waterbodies. The implementation of these and other guidelines, in concert with the application of LIM environmental policies and procedures, will mitigate the potential adverse interactions between the Project and fish and fish habitat. The potential effects span the Project phases (construction, operation, and decommissioning) and are described by category rather than phase. The categories that apply to this Project include: direct habitat destruction, pollution prevention, water management, and current and future fisheries.

7.1.4.1 Direct Habitat Destruction

As stated above there is no requirement for direct habitat destruction through any need to construct or operate in fish-bearing waters as all culverts and stream crossings are already in place. No infilling is required for the Project and no materials such as waste rock or reject fines will be deposited in fish-bearing waters.

Blasting activities will be limited in nature as little blasting may be required in the mine pits. All blasting will be distant from fish habitat as per DFO guidelines (Gosse et al. 1998; Wright and Hopky 1998); otherwise appropriate precautions will be implemented.

7.1.4.2 Pollution Prevention

The DFO guidelines detail measures for the control of clearing, grubbing, and the prevention of erosion in nearby waterbodies. These guidelines in conjunction with the maintenance of undisturbed vegetated buffer zones will control potential sediment releases into fish habitats. Other controls include suppression of dust (i.e., lift-off from exposed soils and generated from transport and crushing activities), and reduction of suspended solids in drainage channels through the use of geofabric, ditch dams, and proper layout of site drainage. Settling ponds will also be effective in reducing suspended solids from being released to the environment.

Other pollutants that could potentially be released into waterbodies include waste water/wash water, metals, blast residue (ammonia), concrete products and minor hydrocarbons from vehicle use. All of these can be controlled under normal circumstances through proper handling and disposal, site management and housekeeping practices, treatment where necessary (e.g., oil/water separators), and adequate emergency spill response equipment and training to address unplanned events.

7.1.4.3 Water Management

The Project may have the potential to affect fish and fish habitat by the withdrawal and release of dewatering activities. The plan for water management at the James site is comprised of two circuits.

Groundwater dewatering will be conducted continuously to reduce groundwater intrusion to the active mine pits at James. Although the initial groundwater dewatering may have elevated TSS, it is currently designed to incorporate source filtration at the well heads and it is further expected that well water upon full development will be clear. Clear groundwater dewatering will meet provincial water quality regulations and will be released, in part, to the unnamed tributary via a constructed settling pond to feed into the unnamed tributary on the James Property to maintain existing fish habitat. Any extra dewatering water will be directed into James Creek, with the groundwater potential being used at the Silver Yard for use in beneficiating the rock.

Pit water with elevated TSS will be pumped from the active pits to a settling pond at the SP1 settling pond area, prior to being pumped to the Silver Yard for use in the beneficiation process and then directed to the Ruth Pit.

There will be a storm water management pond at the Silver Yard to collect and manage site drainage.

Water for the Silver Yard beneficiation may come from two sources: clean water from the groundwater dewatering circuit, or residual pit water via the pit water settling pond at the SP1 settling pond area.

This water management plan is designed to protect fish habitat from dewatering activities and the potential of accidental washwater releases.

The Redmond Site will have a much simpler plan as pit dewatering requirements are reduced by a lower water table and because water from the active pit can be pumped directly to an exhausted nearby historical pit (Redmond 2). There is no surface flow connection between Redmond 2 and the unnamed stream nearby. To maintain this hydraulic isolation, the water level in Redmond 2 will be monitored during operations and once the water level reaches a pre-determined level, waste rock disposal from the proposed pits into Redmond 2 will cease and be stockpiled in other locations. In this manner, no overflow will occur.

7.1.4.4 Current and Future Fisheries

New developments in previous unpopulated or sparsely populated areas bring two potential pressures on existing fish resources and existing fisheries. First, anytime a new area of wilderness is opened, access is provided for others to come in and pursue the ‘new’ fishery. In extreme cases, the adult fish stocks can be depleted to the point that future recruitment is in jeopardy. This is not the case for this Project as all roads are already in place and resulting access provided to local fishers.

The second pressure is that Project personnel may pursue angling in the local streams and ponds to a level that again depletes the adult fish stocks. To mitigate this possibly, LIM will implement and enforce a no fishing policy for workers, including workers staying at the work camp seasonally during operations, and this policy will be effective in limiting angling pressure on the adjacent streams and ponds.

7.1.5 Environmental Effects Assessment, Management, and Residual Effects Determination

The potential effects of the Project on fish and fish habitat are summarized above by the three phases. Mitigative measures will be applied to the potential effects and the results are the residual effects, which are examined to determine their significance.

7.1.5.1 Residual Environmental Effects Significance Criteria

Residual environmental effects are those which are predicted to affect fish and fish habitat, once mitigation measures have been applied to a Project. Each prediction is described according to:

- geographic extent (i.e., site-specific, within the Assessment Area, throughout the Assessment Area and beyond);
- frequency of occurrence (i.e., once, infrequently, continuous, not likely to occur);

- duration (i.e., less than one generation, over several generations, permanent);
- magnitude (i.e., low - no measurable change relative to baseline conditions, moderate - measurable change that does not cause management concern, high - measurable change that does cause management concern);
- reversibility (i.e., reversible or irreversible);
- confidence (i.e., low or high confidence regarding the significance prediction); and
- likelihood (i.e., significant effect is likely or unlikely).

A significant adverse residual environmental effect is one in which the Project would cause a population decline, such that the viability or recovery of the local/regional fish species is threatened.

7.1.5.2 Summary of Residual Environmental Effects Prediction

A summary of the mitigation measures, and the significance of residual effects once mitigation is applied are provided in Tables 7.2, 7.3, and 7.4 for the three phases of the Project. Follow-up and monitoring requirements are indicated near the bottom of each table. An outline of monitoring activities is provided in Section 8.3 Environmental Monitoring and Follow-Up Programs.

Table 7.2 Summary of Residual Environmental Effects for Fish and Fish Habitat: Construction

Mitigation	
• Retain vegetated buffer zones where possible • Sediment control measures (settling ponds, geofabric, ditch dams, dust control) • Proper handling of waste, hazardous waste, waste water, wash water, • Implementation of emergency measures to respond to spills and other accidental events • Pit and site water to Ruth Pit • No fishing by Project personnel	
Significance Determination	
Geographic extent	Within the Assessment Area
Frequency of occurrence	1-2 years
Duration of impact	Less than one generation
Magnitude of impact	Low
Permanence/reversibility	Reversible
Significance	**Not Significant**
Confidence	Not applicable
Likelihood of occurrence	Not applicable
Follow-up and monitoring	
• Effluent monitoring under provincial and federal approvals and regulations	
Note – Confidence and Likelihood of Occurrence are Not Applicable when residual environmental effect is not significant	

Table 7.3 Summary of Residual Environmental Effects for Fish and Fish Habitat: Operation

Mitigation	
• Maintenance flow in Unnamed Tributary (James Deposit) to protect fish habitat • Erosion and sediment control as in Construction • Waste control as in Construction • Implementation of emergency measures to respond to spills and other accidental events • No fishing by Project personnel • No blasting near water • Pit and site water to Ruth Pit • Control of release from Ruth Pit	
Significance Determination	
Geographic extent	Within the Assessment Area
Frequency of occurrence	Continuous
Duration of impact	Over several generations
Magnitude of impact	Low
Permanence/reversibility	Reversible
Significance	**Not Significant**
Confidence	Not applicable
Likelihood of occurrence	Not applicable
Follow-up and monitoring	
• Effluent monitoring under provincial and federal approvals and regulations • EEM under provincial and federal approvals and regulations	
Note – Confidence and Likelihood of Occurrence are Not Applicable when residual environmental effect is not significant	

Table 7.4 Summary of Residual Environmental Effects for Fish and Fish Habitat: Decommissioning

Mitigation	
• Maintenance flow in Unnamed Tributary (James Deposit) to protect fish habitat • Erosion and sediment control as in Construction/Operation • Waste control as in Construction/Operation • Implementation of emergency measures to respond to spills and other accidental events • No fishing by Project personnel	
Significance Determination	
Geographic extent	Within the Assessment Area
Frequency of occurrence	Period of decommissioning
Duration of impact	Less than one generation
Magnitude of impact	Low
Permanence/reversibility	Reversible
Significance	**Not Significant**
Confidence	Not applicable
Likelihood of occurrence	Not applicable
Follow-up and monitoring	
• Effluent monitoring under provincial and federal approvals and regulations • EEM under provincial and federal approvals and regulations	
Note – Confidence and Likelihood of Occurrence are Not Applicable when residual environmental effect is not significant	

7.1.6 Cumulative Environmental Effects

The environmental effects assessment for fish and fish habitat has considered the potential effects resulting from the Project, compared with existing (much of which has resulted from past mining activities) and potential disturbances. Cumulative environmental effects result from other ongoing or foreseeable projects or activities that may interact cumulatively with the effects of the Project. The boundaries for cumulative environmental effects assessment are the same temporal and spatial boundaries for fish and fish habitat as defined above, i.e., the watersheds at the James and Redmond Deposits.

Existing projects, disturbances and activities considered to contribute cumulative effects include activities associated with the development of associated roads and the operation of the TRH railroad. Future projects for this area include the expansion of the existing Elross Lake Iron Ore Mine and the expansion of the current Project to include six additional deposits.

Cumulative effects may accrue from increased use of existing roads and the railway. An expansion of the Project to include the development of other pits at Knob Lake, Houston, Astray Lake, Sawyer Lake, Howse, or Kivivic will lead to increased traffic on the local roads and increased processing at the Silver Yard.

The potential cumulative effects are ones that have been described for the current Project and the same mitigative measures can be applied to reduce adverse environmental effects on fish and fish habitat. A summary of these potential cumulative environmental effects is shown in Table 7.5 along with the anticipated significance.

Table 7.5 Summary of Residual Environmental Effects for Fish and Fish Habitat: Cumulative Effects

Mitigation	
Other projects are subject to applicable Federal and Provincial regulations	
Significance Determination	**Fish and Fish Habitat at James & Redmond**
Geographic extent	Within the Assessment Area
Frequency of occurrence	Continuous
Duration of effect	Over several generations
Magnitude of effect	Low
Reversibility	Reversible
Significance	**Not Significant**
Confidence	Not Applicable
Likelihood of occurrence	Not Applicable
Follow-up and monitoring	
Monitoring limited to that directly connected with current Project	
Note – Confidence and Likelihood of Occurrence are Not Applicable when residual environmental effect is not significant	

7.2 Caribou

Caribou was chosen as a VEC based on the knowledge that the large and migratory George River Herd (GR Herd) occurs in the Project area on a seasonal basis, although their movements locally are difficult to predict year to year. This large herd has important cultural, recreational and economic benefit for residents and supports an extensive outfitting industry.

There is no tangible evidence to suggest that other caribou herds overlap the Project area at this time. Perhaps the nearest other herd of consequence, is the Lac Joseph herd, a sedentary population of Labrador, that exists over 100 km south of the Project area. This population, along with Labrador's other sedentary populations located at greater distances, is designated as "Threatened" by the Committee on the Status of Endangered Wildlife in Canada since May 2002 (COSEWIC 2008; SARA 2008) due the population decrease throughout most of the range. Formerly sedentary caribou existed also to the west and were known as the McPhayden and Caniapiscau Herds (Bergerud et al. 2008). The results of the aerial survey in May 2009 indicated that some caribou were still in the area (LIM and NML 2009) despite the fact that residents indicated the GR Herd had not been observed during the winter (R. McKenzie, pers. comm.). At the time of writing the herd affiliation of these caribou is unknown. Thus, for the purposes of the assessment and as a conservative measure, it will be assumed that woodland caribou do occur within the Assessment Area although they are at a low density.

The sensitivity of caribou to Project interactions and the importance of this species are key reasons why caribou was chosen as a VEC. The herd will be assessed because the Project overlaps with its range (i.e., during winter) and because of its socio-economic and cultural relevance to surrounding communities. Because of the unknown affiliation of the caribou observed in May 2009, woodland caribou will also be assessed in terms of Project interactions. The Project may affect caribou through changes in habitat availability or effectiveness, changes in movement patterns, and increased mortality through influences affecting predation/poaching/hunting and vehicle collisions.

A full description of the existing conditions regarding caribou including population, seasonal movements, and habitat use is presented in Section 4.2.2.1.

7.2.1 Environmental Assessment Boundaries

Environmental assessment boundaries for caribou are discussed in Section 4.2.2.1.

7.2.2 Potential Project-VEC Interactions

The potential interactions between caribou (whether from the GR Herd or possibly woodland caribou from one of the sedentary herds) and each Project activity during construction, operations, and decommissioning comprise the scope of the environmental assessment for this VEC (Table 7.6).

7.2.2.1 Construction

Project activities that involve some level of alteration and/or loss of habitat in the vicinity of the deposits may potentially interact with caribou; this includes site preparation, placement of infrastructure, and placement of equipment and buildings. The re-establishment of the Silver Yard as a beneficiation and load out area, construction of pipelines, and rehabilitation of site roads are all examples of activities that will, to some degree, change the already disturbed landscape in the Assessment Area. In addition, the re-establishment of the railway spur line along the existing rail bed increases the area of potential disruption. These activities may result in some habitat loss through clearing and removal of vegetation or through disturbance associated with noise, dust and/or visual changes that can displace caribou from suitable habitats that may exist near the development sites. However, it is noted that most of the surface areas of the current Project Area were previously disturbed by historical mining operations. Caribou also react to vehicle movements based on the rate of approach, and proximity (Horesji 1981).

In most instances, caribou flee for a short period, once the perceived threat is removed. Potentially temporary or longer-term displacement can result in a functional loss of habitat.

Mortality of caribou related to the Project may occur as a result of collisions with increased rail and vehicular traffic and may also occur in association with transportation during operations. Related to this potential interaction, is the possibility of an increased harvest of caribou with the increased accessibility due to road re-establishment, however, there are already numerous roads in the area remaining from the historical development.

Table 7.6 Potential Project-VEC Interactions for Migratory and Woodland Caribou

Project Activities and Physical Works		
Environmental Effects		
	Habitat Change	**Mortality**
Construction (Project activities in 2009)		
Site Preparation (grubbing, clearing, excavating)	X	
Placement of Infrastructure (reinstatement of rail spur, utilities)	X	
Placement of Equipment and Buildings	X	
Operations (on-site power generation, solid waste, grey water, human presence, transportation)	X	X
Employment and Expenditures		
Operation (Project activities starting in 2010)		
Iron Ore Extraction (excavation – mechanical, blasting)	X	X
Iron Ore Beneficiation (crushing, washing, screening, stockpiling, hazardous and mining waste disposal)	X	
Stormwater and Wastewater Management		
Transportation (on-site trucking, rail loading)	X	X
Operations (on-site power generation, solid waste, grey water, human presence)	X	
Employment and Expenditures		
Decommissioning		
Removal of Facilities and Equipment	X	
Site Reclamation (grading, re-vegetation)	X	

7.2.2.2 Operation

During the operation phase of activity, there is further potential for interactions with caribou, especially given the relative length of operation in comparison to the more short-term construction phase. Activities such as blasting and beneficiation will create noise levels that can be expected to have disturbance effects on caribou.

7.2.2.3 Decommissioning

During decommissioning, removal of facilities and equipment will result in further sensory disturbance to caribou in the area. In addition, site reclamation, including grading and re-vegetation, will result in conditions that would eventually be attractive to caribou. Following decommissioning, the quality of habitat for caribou will improve over the long-term.

7.2.3 Potential Effects and Review of Existing Knowledge

Issues and concerns relating to caribou and the proposed Project can be considered within two effects:

- Change in Habitat – related to the loss or reduction of caribou habitat from site clearing, and/or sensory (e.g., noise) disturbance associated with the presence and operation of people and equipment. This change in habitat can also result in an alteration of movements and distribution into lower quality habitat, and enhanced susceptibility to predation; and
- Mortality – directly related to increased hunting pressure as a result of improved access, and collisions with vehicles or other equipment.

7.2.3.1 Change in Habitat

Lichen is the primary winter food for caribou and thus influences abundance and distribution (Dzus 2001). Activities (natural and anthropogenic) that cause the removal of this important food source usually result in adverse effects for this species. Foster (1985) reported that lichen may take up to 40 years to recover in post-fire black spruce forests in Labrador. Caribou habitat may require more than 50 years for recovery following fire (Review by Bergerud et al. 2008). Forest harvesting, particularly of stands with relatively high lichen content (e.g., black spruce forest) also directly influence caribou use.

Mining and similar resource development projects on the landscape have been the subject of many assessments in relation to caribou. Bergerud et al. (1984) studied eight caribou populations exposed to industrial activities or transportation corridors and found that there was no evidence that disturbance activities or habitat alteration affected caribou productivity. They observed caribou’s resilience to human disturbance and also concluded that seasonal movement patterns and extent of range occupancy appear to be a function of population size as opposed to disturbance (Bergerud et al. 1984). Weir et al. (2007) looked at the impacts of Hope Brook gold mine in southwest Newfoundland on the La Poile Caribou Herd and concluded that prior to mine development, caribou were dispersed throughout the study area, but the number of caribou increased linearly with distance away from the mine over all five seasons during both construction and operation phases. Within 6 km of the mine center, group size and the number of caribou decreased as mine activity increased, indicating an avoidance of the development (Weir et al. 2007).

Monitoring of another Newfoundland caribou herd (Buchans Plateau Caribou Herd) during the development of a hydroelectric project in Newfoundland indicated that caribou densities were lower within 3 km of the site during the first year of construction (Mahoney and Schaefer 2002). The lowered caribou densities of this herd (particularly females with calves) within 3 km of the site persisted for at least two years after the construction phase had been completed. In addition to the change in distribution, they concluded that the development caused a disruption of migration timing during the construction phase and longer-term through operations (Mahoney and Schaefer 2002).

In addition to the 4-6 km reported for Hope Brook mine (Weir et al. 2007) and 3 km for the Star Lake hydroelectric development (Mahoney and Schaefer 2002), other reported distances of lower density around developments for caribou (usually females) include: 100 to 150 m for seismic lines (Dyer et al. 2001); and 1.2-50 km regarding forest harvesting (Chubbs et al. 1993, Smith et al. 2000, Schaefer and Mahoney 2002, Vors et al. 2007). This avoidance is cited as being related to the removal of suitable forage, increased susceptibility to predation particularly by wolves, and/or sensory disturbance associated with the presence of workers and equipment. Studies on the impacts of noise on wildlife indicate that the threshold above which potential negative effects are expected is 90 dBA (Manci et al.

1988). Noises at this level are associated with a number of behaviours such as retreat from the sound source, freezing, or a strong startle response. Harrington (2003) suggested that the most important reactions to noise are difficult to discern and often result in no overt reaction. However, observable reactions provide insight into the potential concerns of noise. Caribou react to noise and display startle reflexes, such as running or ceasing feeding, but these reactions are relatively short-term, resuming normal activities 5 to 15 minutes later (Harrington 2003). It is the extended period of noise that bring about concerns such as “masking”, or the inability of an animal to hear important environmental signals, such as noises made by potential mates, predators, or prey (Manci et al. 1988).

CEAA (1997) stated that noise and human presence associated with development would disturb caribou less than alteration of habitat, and would last for a shorter time - caribou would habituate to routine events. However, disruption of caribou may occur where anthropogenic influences are prolonged in space or time; habituation may not necessarily occur, even if the degree of human activity is not too high (Mahoney and Schaefer 2002). In addition to displacement, change in habitat may also result in the disruption of movements across linear features and/or move them into areas of higher predator exposure (Dyer et al. 2002). Additionally, linear facilities (e.g. roads, rail lines, right of ways) may reduce caribou crossings with increasing width, presence of vertical structures, increasing number of vehicles, and/or if aligned adjacent to each other (Curatolo and Murphy 1986, Wolfe et al. 2000, Dyer et al. 2002, Vistness et al. 2004). Bergerud (1996) and Ferguson and Elkie (2004) identify movement, low density distribution and the availability of high quality habitat as important factors for the avoidance of predation.

7.2.3.2 Mortality

Increased access through the development of expanding road networks or other linear corridors such as railways may result in increased legal and illegal hunting (Dzus 2001, Vistnes and Nelleman 2001). However, it is noted that LIM will not construct new rail lines as part of the Project as the existing railbed is already in place, having been constructed by historical mining operations. Hunting is normally not considered to be a population limiting factor but could become so if the caribou herd is in decline (Messier et al. 1988, Thomas and Gray 2002). Most mortality from hunting is therefore considered additive and not compensatory to other mortality factors (Bergerud et al. 2008).

Although statistics are unavailable, Nalcor Energy (2009) report that caribou are known to be struck by vehicles when attempting to cross the Trans-Labrador Highway. Collisions with trains are cited by Goldwin (1990) as a significant source of mortality for woodland caribou in northwestern Ontario. Forest fires may cause change in habitat through the availability of lichen (Foster 1985), but are not expected to cause mortality.

7.2.4 Residual Environmental Effects Significance Criteria

Residual environmental effects are those which are predicted to affect caribou populations, once mitigation measures have been applied. Each prediction is described according to:

- geographic extent (i.e., site-specific, within the Assessment Area, throughout the Assessment Area and beyond);
- frequency of occurrence (i.e., once, infrequently, continuous, not likely to occur);
- duration (i.e., less than one generation, over several generations, permanent);

- magnitude (i.e., low - no measurable change relative to baseline conditions, moderate - measurable change that does not cause management concern, high - measurable change that does cause management concern);
- reversibility (i.e., reversible or irreversible);
- confidence (i.e., low or high confidence regarding the significance prediction; and
- likelihood (i.e., significant effect is likely or unlikely).

A significant adverse residual environmental effect is one in which the Project would cause a population decline, such that the viability or recovery of the herd is threatened.

7.2.5 Mitigation Measures

In order to mitigate potential effects of the Project on caribou, activities during all phases of the Project will be planned with three main considerations:

- The recently completed caribou survey (May 2009) is considered inconclusive regarding the determination of the ecotype of caribou which were present in the project area. As such, LIM will undertake a caribou mitigation strategy which protects all caribou, including the potential for sedentary caribou to exist, although their presence/absence in the project area is currently unconfirmed. Additional associated survey data, such as outstanding DNA analyses, satellite collar data, and ongoing monitoring are anticipated to be of assistance in the near future in the determination of caribou type. LIM proposes that the mitigation strategy and supporting data be re-assessed at the end of Year 1 of operation for appropriateness and effectiveness including clarification of caribou ecotype;
- In the event that caribou are observed within the Assessment Area or in the vicinity of Project activities, a set of procedures will be incorporated to reduce or eliminate disturbance and encounters with caribou; and
- Any activity that may potentially affect caribou habitat or mortality in some manner will be implemented with appropriate mitigation regardless of whether caribou are actually present.

Specific mitigation measures that apply to woodland caribou will include:

- Woodland caribou typically occur in small groups (1-6 animals), whereas migratory caribou such as the George River, may exist in large herds (>100). Should small groups of caribou (e.g., 1-6 animals) be observed at Project facilities and/ or by Project personnel (i.e., essentially within 3 km of the mine area), LIM will take such actions as are deemed necessary or appropriate so as to ensure that there is no harm to caribou, including such actions as to modify/restrict any activities that could result in harm to caribou until LIM has contacted the Provincial Wildlife Division to review the information. To support Wildlife's evaluation, LIM will provide information including the number of animals, location and direction of their movement on a topographic map, as well as the location of ongoing Project activities, although the identification of the actual ecotype of caribou may not be possible at that time.LIM will work with the Wildlife Division to review the information and provide guidance on activity modifications or adjustments on a case by case basis that will eliminate any potential for harm or harassment until these animals are outside of this area. There will be no hunting or other harassment of these animals at any time within a 3 km radius of Project facilities/activities.
- If caribou are observed at a distance of 3 to 5 km from Project infrastructure and activities, LIM will issue an advisory of their proximity to personnel to be alert and that activities may need to be modified until these animals have left the area; and

- Sightings of caribou or reports of same within a 20 km radius will be included in regular advisories and briefing documents such as the Environmental Protection Plan (EPP). Project personnel will be able to document potential observations of caribou (and other wildlife) during daily commuting, and throughout the road network connecting the ore bodies of this Project.

Specific mitigation measures that apply to caribou from the GR Herd will include:

- Encounters between these caribou and personnel/equipment will be addressed through a non-harassment policy that will include no hunting, pursuit or other chasing, vehicles will yield to wildlife, and if in the event blasting was scheduled, details of the proposed location of this activity as well as the location of the caribou will be provided to Wildlife Department for their review and instruction;
- Should caribou from this herd approach the Project area (i.e., within 5 km), an advisory will be issued to Project personnel, to be alert and exercise caution;
- Should animals from this migratory herd enter the 50 km radius [as indicated by observations within the community, co-ordination with Provincial authorities (e.g., monitoring of satellite collars via the internet) and other stakeholders], management staff will be advised; and,
- Ongoing traditional knowledge reports, including documentation of animal movements and activities, will be conducted by LIM with local communities to provide further information on caribou behaviour and locations.

Other mitigation measures to be implemented with Project activities are outlined in Table 7.7.

Table 7.7 Proposed Mitigation Measures for Caribou

Project Activities	Mitigation Measures
Construction (Project activities in 2009)	
General	When caribou are observed within 3-5 km of the site, modify or restrict any activities that could result in harm to caribou until LIM has contacted the Provincial Wildlife Division to review the information.
Site Preparation (grubbing, clearing, excavating)	Clear vegetation in a pattern that does not leave a recognizable trail, where practical. This reduces accessibility and visibility to humans and predators. These activities would be restricted to the physical footprint of the Project. Fire prevention and response procedures, training and equipment will be implemented.
Placement of Infrastructure (reinstatement of rail spur, utilities)	The width, density and length of access roads and rail lines will be minimized. Where possible, any new disturbance will be reduced by locating these facilities adjacent to existing areas of surface disturbance. Ensure that linear facilities such as rail lines and roads are separated by more than 100 m, where practical.
Placement of Equipment and Buildings	Fence hazardous construction areas such as open pits, or any locations with blasting activities
Operations (on-site power generation, solid waste, grey water, human presence, transportation)	Personnel authorized to operate company vehicles will possess a valid driver's license, undergo employee orientation and safety training, and be briefed on seasons of greater risk of wildlife-vehicle collisions Speed limits of 50 km/hr (daylight) and 30 km/hr (darkness) and wildlife caution signs will be posted and enforced along Project roads and rail lines. Traffic reduction/convoying would be implemented through sensitive caribou areas such as crossings in the event of caribou being reported in the area; Approach ramps would be installed at strategic locations such as crossings along linear disturbances. A "bear-aware" waste management plan will be developed and implemented to reduce the likelihood of bears (predators) in the Project areas. All observations of caribou by staff will be recorded (including observer, time and location) and

Project Activities	Mitigation Measures
	submitted to wildlife monitors and LIM management to determine appropriate mitigation. Hazardous material handling procedures, training and response in the event of a spill will be implemented.
Employment and Expenditures	No hunting and firearms policies will be enforced among all personnel. Monitors will be used to keep construction staff and management informed on the presence of caribou at the mine site as described above.
Operation (Project activities starting in 2010)	
Iron Ore Extraction (excavation – mechanical, blasting)	In the event that caribou are observed near the site when blasting is scheduled, details of the proposed location of this activity as well as the location of caribou will be provided to Wildlife Department for their review and instruction.
Iron Ore Beneficiation (crushing, washing, screening, stockpiling, hazardous and mining waste disposal)	Fence hazardous construction areas, such as locations with open pits or any explosive activities. Fire prevention and response procedures, training and equipment will be implemented. Hazardous material handling procedures, training and response in the event of a spill will be implemented.
Stormwater and Wastewater Management	Ensure materials are handled and disposed consistent with federal and provincial regulations
Transportation (on-site trucking, rail loading)	Personnel operating company vehicles will possess a valid driver's license, undergo employee orientation and safety training, and be briefed on potential for and strategies for avoiding, wildlife-vehicle collisions Speed limits of 50 km/hr (daylight) and 30 km/hr (darkness) and wildlife caution signs will be posted along Project roads and rail lines
Operations (on-site power generation, solid waste, grey water, human presence)	A "bear aware" waste management plan will be developed and implemented to reduce the likelihood of bears (predators) in the Project areas. Observations of caribou (and other wildlife) by staff will be recorded (including observer, time and location) and submitted to monitors and LIM management to determine appropriate mitigation.
Employment and Expenditures	No hunting and firearms policies will be enforced among all personnel while onsite. Monitors will be used to keep operations staff and management informed on the presence of caribou at the mine site.
Decommissioning	
Removal of Facilities and Equipment	Modify or restrict activities while caribou are in the Project area to assure no harm or harassment. Personnel operating company vehicles will possess a valid driver's license, undergo employee orientation and safety training, and be briefed on potential for and strategies for avoiding wildlife-vehicle collisions. No hunting and firearms policies will be enforced among all personnel while onsite. Monitors will be used to keep staff and management informed on the presence of caribou at the mine site. Speed limits of 50 km/hr (daylight) and 30 km/hr (darkness) and wildlife caution signs will be posted along Project roads and rail lines.
Site Reclamation (grading, re-vegetation)	Reclamation techniques will emphasize the revegetation of the site with local plants that would encourage growth of caribou winter forage. Fire prevention and response procedures, training and equipment will be implemented. Hazardous material handling procedures, training and response in the event of a spill will be implemented.

7.2.6 Environmental Effects Assessment, Management, and Residual Effects Determination

The determination of residual environmental effects examines the potential change in habitat or mortality as a result of the interactions identified in Table 7.6, for each phase of the Project.

7.2.6.1 Construction

Most of the construction-affected area will occur immediately adjacent to (or within) already disturbed locations from the previous mining activity. The interaction is further reduced as this portion of the GR Herd range is used seasonally if at all. As the results of the May 2009 survey (LIM and NML 2009) are inconclusive, the mitigation measures for woodland caribou described above (including modification or reduction of activities if Project personnel or others observe caribou) would apply. The measures identified in Table 7.7 to limit the amount of surface disturbance (e.g., limit the width, density and length of access trails and rail lines) and to implement no harassment policies will reduce the potential amount of physical and sensory displacement associated with the Project during construction. Based on the literature, it is reasonable to assume caribou may avoid cleared areas or active work locations by at least 3 km.

Mortality associated with the construction phase is anticipated to be unlikely. Several measures will be in place to restrict personnel from hunting on the property and to restrict others from accessing, should caribou be present. If caribou do enter the work area, and the woodland caribou mitigation is in place; LIM will take such actions as are deemed necessary or appropriate so as to ensure that there is no harm to caribou, including such actions as to modify/restrict any activities that could result in harm to caribou until LIM has contacted the Provincial Wildlife Division to review the information. The surrounding terrain will alleviate visual and auditory stimuli from the Project should other wildlife occur to the west of such activities. If the migratory caribou enter the work area, vehicle operators will be instructed to yield to all wildlife. Reduced speed limits will be maintained regardless of the presence of caribou. Potential entrance points at open pits and steep slopes will be fenced.

7.2.6.2 Operation

No further habitat loss will occur during operation. Sensory disturbance around work areas will continue that could represent at least 3 km avoidance, should caribou enter the area. Linear corridors for vehicle or rail transport would potentially reduce or prevent crossing by caribou depending on the level of activity. Controlled speed limits, yielding to wildlife and no-harassment policies will limit this sensory disturbance. Furthermore, alerts when caribou enter the Assessment Area and communication with the Provincial Wildlife Division, particularly when blasting activities are planned, will limit disturbance during operations.

As with construction, the mitigation measures (Table 7.7) to reduce the possibility of mortality related to the Project will be in place. Speed limits will be posted, a no harassment policy will remain in place, no hunting in work areas, and onsite access will be restricted to personnel. If the woodland caribou mitigation is in place, LIM will take such actions as are deemed necessary or appropriate so as to ensure that there is no harm to caribou, including such actions as to modify/restrict any activities that could result in harm to caribou until LIM has contacted the Provincial Wildlife Division to review the information. If it is assumed that the migratory caribou mitigation applies, LIM will co-ordinate with Provincial Wildlife Division officials when caribou enter the Assessment Area and possibly approach the Project infrastructure. This will allow for advance planning and communication to further reduce the possibility of mortality to the GR Herd. If larger numbers of migratory caribou (i.e., >100 are present, activities may need to be delayed or modified until the caribou have moved out of the area.

7.2.6.3 Decommissioning

One of the main objectives of decommissioning will be to restore the LIM Project work areas to a more natural state, including those areas within the LIM development area that were previously abandoned by others without remediation. Areas will be sloped and/or revegetated, and/or left in a situation that would allow revegetation such that there would be a net gain in available habitat. There will be some ongoing sensory disturbance associated with the site reclamation but this will be temporary. Should caribou be present at the time, a similar avoidance of at least 3 km could be expected. Again, if the woodland caribou mitigation is in place, as with construction, the mitigation measures (Table 7.7) to reduce the possibility of mortality related to the Project will be in place. Speed limits will be posted, a no harassment policy will remain in place, no hunting in work areas, and onsite access will be restricted to personnel. If the woodland caribou mitigation is in place, LIM will take such actions as are deemed necessary or appropriate so as to ensure that there is no harm to caribou, including such actions as to modify/restrict any activities that could result in harm to caribou until LIM has contacted the Provincial Wildlife Division to review the information. If it is assumed that the migratory caribou mitigation applies, LIM will co-ordinate with Provincial Wildlife Division officials when caribou enter the Assessment Area and possibly approach the Project infrastructure. This will allow for advance planning and communication to further reduce the possibility of mortality to the GR Herd. If larger numbers of migratory caribou (i.e., >100 are present, activities may need to be delayed or modified until the caribou have moved out of the area.

If the migratory caribou mitigation applies, the same mitigation measures related to the operation of equipment and responsibility of LIM and its workforce regarding wildlife will be in place throughout the decommissioning period (Table 7.7). Active work sites will continue to be posted as no hunting areas and staff will abide by the no hunting or other harassment policy until the area is returned to a natural state to the satisfaction of Provincial officials.

7.2.6.4 Summary of Residual Environmental Effects Prediction

During construction, the monitoring program and on-site mitigation measures will reduce both the physical extent of activities, and the associated disturbance and possibility of mortality related to the Project. The geographic extent of this activity will be site specific and occur in a continuous manner during this phase. The clearing associated with the Project is minimal as the development area is within a historically disturbed former mining area and would require several generations to recover. As a result, this effect as well as the unlikely possibility of mortality is not at a level that would cause management concern. The effects associated with the LIM Project development are considered reversible and are not significant (Table 7.8).

Table 7.8 Summary of Residual Environmental Effects for Caribou Construction

<table>
<tr><th colspan="3">Mitigation</th></tr>
<tr><td colspan="3">• Monitor movements of the GR and/or possible woodland Herds. Reduce speed limits, fencing construction sites, patterns of vegetation clearing, no hunting policy, reduce construction activities while caribou are present</td></tr>
<tr><th>Significance Determination</th><th>George River Caribou Herd</th><th>Possible Woodland Caribou Herd</th></tr>
<tr><td>Geographic extent</td><td>Site-specific</td><td>Site-specific</td></tr>
<tr><td>Frequency of occurrence</td><td>Continuous (throughout construction)</td><td>Continuous (throughout construction)</td></tr>
<tr><td>Duration of effect</td><td>Less than one generation</td><td>Less than one generation</td></tr>
<tr><td>Magnitude of effect</td><td>Moderate</td><td>Low</td></tr>
<tr><td>Reversibility</td><td>Reversible</td><td>Reversible</td></tr>
<tr><td>Significance</td><td>Not Significant</td><td>Not Significant</td></tr>
<tr><td>Confidence</td><td>Not Applicable</td><td>Not Applicable</td></tr>
<tr><td>Likelihood of occurrence</td><td>Not Applicable</td><td>Not Applicable</td></tr>
<tr><th colspan="3">Follow-up and monitoring</th></tr>
<tr><td colspan="3">• See Section 8.3.3</td></tr>
<tr><td colspan="3">Note – As residual environmental effect is not significant, description of Confidence and Likelihood of Occurrence is Not Applicable</td></tr>
</table>

The operation phase will also have the same monitoring program and on-site mitigation measures in place as proposed during construction. LIM will proceed with the woodland caribou mitigation in place until the end of Year 1 of operation, at which point additional outstanding data will be assessed to provide additional information regarding the identification of ecotypes in the area and this information will be submitted for review to Provincial Wildlife representatives to assess the appropriateness of the strategy selected. As there will be no further surface disturbance, but sensory disturbance would remain, the geographic extent of this phase will continue to be site specific and occur in a continuous manner. The mine workings associated with the Project during operations are considered minimal when compared to the current state of historical disturbance, which already would take several generations to recover (without mitigation). Therefore, the effect of the LIM Project development as well as the unlikely possibility of mortality is not at a level that would cause management concern. These effects are considered reversible and are not significant (Table 7.9).

Table 7.9 Summary of Residual Environmental Effects for Caribou: Operation

<table>
<tr><th colspan="3">Mitigation</th></tr>
<tr><td colspan="3">Monitor movements of GR and/or possible woodland Herds. Reduce speed limits, fence hazardous work areas, no hunting policy, delay blasting while caribou are present</td></tr>
<tr><th>Significance Determination</th><th>George River Caribou Herd</th><th>Possible Woodland Caribou Herd</th></tr>
<tr><td>Geographic extent</td><td>Site Specific</td><td>Site Specific</td></tr>
<tr><td>Frequency of occurrence</td><td>Continuous (throughout operations)</td><td>Continuous (throughout operations)</td></tr>
<tr><td>Duration of effect</td><td>Over Several Generations</td><td>Over several Generations</td></tr>
<tr><td>Magnitude of effect</td><td>Moderate</td><td>Low</td></tr>
<tr><td>Reversibility</td><td>Reversible</td><td>Reversible</td></tr>
<tr><td>Significance</td><td>Not Significant</td><td>Not Significant</td></tr>
<tr><td>Confidence</td><td>Not Applicable</td><td>Not Applicable</td></tr>
<tr><td>Likelihood of occurrence</td><td>Not Applicable</td><td>Not Applicable</td></tr>
<tr><th colspan="3">Follow-up and monitoring</th></tr>
<tr><td colspan="3">• See Section 8.3.3</td></tr>
<tr><td colspan="3">Note – As residual environmental effect is not significant, description of Confidence and Likelihood of Occurrence is Not Applicable</td></tr>
</table>

Decommissioning activities will be of a relatively short-term nature, and once completed, no further presence of vehicles or personnel will occur. During this relatively brief period, appropriate monitoring and mitigation measures regarding woodland caribou will remain in place unless it has been demonstrated that caribou are associated with the GR Herd. The surface disturbance during the reclamation and associated sensory disturbance would continue to be site specific in terms of geographic extent. The continuous activities during this phase would result in enhanced conditions for encouraging a return to natural conditions. While the recovery would take several generations, the eventual natural state would be permanent. While measurable, these activities will not be at a level that would cause management concern particularly in light of the conservative mitigation strategy (i.e., assuming woodland caribou until proven otherwise) that would be in place. The positive outcome of this phase will be reversible in terms of creating natural conditions and assisting in reducing some of the existing areas of historical mine disturbance and are therefore not significant (Table 7.10).

Table 7.10 Summary of Residual Environmental Effects for Caribou: Decommissioning

Mitigation		
• Monitor movements of GR and/ or possible woodland Herds during decommissioning. Reduce speed limits, and implement no hunting policy		
Significance Determination	**George River Caribou Herd**	**Possible Woodland Caribou Herd**
Geographic extent	Site Specific	Site Specific
Frequency of occurrence	Continuous (throughout decommissioning)	Continuous (throughout decommissioning)
Duration of effect	Permanent	Permanent
Magnitude of effect	Moderate	Low
Reversibility	Reversible	Reversible
Significance	**Not Significant**	**Not Significant**
Confidence	Not Applicable	Not Applicable
Likelihood of occurrence	Not Applicable	Not Applicable
Follow-up and monitoring		
• No longer required following decommissioning		
Note – As residual environmental effect is not significant, description of Confidence and Likelihood of Occurrence is Not Applicable		

7.2.7 Cumulative Environmental Effects

The environmental effects assessment for caribou has considered the potential effects resulting from the Project, compared with existing and potential disturbances at a regional level. The cumulative environmental effects assessment considers how other ongoing or foreseeable projects or activities may interact cumulatively with the effects of the Project. The boundaries for cumulative environmental effects assessment are the same temporal and spatial boundaries for caribou as defined above.

The effects of existing projects, disturbances and activities such as the activities associated with the Municipality of Schefferville, the Québec North Shore & Labrador Railroad, the Iron Ore Company of Canada Mine (operations ceased in 1980 at this location), and the Menihek Dam are captured and reflected in the baseline environment conditions for caribou. Future projects for this area include the construction of the Elross Lake Iron Ore Mine and the possible development of LIM's additional six deposits (Table 7.11).

Table 7.11 Projects and Activities Considered in Cumulative Environmental Effects Assessment

Project	Status
Elross Lake Iron Ore Mine (NMCC): • Proponent: New Millennium Capital Corporation • New Millennium Capital Corporation is planning to develop an iron ore mine in Québec and Western Labrador, approximately 30 kilometres northwest of Schefferville, Québec. Ore will be transported via rail to Sept-Îles, Québec, for shipment to customers.	Reasonably Foreseeable Project
Bloom Lake Railway • Proponent: Consolidated Thompson Iron Mines Ltd. • Consolidated Thompson Iron Mines proposes to construct and operate a new 31.5 km long single-track railway line to connect the company's new load-out facilities within Labrador with the existing railway line between Wabush Mines and the Québec North Shore & Labrador Railway.	Reasonably Foreseeable Project

As discussed in Section 7.2, caribou observed in the Assessment Area are expected to be part of the GR Caribou Herd (Schmelzer and Otto 2003, Bergerud et al. 2008); however, for the purpose of this environmental assessment, it will be assumed that woodland caribou may also be present until the full results of the May 2009 survey (LIM and NML 2009) confirm otherwise. The Assessment Area of 7,850 km^2 represents approximately 1 percent of the range of the GR Herd, and the physical disturbance associated with the Project would represent less than one percent of the Assessment Area. The Assessment Area would overlap most of the former range of the McPhadyen Herd indicated by RRCS (1989). The other projects will collectively represent a larger proportion of the Assessment Area. Each other foreseeable project will be subject to the same scrutiny, regulatory environment and codes of best practice as LIM and therefore would reduce their respective effects as much as possible. These activities would be continuous, and persist over several generations. Regardless, and based on the extensive range of the GR Herd and the location of the Assessment Area at its periphery, it is expected that the development of the already disturbed James and Redmond deposits within the context of other regional activities would result in a measurable change that would not cause management concern. Ultimately, the reclamation and remediation of the previously disturbed and abandoned properties will eventually enhance the quality and quantity of habitat. In terms of the possibility of woodland caribou remaining in this area, strict mitigation measures that reduce and eliminate any associated disturbance would apply to LIM and other initiatives in the area. These effects are considered reversible and not significant (Table 7.12).

Table 7.12 Summary of Residual Environmental Effects for Caribou: Cumulative Effects

Mitigation		
• Both projects would be subject to applicable Federal and Provincial regulations		
Significance Determination	**George River Caribou Herd**	**Possible Woodland Caribou Herd**
Geographic extent	Assessment Area	Assessment Area
Frequency of occurrence	Continuous (throughout Project)	Continuous (throughout Project)
Duration of effect	Over several generations	Over Several Generations
Magnitude of effect	Measurable Change that does not cause management concern	Low
Reversibility	Reversible	Reversible
Significance	**Not Significant**	**Not Significant**
Confidence	Not Applicable	Not Applicable
Likelihood of occurrence	Not Applicable	Not Applicable
Follow-up and monitoring		
• See section 8.3.3		
Note – As residual environmental effect is not significant, description of Confidence and Likelihood of Occurrence is Not Applicable		

7.3 Hydrology

Hydrology was not identified as a VEC; however, the impacts of the proposed Project on the natural hydrology of the area are presented in this section as the impacts are considered ‘environmental effects’. The following subsections describe the impact of the proposed Project on the existing hydrological regime.

7.3.1 James Property

The existing James Property hydrology is described in Section 4.1.4.1 and the proposed development of this property is described in Chapter 3. The primary hydrology impacts will result from the dewatering of the open pits which will alter the groundwater levels in these areas and will add flow to existing surface water features on the James Property.

7.3.1.1 James North and James South Springs

Pit dewatering will be required to lower the water table in the immediate vicinity of the active pits to allow mining to occur. Dewatering will be achieved using in pit sumps and perimeter dewatering wells. The lowering of the water table in response to pit dewatering is expected to affect the flow from the James North and James South Springs, and will likely lead to a reduction and perhaps even complete cessation of flow from the unnamed tributary unless steps are taken to replace the lost flow.

The steps that will be taken to prevent this will involve diverting a portion of the perimeter well dewatering water to the unnamed tributary. Development of the pumping wells to a sediment-free state may take several weeks; therefore water from the wells may need to be put through a settling pond/filter system as a temporary measure until well development has been achieved. The targeted redirected water flow rate during operations would be the maximum rate measured from the tributary (SG4 flow data) during the 2008 monitoring period, while the average flow rate measured would be used during winter shutdown periods. Pumping will be continued during the winter months.

The maximum, minimum, and mean flows from the James North and James South Springs over the June to October recording period are summarized below (Table 7.13).

Table 7.13 Maximum, Minimum and Mean Flows, June to October

Flow	James North Spring – SG1	James South Spring – SG2
Maximum (m^3/min)	3.4	2.7
Minimum (m^3/min)	1.1	1.6
Mean (m^3/min)	2	2.1

Flow from the James North Spring forms the upper end of an unnamed tributary that flows southeast, accepts additional flow from the James South Spring, and ultimately discharges into Bean Lake (Figure 7.1). Flow rates for the unnamed tributary were also recorded from June to mid October 2008 at a location just before it discharges to Bean Lake (SG4). The maximum, minimum, and mean flow rates for this location are summarized below (Table 7.14).

Figure 7.1 James Springs and Unnamed Tributary

Table 7.14 Maximum and Mean Flows, Unnamed Tributary

Flow	Unnamed Tributary at Bean Lake – SG4
Maximum (m^3/min)	3.2
Minimum (m^3/min)	0.9
Mean (m^3/min)	1.6

The flow rate from SG4 (downstream end of the tributary) was always less than the combined flow from the two springs, indicating that water in the tributary infiltrates into the ground as it flows toward Bean Lake.

7.3.1.2 James Creek

Flow monitoring of James Creek in 2008 determined a mean flow of 42 m^3/min. The washwater discharge rate to Ruth Pit is estimated to be 8.4 m^3/min, therefore the washwater discharge will add 20% flow to James Creek. Historically, dewatering water from Ruth Pit was discharged to James Creek when Ruth Pit was operational. Discussions with a former IOC engineer (Don Hindy), who was involved with the IOC dewatering operations, indicate that the dewatering rates for the former pits was significant and, as an example in the case of French Pit, as high as 20,000 gallons per minute (75.7 m^3/min). The additional discharge of water from Ruth Pit to James Creek from the ore washing facility will be very minor in comparison to these historical flows. The outflow from Ruth Pit will not adversely affect existing fish habitat observed within James Creek, and monitoring of the Ruth Pit outflow and James Creek water levels during all phases of the operation will be conducted to ensure stable conditions. The noted additional flows to be added to Ruth Pit from the washwater will not significantly increase flows within James Creek and, therefore, will not have the potential to destroy existing fish habitat. As past mining operations have historically used James Creek as the discharge location from pit dewatering at a much greater rate, as noted above, the increase in flow from Ruth Pit will have insufficient energy to physically alter the channel structure.

7.3.1.3 Bean Lake

An analysis has been conducted of the expected change in water level of Bean Lake from the introduction of water from the James (North and South) pit perimeter dewatering wells. The outlet from Bean Lake is the controlling factor. This outlet consists of a corrugated steel culvert having a diameter of 3.65 m.

The hydraulic radius of the culvert was calculated at increments of 5% of the total diameter of the culvert (or increments of 0.183 m). Velocity was calculated for each increment using the Manning Equation with an estimated slope of 0.0048 and a roughness coefficient of 0.020 for corrugated steel pipe (Hornberger et al. 1998). Velocity was then converted to discharge by multiplying it by the flow area. This allowed a stage-discharge curve to be developed for the culvert, which could then be used for predictive purposes. The stage-discharge curve was validated by plotting the flow through the culvert measured in June, July, and September 2008 on the curve and comparing the measured and predicted values. A numerical comparison is presented in Table 7.15 and the stage-discharge curve is presented in Figure 7.2.

The average total discharge at the Bean Lake outlet (170.7 m^3/min or 248,808 m^3/d) was estimated using the average natural flow (57.7 m^3/min) plus the estimated dewatering flow (113 m^3/min). The incremental depth of Bean Lake as a result of this flow would be approximately 0.72 m, which is approximately 0.29 m deeper than the average depth in the culvert between June and September 2008.

Table 7.15 also presents the maximum flow possible through the culvert as predicted using the stage-discharge curve described above and presented in Figure 7.2. The maximum flow that could be maintained by the culvert was estimated to be 2,214 m^3/min (36.91 m^3/s, 3,188,869 m^3/d), which is approximately 13 times the estimated flow under dewatering conditions.

Table 7.15 Measured and Predicted Discharge due to Natural Conditions, Dewatering, and Maximum Possible Flow

	June		**July**		**Sept**		**Dewatering + Avg. Natural Flow***	**Max.**
	M	**P**	**M**	**P**	**M**	**P**		
Diameter of pipe (D; m)	3.66	3.66	3.66	3.66	3.66	3.66	3.66	3.66
Radius of pipe (D; m)	1.83	1.83	1.83	1.83	1.83	1.83	1.83	1.83
Circular Segment Height (h; m)	0.42	0.42	0.43	0.42	0.42	0.43	2.95	0.18
Central Angle (θ; radians)	1.38	1.39	1.41	1.38	1.39	1.41	4.46	0.90
Circular Segment Area (K; m^2)	0.67	0.68	0.70	0.67	0.67	0.71	9.08	0.20
Arc Length (s; m)	2.53	2.54	2.58	2.53	2.54	2.58	8.15	1.65
Flow Area (A; m^2)	0.67	0.68	0.70	0.67	0.67	0.71	1.44	10.32
Wetted Perimeter (Pw; m)	2.53	2.54	2.58	2.53	2.54	2.58	3.34	9.85
Hydraulic Radius (RH; m)	0.26	0.27	0.27	0.26	0.27	0.27	0.43	1.05
Velocity (V; m/sec)	1.41	1.43	1.30	1.43	1.52	1.46	1.98	3.57
Discharge (Q; m^3/s)	0.94	0.97	0.92	0.95	1.03	1.03	2.85	36.91
Discharge (Q; m^3/min)	56.65	58.12	54.91	57.21	61.57	61.83	170.73	2,214.49
Discharge (Q; m^3/d)	81,571	83,692	79,068	82,383	88,659	89,035	245,844	3,188,869

Notes:
* Average natural flow is average of measured flows in June, July, and September (57.7 m^3/min) plus estimated flow due to dewatering (113 m^3/min), which totals 170.7 m^3/min.
M = Measured
P = Predicted

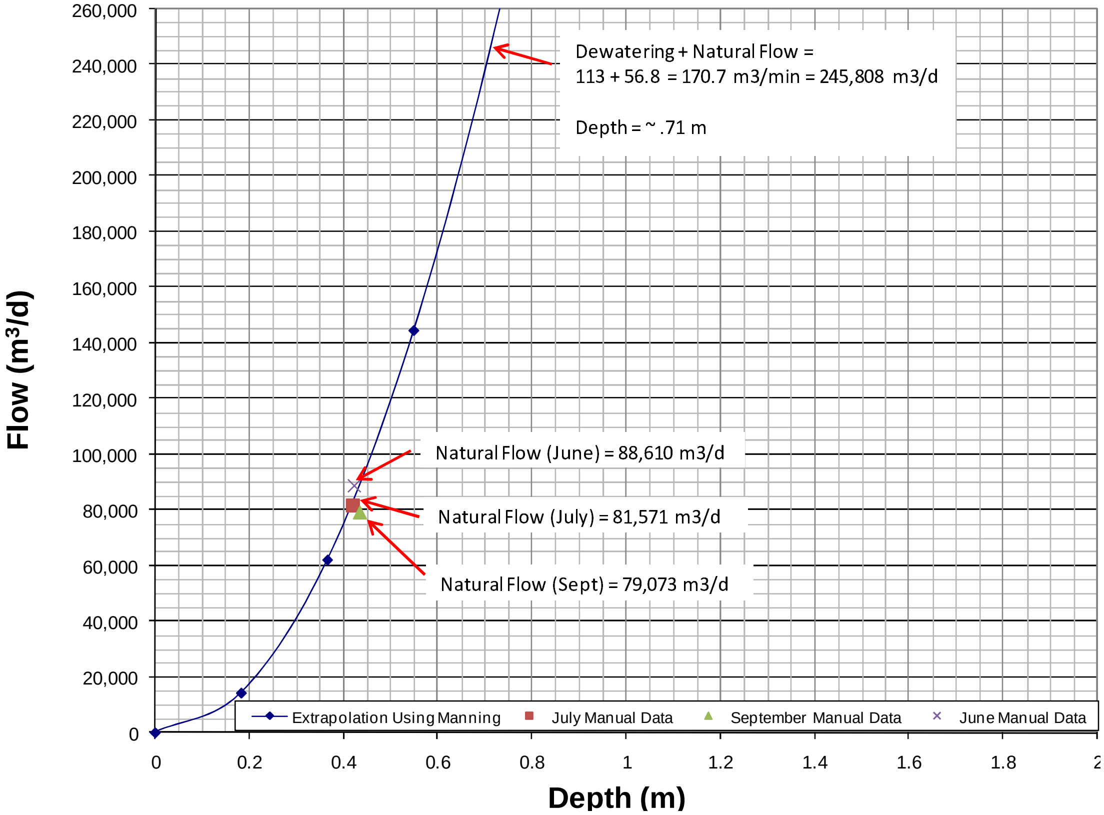


Figure 7.2 Stage-Discharge Curve for Bean Lake Outlet (BL OUT SG-5)

Based on site baseline work, the groundwater contribution to Bean Lake is expected to be greater from the west than from the north, east, or south because of the topography of the area around Bean Lake and the orientation of Bean Lake within this topography, and because of the presence of other lakes to the east and south of Bean Lake. There is a large bedrock ridge located west of the James property and west of Bean Lake. This ridge has a significant influence on groundwater flow in the area and is likely the reason why there are springs located on the James property. The direction of groundwater flow is approximately orthogonal to this ridge, with flow to the east/southeast from the ridge toward Bean Lake. The ridge is a large driving force for groundwater flow to the east. This flow direction is also orthogonal to the long axis of Bean Lake, thereby maximizing the potential groundwater flux to Bean Lake. The presence of lakes nearby to the east and south of Bean Lake (at lower elevations than Bean Lake) limits groundwater flow toward Bean Lake from those directions. There is likely some groundwater discharging to Bean Lake from the north, but the east/west cross-sectional area of Bean Lake is much less than the north/south cross-sectional area, so the potential flux would be much less. The cross-sectional area of groundwater discharge to Bean Lake in an approximate north/south direction (i.e., orthogonal to groundwater flow direction) was estimated based on the length of the lake and the estimated depth of the groundwater discharge zone. This depth was based on bathymetric information collected in Bean Lake. This is a standard method for estimating groundwater flux.

7.3.1.4 Ruth Pit

An additional item in the James Creek/Bean Lake water balance includes process water used to wash the ore in preparation for shipment. It is estimated that up to 8.4 m^3/min of water will be required for this purpose and the water will be taken from the James Property pit dewatering system. The reject fines wash water will contain approximately 21 percent solids after washing and will be pumped to Ruth Pit for settling. This additional volume will have a negligible hydraulic impact on Ruth Pit, which has an area of 61 hectares (hydraulic loading of 0.001 cm/min).

The volume of Ruth Pit is roughly estimated to be 50,000,000 m^3 based on the area of the pit and the average depth of the pit determined from a bathymetric survey conducted by AECOM in September 2008. At a fines washwater input rate of 8.4 m^3/min, and based on the expected operational period of washing (the anticipated annual beneficiation duration), the resulting flow to Ruth Pit equates to approximately 2,187,000 m^3/year. This results in a theoretical maximum residency time for this wash water in Ruth Pit is approximately 23 years. The actual residency time will likely be less than this as a result of short-circuiting through the pit; however the residency time should be on the order of years.

The only change to the existing water balance of this water body will be the fines washwater incremental flow into Ruth Pit at a rate of 8.4 m^3/min and the balancing incremental outflow from the Pit (conservatively assumed to be 8.4 m^3/min). The outflow from Ruth Pit will be controlled by an outlet structure which will decant water from the pit and prevent fish from migrating from James Creek into Ruth Pit. LIM is evaluating the existing outlet structure at Ruth Pit and it is anticipated that upgrades to this structure may be required. The details of the upgrades will be developed with the overall design of the Project, and the final design will be provided as part of the Development Plan which will be reviewed by WRM prior to approval of the Project. LIM also acknowledges that permitting, if work is required, will be undertaken subject to Section 48 of the WRA and that monitoring will be required.

Ruth Pit will act as a wet detention pond (i.e., a retention pond that always has water in it). These types of ponds are very effective for the removal of Total Suspended Solids (TSS) and can generally achieve 90% TSS removal with a detention time of 24 hours. The degree of thermal stratification of the water in Ruth Pit is expected to be limited due to the short summer season in this area. Even if a thin stratification layer forms (warmer water at surface), there is not expected to be thermal shortcircuiting of the washwater because the ore washwater will be introduced into Ruth Pit at depth, and at a relatively slow flow rate (volume) compared with the volume of water in the pit, and therefore the washwater will mix with the cold pit water quickly before it will short circuit due to thermal stratification.

The discharge location for the washwater into Ruth Pit will be selected to optimize the retention time within the pit. The exact location of the discharge will be determined during detailed design and will take into account the nature of the proposed Ruth Pit outlet structure and flow patterns within the pit. During the detailed design process, other measures such as hanging silt curtains, groin channels, etc. may be incorporated if required to prevent short-circuiting. The outflow from Ruth Pit will be controlled by an outlet structure which will decant water from the pit and prevent fish from migrating from James Creek into Ruth Pit.

A detailed design of Ruth Pit effluent treatment process will be provided at the permitting stage (Development Plan as required under the *Newfoundland and Labrador Mining Act* and reviewed by Water Resources).LIM is aware that once in operation, the discharge from Ruth Pit will trigger the MMER and LIM will thus be responsible for completing all regulatory requirements under that regulation. It is acknowledged that the MMER will apply and that LIM is aware of the triggers that enable regulation to be enacted during LIM operations.

7.3.1.5 Summary

Overall, the cumulative amount of water pumped by the pit dewatering system is estimated to be up to 113 m^3/min (SNC 2008). Approximately 8.4 m^3/min of this water will be diverted to the unnamed tributary to offset water lost from the springs by dewatering, therefore approximately 105 m^3/min of dewatering water will be sent directly or indirectly to James Creek and Bean Lake via settling ponds and the beneficiation process. The area of Bean Lake is approximately 54 ha; therefore, the estimated discharge rate only adds about 0.02 cm/min to the hydraulic loading of Bean Lake. The hydraulic impact to Bean Lake is considered to be negligible.

7.3.2 Redmond Property

The existing Redmond Property hydrology is described in Section 4.1.4.2 and the proposed development of this property is described in Chapter 3. The primary hydrology impacts will result from the dewatering of the active open pits which may temporarily alter the groundwater levels in these areas.

7.3.2.1 Redmond 2B Pit Development

The approximate location of the proposed Redmond 2B Pit is shown on Figure 4.12. The depth to groundwater in the proposed pit area is approximately 25 metres below ground surface and the maximum depth of the proposed pit is 40 metres. Therefore, pit dewatering may be required after the first year of mining, when extraction approaches the water table, to lower the water table in the immediate vicinity of the pit to allow mining to occur to the base depth of the proposed pit.

Dewatering is planned to be conducted using in pit sumps and perimeter dewatering wells. Pit dewatering may affect the rate of groundwater discharging to the area north of the proposed Redmond 2B pit if it falls within the dewatering zone. After initiation of mining at Redmond 2B, water levels will be measured regularly in the groundwater monitoring wells and flow rates at location SG-7 will be monitored to track potential effects, if any.

Redmond 2 pit, which currently has no surface connectivity to nearby surface water bodies, will be used as a settling pond for pit dewatering from the proposed Redmond 2B open pit. It will also be a waste rock storage area for some portion of the waste rock from Redmond 2B. It is planned to maintain the non-connectivity of Redmond 2 to nearby surface water bodies. To maintain this hydraulic isolation, the water level in Redmond 2 will be monitored during operations and once the water level reaches a pre-determined level, waste rock disposal from the proposed pits into Redmond 2 will cease and be stockpiled in other locations. In this manner, no overflow will occur.

Hydrogeological studies are continuing at the Redmond area to supplement current data and to refine information relating to pit dewatering rate estimates for Redmond 2B and additional design details, including but not limited to retention times, flow rates, and hydraulic controls, which will be provided at the permitting stage.

7.3.2.2 Redmond 5 Pit Development

Pit dewatering water from the Redmond pits will be pumped to the historical Redmond 2 pit for suspended solids settling. This process will be the same as discussed for Redmond 2B in Section 7.3.2.1. Similar to Redmond 2B, dewatering rates for Redmond have not been fully determined yet, but will be provided at the permitting stage.

Further discussions on dewatering activities are presented in Section 3.3.5.

7.4 Employment and Business

Employment and business was chosen as a VEC based on public concern that economic benefits accrue to local communities, Labrador and the Province. This includes benefits to the population and economy as a whole, and to such under-represented groups as the Innu and women. The effects on employment and business have been assessed on other recent projects and such an assessment is required under the Project-specific EIS Guidelines.

7.4.1 Potential Project-VEC Interactions

Issues relating to employment and business and the Project include:

- The creation of employment for residents of the Province, including Labradorians, the Innu and women;
- Training requirements associated with Project employment, in support of the above employment objective;
- The creation of business for Newfoundland and Labrador companies, and especially those located in Labrador; and
- Inflationary effects on the costs of labour, goods and services.

7.4.2 Employment and Business Assessment

There will be direct and indirect employment and business impacts resulting from, first, the construction of the Project and, second, from its operation. These will include the employment of, and income to, those working directly on the Project, indirect employment and income impacts to workers providing goods and services to the Project, and induced impacts, which are generated when those working directly and indirectly on the Project spend their incomes in the economy. These Project and Project-related expenditures have the potential to have inflationary effects. The effects management for this VEC, primarily through the Project Benefits Policy (Section 2.2.3) and related Benefits Plan (Appendix D) initiatives, is and has always been intended as part of the Project and hence in is an inherent part of this assessment. As such, there is no separate section on effects management.

As required by the EIS Guidelines, this section includes employment and business goals for both the construction and operating phases of the Project.

7.4.2.1 Construction Phase

Direct Impacts

There will be substantial short-term employment benefits during the construction phase of the Project. This will involve a total of approximately 40 workers employed over the approximately eight-week duration of construction. The direct construction phase employment is described, by NOC Code, in Table 3.4. The majority of these positions will be filled from within Labrador, which will receive hiring preference under the LIM Benefits Policy (Section 2.2.3) and through implementation of the associated Benefits Plan (Appendix D). LIM will fill all positions not filled locally by using a commute system. All workers will be employed in Newfoundland and Labrador. Workers will commute by air and rail from Goose Bay, Wabush and Labrador City as appropriate.

The employment of the Labrador Innu and women will be promoted through the IBA with the Innu Nation of Labrador and Project Women's Employment Plan (Appendix D) respectively.

The IBA is a life-of-mine agreement that establishes the processes and sharing of benefits that will ensure an ongoing positive relationship between LIM and the Innu Nation. In return for their consent and support of the Project, the Innu Nation and their members will benefit through training, employment, business opportunities and financial participation in the Project.

The Project Women's Employment Plan details LIM's approach to employment equity; establishes appropriate initiatives and targets; and, describes a process for achieving these targets, monitor success in meeting them, and reviewing and revising women's employment initiatives. This plan will apply to LIM and its Project contractors.

LIM will continue to liaise with the College of the North Atlantic to investigate training local residents for these construction positions. However, it is recognized that the opportunities for training specifically for this Project will be very limited, given the small number of positions and short duration of employment.

Project construction will be completed in advance of the construction labour requirements of other proposed Labrador projects such as the Lower Churchill Hydroelectric Generation Project (peak employment 1,700, construction period 2010 to 2018) and Aurora uranium mine (peak employment 700, construction period 2011 to 2014), and it will therefore not compete with them for labour. A discussion of other projects planned for Western Labrador is included in the assessment of cumulative effects, Section 7.4.3. Indeed, the Project will provide employment to some workers in Labrador West who are currently unemployed, as a result of the economic downturn. The Project will also provide these and other Labrador residents with an opportunity to further develop their skills and employment experience, thereby assisting in the development of the labour force for subsequent projects.

It is anticipated that a small number of the Project-specific engineering, design and specialized Project management positions will be filled from outside the Province. Targets and initiatives with respect to Project employment are discussed in the NL Benefits Plan and Women's Employment Plan (Appendix D).

Indirect Impacts

The local share of supply and services contracts will be maximized through the LIM Benefits Policy (Section 2.2.3) and associated strategy. This policy will build on, and is consistent with, LIM's past performance in delivering local benefits. LIM has spent $5.0 million on goods and services from Newfoundland and Labrador companies since 2004.

For example, the following contracts have been awarded to Newfoundland and Labrador companies in the past:

- SNC-Innu conducted an engineering study on the Project;
- Cartwright Drilling carried out an exploration drilling program in 2006;
- Jacques Whitford was retained to prepare this environmental assessment; and
- RSM Engineering carried out a bulk-sampling and crushing and screening program in 2008.

In addition, preliminary discussions have been conducted with other Newfoundland and Labrador-based companies and this work may be awarded at the appropriate phase of the Project. Examples include:

- Land Surveying: N.E Parrot Surveys Ltd, to execute the legal land surveys; and
- Provincial Airlines/Innu – Mikun Partnership to provide air transportation services.

As was noted above, under the terms of its IBA with LIM, the Innu Nation of Labrador and their members will benefit through Project business opportunities.

The construction of the mine will see the procurement of a wide range of goods and services, the majority of which are available in the Province. They include:

- earthworks;
- site construction;
- buildings construction;
- plant construction;
- mine preliminary works and overburden stripping;
- fuel and refuelling services;
- welding and machining goods and services;
- land surveying;
- taxi and car rental;
- hotel accommodations;
- blasting;
- pipe-laying;
- road construction;
- electrical and mechanical contracting;
- miscellaneous tools and small equipment;
- heavy equipment rental (cranes, excavators, loaders); and
- independent environmental monitoring.

In some cases, Project materials and services are not available in Labrador or, indeed, the Province, and there is no reasonable expectation of this being changed as a result of the Project, or any foreseeable level of provincial demand. For example, the following materials and services will in all likelihood need to be brought to the Project site from outside the Province:

- crusher and beneficiation plant unit supply;
- mine engineering consulting services;
- rails, rail ties and other track materials; and
- rail cars and power units.

Induced Impacts

The use of a commute system will deliver Project-related economic benefits to those parts of the Province in which workers and their families live. Similarly, expenditures by the employees of companies contracted to work of the Project will benefit the Province and the region and communities in which they live.

7.4.2.2 Operation Phase

The Project will also help build the capacity of, and support, the local labour market and businesses during operations. For example, the operating plan of the mine will generate a smaller level of longer-term (an estimated five years duration) seasonal employment benefits to Labrador. In total, the mine will directly require 109 positions (Table 3.6), mostly for about seven months per year. The majority of these workers will be employed by contractors.

Given the nature of the occupations involved, the lead time available to train local people for them, and the LIM Benefits Policy, the majority of the mine operation workers will be hired from Labrador. The Benefits Policy (see Section 2.2.3), which will apply to LIM and Project contractors, will give employment preference to, first, qualified residents of Labrador, and then qualified residents of the Province as a whole.

As is the case for the construction phase, the employment of the Labrador Innu and women will be promoted through the IBA and Project Women's Employment Plan respectively.

Specific targets for operations employment and with respect to women's employment are provided in the NL Benefits Plan and Women's Employment Plan (Appendix D).

LIM will continue to liaise with the College of the North Atlantic to investigate training local residents for these positions. However, it is recognized that there are few senior and experienced mine operation personnel in Labrador, and these positions may have to be filled from elsewhere.

While some workers will be hired from, and live in, Schefferville, most of the Project operations workers and their families will be hired from Labrador and contribute to its economy and community life. As during construction, these Labrador residents will commute from Goose Bay, Wabush, and Labrador City as appropriate.

Mine operations will also require a range of goods and services, the majority of which are available locally. For example, a review of local capabilities indicates that the following will be available on a commercial basis from within Western Labrador:

- fuel and refuelling services;
- welding and machining goods and services;
- catering services and camp management;
- vehicle rental, rail passenger and air transportation services;
- maintenance operations;
- hardware stores miscellaneous tools and small equipment;
- heavy equipment rental (e.g. cranes, excavators and loaders);
- local contracting services (e.g. construction, electrical and mechanical);

- Mine contractors;
- Beneficiation Equipment operation; and
- Power Supply.

Some other goods and services will be available from elsewhere in the Province. Specific targets with respect to procurement of goods and services are provided in the NL Benefits Plan (Appendix D).

7.4.2.3 Decommissioning

The amount of employment and business associated with decommissioning will depend upon the specific techniques employed, but will likely involve grading, material transportation, monitoring and other activities that Labradorians and Labrador companies are well qualified to undertake. These opportunities will only be clear closer to decommissioning.

7.4.2.4 Summary

The Project will make a significant contribution to the further economic development of the Province and, in particular, Labrador, by:

- providing local employment and incomes during construction and operations;
- providing local business during construction and employment;
- providing an important opportunity for participation by the Innu Nation of Labrador and women in the provision of services, businesses, employment and training;
- increasing the capacity and skills of local labour force and businesses, in advance of Lower Churchill and other projects; and
- facilitating further mining development by putting in place these new labour and business capabilities and new transportation infrastructure, thereby making existing and new Labrador projects more competitive globally.

No significant adverse effects are expected. The numbers of workers and scale of expenditures are not sufficient for there to be a danger of inflationary effects, especially given the current downturn in the economy, which is forecast to continue through the Project construction phase.

The residual environmental effects of the Project on Employment and Business are summarized in Table 7.16.

Table 7.16 Summary of Residual Environmental Effects for Employment and Business (All Phases)

Effects Management	
• LIM and its contractors will include a copy of the LIM Benefits Plan in all Project calls for expressions of interest, requests for proposals, and contracts • LIM will liaise with provincial, and especially Labrador, educational institutions and human resources agencies so that they are informed about employment requirements and plans • LIM will liaise with provincial, and especially Labrador, business groups and economic development agencies so that they are informed about goods and services requirements and plans • LIM will monitor the Project labour force to establish the percentage of positions held by residents of the Province • LIM will monitor the award of Project contracts to establish the percentage of the work, by value, awarded to companies based in the Province • LIM will, on a quarterly basis, compile the above monitoring data, assess them relative to Project benefits targets and, if necessary, review and revise its benefits approach, initiatives and targets • LIM will, make the above annual compilation of benefits data available to government departments and agencies, upon request • LIM will, implement the provisions of its Project Women's Employment Plan	
Significance Determination	
Geographic extent	Regional
Frequency of occurrence	Continuous
Duration of impact	Long-term
Magnitude of impact	Low
Permanence/reversibility	Reversible
Significance	**Not Significant**
Confidence	Not applicable
Likelihood of occurrence	Not applicable
Follow-up and monitoring	
• LIM will monitor the Project labour force to establish the percentage of positions held by residents of the Province; • LIM will monitor the award of Project contracts to establish the percentage of the work, by value, awarded to companies based in the Province; • LIM will, on an annual basis, compile the above monitoring data, assess them relative to Project benefits targets and, if necessary, review and revise its benefits approach, initiatives and targets; • Make the above annual compilation of benefits data available to government departments and agencies, upon request; and • LIM will implement the provisions of the Project Women's Employment Plan.	
Note – Confidence and Likelihood of Occurrence are Not Applicable when residual environmental effect is not significant	

7.4.3 Cumulative Environmental Effects

The assessment of the effects of the Project on employment and business is based on the baseline conditions (Section 4.3.3). Future projects in this area include the possible construction of the Elross Lake Iron Ore Mine and the Bloom Lake Railway.

As has been described above, the Project will employ approximately 40 workers for a construction period of eight weeks. The Elross Lake Project could employ an estimated total of 150 people over a 15-month construction phase, originally scheduled to start in 2009 (New Millennium, 2008), but the project still awaits regulatory approval and final sanction. Bloom Lake Railway construction is in progress and will involve an average total of 160 workers (Consolidated Thompson, 2008). It is anticipated that a maximum of 250 construction workers will be required at any one time across these projects. Furthermore, the occupations required will vary across the three projects, and the schedules of them may permit workers in some occupations to work on more than one project.

While it is expected that all three operations will draw on the existing labour force resident in Labrador (there were 800 workers in construction occupations in Labrador at the time of the 2006 Census), any possible shortage can be addressed through employing workers living on the Island of Newfoundland, which had a total 2006 construction labour force of nearly 17,000 workers. It is noted that the current economic situation in Labrador West will facilitate hiring for that region.

The numbers employed in operations are smaller than construction for the other projects. It is has been indicated that during the operation of Phase 1 of Elross Lake, between 2010 and 2013, 150 people will be employed (New Millennium, 2008). The operation of the Bloom Lake Railway project is tentatively scheduled to begin in late-2009 and require only 12 full-time positions (Consolidated Thompson, 2008). In conjunction with the Project, this results in a total operations employment of only about 260 jobs. This should make a valuable contribution to the economy while not resulting in labour shortages or wage inflation.

The cumulative business effects of the three projects will be important to the contracting companies involved, but not place any undue demands resulting in wage and price inflation, especially the recent economic downturn, which is forecast to last for some years. Given the duration of the operations phases, activity on these projects may also result in some expansion of business capabilities.

7.5 Communities

The communities most likely to be affected by the Project are the primary places of residence of the Project labour force: Labrador West, Upper Lake Melville, Schefferville, and Kawawachikamach. Labrador West is also the home of many contracting companies providing goods and services to the Project. LIM has an office in Happy Valley-Goose Bay and will open an office in Labrador West. In addition, the Goose Bay and Wabush Airports and the TSH railroad from Emeril Junction will be used in the provision of some labour and supplies.

7.5.1 Potential Project-VEC Interactions

As required by the EIS Guidelines, this assessment focuses on the effects on health services in Labrador. These are discussed in the context of the broad demographic and other effects of the Project.

7.5.2 Communities Assessment

7.5.2.1 Construction

The construction of the Project will have a negligible short-term direct effect on the communities of Labrador West and Upper Lake Melville. It will only employ approximately 40 workers for eight weeks (Section 3.2.8), and some of these workers will already be residents of these communities when hired. As a result, it is very unlikely that any workers will move to them as a result of Project construction, and hence that there will be an effect on public or community health services, or other community social or physical infrastructure or services, as a result of Project-related population increase.

The commute system for construction workers will be designed to transport construction workers to and from their communities as efficiently as possible. As a result, there will be few occasions when commuting workers will spend more than a short period in Labrador West and Upper Lake Melville communities while en route to or from the workplace. There is a very small likelihood of negative interactions between workers and local residents that might place demands on policing or healthcare services and infrastructure.

Most workers will continue to receive general healthcare in their home communities. Any minor injuries or health problems will be addressed through the provision of first-aid at the worksite. If additional care is required, workers will utilize the health clinic in Schefferville, Québec. If more specialized care is needed, workers will be transported to the Captain William Jackman Memorial Hospital in Labrador City.

However, the effects of the construction phase on local healthcare services and infrastructure will also be minor because the labour force will be small, the workers will mostly be in the prime of life, and accidents will be minimized through rigorous enforcement of LIM's occupational health and safety standards. As a result, no significant new Project-related demand on health services and infrastructure is anticipated.

7.5.2.2 Operation

The Project will also help build the capacity of, and support, local labour market and businesses during operations. In total, the mine will directly require 109 positions (Table 3.6), mostly for about seven months per year. These employees will be largely employed by contractors.

While there will be some multiplier effects of operations, these will have an even smaller incremental effect, especially as most of this employment will go to local residents working for supply and service companies, retail outlets, restaurants, etc. While it will make a minor long-term contribution to the economy of Western Labrador, it is very unlikely that the operations phase spin-off employment will need to be met through in-migration into the region, resulting in additional demand for community and public healthcare services and infrastructure.

As during the construction phase, the commute system for non-locally resident workers will be designed to minimize the possibility of negative interactions between workers and local residents that might place demands on policing or healthcare services and infrastructure. Furthermore, most workers will continue to receive general healthcare in their home communities, minor injuries or health problems will be addressed through worksite first-aid, and if additional care is required, workers will utilize the health clinic in Shefferville, Québec. Only when more specialized care is needed, workers will be transported to the Captain William Jackman Memorial Hospital in Labrador City, but the workers will again mostly be in the prime of life, and accidents will be minimized through rigorous enforcement of Labrador Iron Mines' occupational health and safety standards.

As a result, no significant new Project-related demand on health services and infrastructure is anticipated.

7.5.2.3 Decommissioning

The amount of employment associated with decommissioning will depend upon the specific techniques employed, but Labradorians are likely to be well qualified for this work. However, the scale of such employment will likely be smaller and of shorter duration than operations, and hence is not expected to result in significant new Project-related demand on health, or other community, social or physical, services and infrastructure.

7.5.2.4 Summary

The residual environmental effects of the Project on communities are summarized in Table 7.17.

Table 7.17 Summary of Residual Environmental Effects for Communities (All Phases)

Effect Management	
• Use a commute system and camp accommodations for most Project workers • Minimize time commuting workers spend en route in communities • Rigorous occupational health and safety provisions and implementation	
Significance Determination	
Geographic extent	Regional
Frequency of occurrence	Continuous
Duration of impact	Long-term
Magnitude of impact	Low
Permanence/reversibility	Reversible
Significance	**Not Significant**
Confidence	Not applicable
Likelihood of occurrence	Not applicable
Follow-up and monitoring	
• The monitoring of demands on community services and infrastructure is the responsibility of the relevant government departments and agencies, as part of their normal planning processes. LIM will assist by liaising with them, as requested, and through the timely provision of information about Project activity and plans.	
Note – Confidence and Likelihood of Occurrence are Not Applicable when residual environmental effect is not significant	

7.5.3 Cumulative Environmental Effects

The assessment of the effects of the Project on communities is based on the baseline conditions (Section 4.3.3.4). Future projects in this area include the construction of the Elross Lake Iron Ore Mine and the Bloom Lake Railway. Given the preliminary scale of these projects and their assumed use of commute employment, it is not expected that they will have significant effects on healthcare or other community services or infrastructure in Labrador West or Upper Lake Melville.

7.5.4 Implications for Other Mining Projects, Railways and Mineral Exploration

LIM has been holding discussions with railroad and port operators for an extensive period. To date these have resulted in a number of confidential Memoranda of Understanding regarding the supply of such services.

During 2008, LIM reached agreement with the railroad operators TRH and QNSLR, and with two port and stevedoring companies, regarding the transport, unloading and storage of its bulk sample products over the railroad lines and port facilities. During 2008 these tonnages were transported from the Silver Yard site to port. LIM expects that, subject to completing confidential commercial negotiations, these arrangements will be extended to cover the periods included by the Project production scenario.

LIM notes that each of the railroads over which its iron ore will be transported to port are covered by the application and provisions of the *Canada Transportation Act* 1996, and accordingly are required under the terms of that *Act* to provide a level of service.

LIM continues to be in discussion regarding ongoing port facilities under various Memoranda of Understanding, and expects to conclude successful and friendly negotiations with various port operators to provide a sufficient level of stevedoring service in the general Port of Sept-Îles area well before the commencement of commercial production. LIM also expects to extend these agreements to cover the expected life of this Project.

7.6 Accidental Events

7.6.1 Fish and Fish Habitat

Accidental events that could have consequences for fish and fish habitat include: sedimentation events due to slope failure, flooding; pollution from vehicular accidents, spills; and fire. Accidents leading to sedimentation events can vary in origin, area, intensity and duration, however the results are usually restricted to the site of the event and the downstream habitat. These events are usually localized in nature and reversible if the intensity is not extreme. Sometimes habitat can be rehabilitated if natural restoration is not evident.

Spills are also usually limited to a local area with various downstream effects within the same watershed. The effects of accidental introductions of pollutants into fish habitat will vary with the material and intensity (i.e., amount and duration). Fish kills may result from exposure to acutely lethal substances. Sub-lethal effects from less toxic materials may result in stress, lack of condition, impairment of growth or reproduction, or avoidance.

Forest fires can spread from watershed to watershed, moving with the prevailing wind. Fires can consume riparian vegetation, destabilize shore area soils, and lead to erosion and sedimentation events. Habitat can be degraded by the removal of riparian vegetative cover and associated food and nutrient input.

The adverse environmental effect would be reversible and localized and would be not significant.

7.6.2 Caribou

Accidental events and malfunctions for this Project could result in change in habitat and/or mortality for both migratory caribou or woodland caribou (if they are present). Provided that the effects management measures outlined in Section 7.2.5 are adhered to, the risk of an accidental event and the extent of its influence would be reduced to an unlikely event. The most probable of accidental events would be that of a forest fire related to Project activities or a hazardous material spill. Fire prevention and response measures will remain in place throughout the Project. The geographic extent of a forest fire could extend beyond the site (within the Assessment Area), but is not likely to occur also due to the presence and implementation of Project-specific Environmental Protection Plans. The effects could last for several generations (Foster 1985, review by Bergerud 2008), and of a magnitude that would cause management concern although overall for this population, large fires occur naturally and result in extensive changes in habitat and associated distribution. These effects are natural and would be reversible, but would be considered as significant. There is a high degree of confidence that a large fire would result in a significant effect but the measures in place and design of the Project would infer this is an unlikely event.

A hazardous material spill would be confined to the site and would not be expected to interact in a meaningful manner (if at all) with caribou from the GR Herd or possibly in association with a woodland herd. This event would be considered not likely to occur and would result in no measurable change to baseline conditions. The adverse environmental effect would be reversible and not significant.

7.6.3 Employment and Business

Any cessation of Project activity as a result of accidental effects and malfunctions will have a negative effect on Project employment and business. However, such cessations would be anticipated to be short-term and resulting adverse socio-economic effects would be not significant.

7.6.4 Communities

All Labrador communities are at such a distance from the Project site that they will not be directly affected by any accidental effects and malfunctions. However, any cessation of Project activity as a result of such effects and malfunctions will have a negative effect on Project employment and business, and these may have secondary effects on Labrador communities. The adverse effect would be not significant; conversely, there may be secondary community affects resulting from employment and business associated with dealing with the consequences of such effects and malfunctions.

7.7 Effects of the Environment on the Project

The EIS Guidelines specifically requires that the effects of the environment on the mine be assessed, considering in particular the vulnerability and potential risk to the mine from climatic elements (including wind, weather and global climate change). The following section evaluates the potential effects of extreme and other climate events on the mine in consideration of future climate change.

Climate change considerations for the Project are assessed following guidance issued by the Canadian Environmental Assessment Agency Guidelines (CEAA 2003). Considerations focus on the longer operating phase of the Project as opposed to the construction phase, and include analysis of climate parameters that could change over the period influencing Project operating conditions, and magnifying or buffering Project related environmental effects.

The range of effects on the Project due to the physical environment can range from minor facility improvement to catastrophic failure. The primary mitigation tool is the use of sound planning. All engineering design must be done to National Building Code Standards. These standards document the proper engineering design for site specific extreme physical environmental conditions and provide design criteria, which the federal government considers satisfactory to withstand potential physical environmental conditions. These codes consider physical environmental criteria such as wind, snow, wave and ice loading and drainage. In addition, the design life is taken into consideration so that materials are chosen with sufficient durability and corrosion resistance.

A significant effect of the environment on the Project has been defined as one that results in:

- A substantial delay in construction (e.g., more than one season);
- A long-term interruption in mining operations;

- Damage to infrastructure that compromises public safety; or
- Damage to infrastructure that would not be economically and technically feasible to repair.

The potential effects of the environment on the Project are assessed below.

7.7.1 Climate Change Predictions

General Circulation Models (GCM) are considered to be the most comprehensive models for predicting the effects of GHG emissions on the global climate. However, these models become less accurate when attempting to predict regional changes in climate. Climate projections for more specific locations require the development of models that will incorporate specific regional and local climate variables with broader-scale climate change scenarios from the GCM (Lines et al. 2005). Downscaling techniques have begun to emerge over the last decade to meet this requirement. Downscaled climate model predictions for Goose Bay, NL were used assess the potential changes in temperature and precipitation at the LIM sites.

Climate can be described in terms of average temperature and precipitation, as well as day-to-day and year-to-year variations and extremes that define weather. The baseline climate (1971 – 2000) for this region is described in Section 4.1.1.

7.7.1.1 Temperature and Precipitation

Downscaled model results are available for Goose Bay, NL which is southeast of Schefferville. Results tend to differ between a Statistical Downscaling Model (SDSM) and Global Climate Model (GCM). Monthly, seasonal, and annual SDSM results were typically indicating higher temperature and precipitation changes than those of the Canadian coupled global climate model version 1 (CGCM1).

The overall increases in the annual average minimum temperatures projected for Goose Bay between 2020 and 2080 range from 1.3 C° to 4.1 C°, and from 1.7 C° to 5.0 C° for the SDSM and CGCM1 model results respectively. These results are consistent with projected changes to the annual average maximum temperature for the same time period at Goose Bay, expected to range from 1.8 C° to 4.7 C° and 1.6 C° to 3.8 C° for the SDSM and CGCM1 model results respectively (Lines et al. 2005) (Table 7.18)

Table 7.18 Projected Mean Annual Maximum and Minimum Temperature Increases, and Percent Precipitation Change for the 2020s, 2050s, and 2080s

	T max Change C º		T min Change C º		Precipitation Change (%)	
	SDSM	CGCM1	SDSM	CGCM1	SDSM	CGCM1
2020s	1.8	1.6	1.3	1.7	2	-3
2050s	2.3	2.1	2.2	2.9	3	3
2080s	4.7	3.8	4.1	5.0	5	9

The SDSM predictions for maximum temperatures for the 2050s at Goose Bay for summer, fall and winter increases are 2.2 C° to 4.3 C°, while for the spring, slight cooling is anticipated (-0.8 C°). By the 2080s, temperatures are projected to increase in all seasons, with greater warming in the summer, fall and winter (4.6 C° to 7.1 C°) than the spring (1.2 C°) (Lines et al. 2005). This average temperature change will be gradual over the period and will change precipitation types and patterns. The SDSM predictions for precipitation change for the 2050s are for spring, summer, and fall increases (1 percent to 8 percent), while for the winter, decreasing precipitation is anticipated (-6 percent). By the 2080s, precipitation is projected to increase more in the fall and summer (9 percent to 12 percent), and decrease in the spring and winter (-2 percent) (Lines et al. 2005).

The warmer fall and winter could cause later freeze up and earlier spring break up, wetter and heavier snow, more liquid precipitation occurring later into the fall, more freezing precipitation, and a longer growing season (and hence, vegetation growth). With little change in spring temperatures, differences in ice formation and breakup patterns will likely be slight. The decrease of precipitation (snow) in the winter months could increase the area and depth of the permafrost. However, since there is overall warming predicted for all seasons, it is likely that the permafrost area and depth will decrease overall.

7.7.1.2 Water Table and Lake Levels

Based on the predicted changes in temperature and precipitation, it is also expected that the water distribution and resources will be altered. Between now and the 2080s, the temperature is expected to increase during all seasons. This increase in temperature, particularly in the summer, is expected to increase evapotranspiration. By the 2080's overall precipitation is also predicted to increase. Water runoff available to lakes, streams, bogs, and groundwater is determined by the levels of precipitation and evapotranspiration. Since it is predicted that the evapotranspiration will increase and that the precipitation will also increase, it is possible that these two effects will counteract one another. However, if either of these effects dominates, water levels and soil moisture could be affected.

7.7.1.3 Wind Speed

By the 2050s, it is predicted that on an annual basis there will generally be a decrease in mean sea level pressure (MSLP) across Canada, with the exception of the east coast, west coast, and south-eastern regions where there are small increases predicted (Barrow et al. 2004). These changes in MSLP will result in a higher pressure gradient across Canada and may result in increased annual mean wind speeds (Barrow et al. 2004). With the exception of the coastal areas, most areas in Canada are predicted to have increased wind speed, particularly Northern regions (Barrow et al. 2004). The greatest increase is predicted to reach 25 percent over north-eastern regions of the country (Barrow et al. 2004). Thus, in the area of the LIM properties, wind speeds are predicted to increase substantively by 2050.

7.7.1.4 Extreme Weather

Severe weather incidents are generally projected to be more frequent and more intense over the next 100 years, a continuation of current global trends, and based on projections of additional energy and moisture in the atmosphere as it warms. Such events will typically result in more intense precipitation events and more rapid surface runoff. Extreme weather events have the potential to disrupt transportation, electricity transmission, communications, as well as damage equipment and buildings on the LIM property.

7.7.2 Project Sensitivity to Climate Change

The effect of projected climate change on the Project was assessed qualitatively following the CEAA guidelines (CEAA, 2003). This assessment was based on the analysis of predicted changes to present climate over the period of operation of the Project to predict whether or not there is a risk to the public or the environment.

The sensitivity of various phases of the Project to these predicted changes was ranked (see Table 7.19). These rankings reflect the effect of climate change on the Project in terms of productivity or additional environmental management required. A ranking of Nil or Low indicates that no or very small changes are expected with respect to productivity or environmental management. A ranking of Medium indicates some intervention may be necessary to mitigate against decreased productivity.

Table 7.19 Project Sensitivities to Direct and Indirect Climate Influences

Climate Parameter	Project Phase		
	Construction	Operation	Decommissioning
Mean temperature	Nil	Low	Nil
Extreme temperature	Nil	Low	Low
Mean rainfall	Nil	Low	Nil
Mean snowfall	Nil	Low	Nil
Extreme precipitation	Low	Low	Low
Extreme winds	Low	Nil	Low
Earthquakes	Nil	Nil	Nil
Lake Levels and Streamflows	Nil	Low	Low
Soil moisture and groundwater	Nil	Nil	Low
Evaporation rate	Low	Low	Nil
Permafrost extent/levels	Low	Low	Low
Extreme weather events	Low	Low	Low

Project sensitivity for the construction phase is ranked as nil to low because weather conditions are likely to affect transportation of materials and construction activities only modestly in the period between approval and completion of construction.

Project sensitivity for operations is low overall. An increase in mean air temperature should not have a significant effect on the Project. An increase in precipitation and runoff may have an effect on surface storage ponds, though a larger design that incorporates potential future precipitation events would keep this sensitivity low. If there is a considerable increase in precipitation, additional excavation and/or construction of runoff water containment and sedimentation control structures will be required. Currently the pond capacity is designed for the highest precipitation in the past 50 years. To reduce the likelihood of an adverse effect, pond capacities should be designed for the highest precipitation event projected for the operating period. This could be achieved by adding the predicted increase in precipitation to the present design and then adding an additional safety factor since it is predicted that there will be more intense storms in the future.

Changes in multiple parameters (e.g., increased evapotranspiration and increased precipitation) may have additive effects or may have the effect of cancelling out a negative effect. Project sensitivity is ranked as nil for all other parameters (e.g., extreme winds, which may increase in magnitude and frequency) since the Project will be constructed to meet extreme weather criteria.

Project sensitivity for decommissioning is ranked as low overall based on the assumption of remediating the site to non-industrial land use following the life of the facility. The nature and the success of revegetation activities at the site would depend on climate conditions at that time.

As a result of this analysis, it is recommended that all components of this Project (ponds, buildings, equipment, etc.) are designed to avoid any adverse affect to the public or the environment due to the predicted future climate. Safety design factors will be incorporated where appropriate. In particular, settling ponds should be designed with consideration for the predicted increase in extreme precipitation events and overall increase in precipitation.

7.7.3 Summary of Effects of the Environment on the Project

The Project will be designed and built to safely withstand current climatic conditions in accordance with building codes and standard good practice. All materials specified for this Project will be in compliance with applicable building codes for anticipated temperatures, winds and precipitation levels and as such will maintain the integrity and ductility to function as they were designed. All components of the mine will also be designed to support the structural loadings created by extreme snow and ice events. All erosion and sediment control measures for the mine will be designed to handle extreme participation and sudden snow melt. Weather forecasts will be monitored during mine construction and operations. If extreme weather conditions in any way compromise a safe operation, accident prevention measures will be taken, including the temporary suspension of operations, as required. Prior to and following extreme precipitation events, all erosion and sediment control structures will be inspected to ensure integrity. Permafrost has been considered in this assessment and is not predicted to affect mine operations as it was not observed in the Project area.

The above discussion of climate change has ensured that the assessment has also considered future climatic conditions and their potential effects on the Project. As a result of this analysis, it is recommended that all components of this Project (ponds, buildings, equipment, etc.) are designed to avoid any adverse affect to the public or the environment due to the predicted future climate. Safety design factors will be incorporated where appropriate. In particular, settling ponds should be designed with consideration for the predicted increase in extreme precipitation events and overall increase in precipitation.

The mitigative strategies described above, can adequately address potential effects of the environment on the Project such that there will not be:

- a substantial delay in construction (e.g., more than one season);
- a long-term interruption in mining operations;
- damage to infrastructure that compromises public safety; or
- damage to infrastructure that would not be economically and technically feasible to repair.
- Therefore the effects of the environment on the Project are predicted to be not significant.

8.0 ENVIRONMENTAL PROTECTION

8.1 Mitigation

8.1.1 Blasting

Although blasting is not planned during the construction phase of the Project, minimal blasting for rock removal will be conducted during the operations phases of the Project. Ground vibration, air blast, and fly rock resulting from blasting operations can have an impact on the surrounding environment. Vibration and air blast overpressures can impact wildlife, cause slope failures, and create avalanches. Fly rock can damage vegetation.

Blasting can have physical and chemical effects on fish and fish habitat. Shock waves and vibrations from blasting can damage a fish's swim bladder and rupture internal organs, and may kill or damage fish eggs or alevins (DFO 1994). Blasting can cause the re-suspension of sediments (Munday et al. 1986), bank failure and resultant sedimentation, and habitat avoidance. Nitrogen-based explosives can affect aquatic life through direct toxicity of the compounds, reducing dissolved oxygen during nitrification and providing nutrients for aquatic plants. Nitrite is toxic to fish and can reduce the oxygen carrying capacity of blood. Ammonia can cause gill damage and nitrate promotes algal growth. Pommen (1983) provides detailed information on the potential chemical effects of blasting. Guidelines for blasting near waterbodies, including specifications for blasting materials, their use, time of year and additional precautions, are outlined by DFO (1994) and, where applicable, will be employed.

Blasting operations at the Project will be designed to control vibration and air blast, to minimize/contain flyrock, and to minimize ammonia and nitrate levels in mine water.

In areas of blasting (i.e., James North and South Pits and Redmond Pit), water (precipitation and groundwater) will be collected in in-pit sumps and directed to a dedicated settling pond for treatment.

8.1.2 Reject Fines Wash Water Slurry

Reject fines washwater generated from crushing, washing, and separation processes will contain an estimated 21 percent by weight of suspended solids. No chemicals will be used in the beneficiation process. Reject fines wash water will be controlled within the beneficiation area and will be directed to the former historical Ruth Mine Pit, which will provide sufficient storage capacity for solids and retention time for settling of suspended solids prior to release to the environment.

All diversions and settling ponds will be designed and constructed with appropriate dimensions and controls to ensure that all discharges are retained and treated to achieve the required quality prior to release to the environment.

Ruth Pit will act as a wet detention pond (i.e., a retention pond that always has water in it). These types of ponds are very effective for the removal of TSS and can generally achieve 90% TSS removal with a detention time of 24 hours. The degree of thermal stratification of the water in Ruth Pit is expected to be limited due to the short summer season in this area. Even if a thin stratification layer forms (warmer water at surface), there is not expected to be thermal short-circuiting of the washwater because the reject fines washwater will be introduced into Ruth Pit at depth, and at a relatively slow flow rate (volume) compared with the volume of water in the pit, and therefore the washwater will mix with the cold pit water quickly before it will short circuit due to thermal stratification.

The discharge location for the washwater into Ruth Pit will be selected to optimize the retention time within the pit. The exact location of the discharge will be determined during detailed design and will take into account the nature of the proposed Ruth Pit outlet structure and flow patterns within the pit. During the detailed design process, other measures such as hanging silt curtains, groin channels, etc. may be incorporated if required to prevent short-circuiting. A detailed design of Ruth Pit effluent treatment process will be provided at the permitting stage (Development Plan as required under the *Newfoundland and Labrador Mining Act* and reviewed by Water Resources).

LIM is evaluating the existing outlet structure at Ruth Pit and it is anticipated that upgrades to this structure may be required. The details of the upgrades will be developed with the overall detailed design of the Project, and the final design will be provided as part of the Development Plan which will be reviewed by WRM prior to approval of the Project. LIM also acknowledges that permitting will be required under Section 48 of the *Water Resources Act* and that monitoring will be required

8.1.3 Stormwater Management

Stormwater will be collected and directed to a settling pond in the Silver Yard area. The Silver Yard Stormwater Pond (SWM-1) will serve three functions:

- The primary function of the Pond will be to collect and treat stormwater from the beneficiation plant area.
- The secondary function of the Pond will be to receive the flush of water from the regular maintenance of the pumping/pipeline system. In order to complete regular Plant and/or pipeline maintenance (approximately once a week), the reject fines discharge pipeline to Ruth Pit will be flushed with clean water to push all reject fines wash water in the system to Ruth Pit. Once the pipeline is flushed and contains only clear water, the water will either be left in the pipe (typical for Plant maintenance under warm ambient temperatures) or the water will be released from the pipeline (as required for pump and pipeline maintenance or plant maintenance during freezing ambient conditions). The pipeline cannot be pumped dry; therefore, in order to clear the pipeline of water, it must be released to drain via gravity. The low point on the line is the Silver Yard Stormwater Pond and this clean water will be released into this pond prior to discharge to the environment. Discharge to the SWM-1 will consist of clear water and will not require significant retention time in the pond.
- The third function of the pond will be to receive the emergency discharge from the pipeline during a power or pumping failure. The Beneficiation Plant will be interrupted during this event and therefore the volume of effluent discharge to the pond should only be the volume of effluent in the pipeline. In this case, the effluent discharged into the pond will be the same quality as the effluent being deposited in Ruth Pit except that due to the decrease in pumping pressure and therefore pipeline velocities, some larger fines particles will settle in the pipeline and not be discharged with the effluent.

In a general risk analysis, the probability of pipeline/pumping malfunction is typically low. In the case of the Silver Yard- Ruth Pit pipeline, the risk of malfunction is associated with freezing conditions and with the continuity of pumping operations. There is no backup pipeline proposed for the Project. The pumping system will include a backup pump and backup power source. In the case of failure of either, the operation of the Beneficiation Plant will be interrupted and the pipeline will be automatically drained to the Silver Yard Stormwater Pond.

The Silver Yard stormwater pond will be designed as a multi-cell settling system to treat each of these effluent flows, to accommodate the varying effluent flows, and to ensure that release of the water/effluent to the environment (James Creek and the unnamed tributary) will meet the discharge requirements under the Certificates of Approval and MMER. This multi-cell design will also ensure maximum retention time and allow pond maintenance operations (removal and disposal of reject fines) to be carried out while the pond is still being used. Pumping the emergency discharge back to Ruth Pit is technically and economically impractical.

A detailed design of Silver Yard Stormwater Pond, which will integrate all effluent treatment requirements hydraulic design and controls to ensure discharge water quality to James Creek in compliance with all regulatory requirements, will be provided at the permitting stage (Development Plan as required under the *Newfoundland and Labrador Mining Act* and reviewed by Water Resources)..

8.1.4 Mine Dewatering

Water collected in in-pit sumps due to precipitation and groundwater inflow and pumped from perimeter dewatering wells at James Pit will be pumped to Settling Pond Area SP1 to be constructed near James Pit prior to release to the environment.

Water collected in in-pit sumps due to precipitation and groundwater inflow and pumped from perimeter dewatering wells at the Redmond 2B and 5 pits will be pumped to the historic Redmond 2 Pit. There is no surface flow connection between Redmond 2 and the unnamed stream nearby. To maintain this hydraulic isolation, the water level in Redmond 2 will be monitored during operations and once the water level reaches a pre-determined level, waste rock disposal from the proposed pits into Redmond 2 will cease and be stockpiled in other locations.

8.1.5 Grey Water/Domestic Sewage Management

The primary concern with domestic sewage is the potential to increase nutrient loading, suspended sediment or the introduction of oil and grease or other contaminants into a watercourse. These introductions can lead to oxygen depletion, eutrophication of waterbodies, adverse sediment effects or water quality contamination.

Sewage effluent will be collected and treated on site using a sterilization system and management of grey water and sewage will comply with the Newfoundland and Labrador Water and Sewage Control Regulations.

Water effluent quality will be monitored in accordance with the Environment Control Water and Sewage regulations and pursuant to the Certification of Approval required from the Pollution Prevention Division.

8.1.6 Air Quality

The main sources of emissions during both the construction and operation phases at the site include the products of combustion (NO_X, CO, SO_2) and fugitive dust (PM) from the operation of equipment. LIM will implement mitigation measures efficiently and effectively to ensure that no significant adverse environmental effects will occur due to Project-related emissions. With the appropriate mitigation implemented, off-site fugitive dust levels will be reduced to below ambient air quality standards. Mitigation techniques for these main source types are examined in more detail in the following sub-sections.

8.1.6.1 Emissions from Combustion

The main sources of combustion-related emissions during both the construction and operation phases are related to the operation of diesel generators in the first one to two years of operation (including at the workers camp), and from on-site road traffic. Although the generators are required for daily operations at the site, emissions from these sources will be reduced through the use of emission control technologies. Combustion emissions from on-site vehicle traffic will also be mitigated through:

- an anti-idling policy to limit emissions from vehicles that are not in use; and,
- a policy regarding the proper maintenance of equipment and vehicles operating in work areas.

8.1.6.2 Emissions from Fugitive Dust

Fugitive dust emissions during construction can occur during land clearing, ground excavation, and from equipment traffic on site. Potential sources of fugitive dust during operation include ore loading/unloading, ore crushing, stockpile erosion and dust from conveyor systems around the site.

Generally, fugitive dust emissions are:

- proportional to the disturbed land area and the level of activity;
- limited to periods of the day and week when the activities take place; and
- vary substantially from day to day with varying meteorological conditions.

Fugitive dust emissions occurring during construction are expected to be localized in extent, limited in duration, and smaller in magnitude than those occurring during operation.

During construction and operation, the following measures will be implemented at the site to mitigate fugitive dust emissions:

- wet suppression to control open dust sources; wetting or covering of transported borrow or fill; and,
- limiting the maximum speed of vehicles travelling along unpaved roadways.

8.2 Emergency Response/Contingency Plans

LIM has developed and implemented a Health and Safety (H&S) Program and a site-specific Environmental Protection Plan or EPP to meet corporate health, safety and environmental objectives and to ensure compliance with related Regulations for the Province of Newfoundland and Labrador. The site specific EPP will be submitted to, and approved by, the Minister of Environment and Conservation before any construction on the Project begins. A copy of LIM’s Health and Safety Policy is presented in Section 2.2 (Environmental Management and Corporate Responsibility Policies).

The EPP will be a "stand alone" document with all relevant maps and diagrams. The target audience for the EPP will be the resident engineer, site foreman/supervisor, Proponent compliance staff and the provincial environmental inspector(s) and, therefore, the EPP will concentrate on addressing such issues as construction/operation mitigation, permit application and approval planning, monitoring activities, contingency planning for accidental and unplanned events and contact lists. In addition, the

EPP will contain a tabular breakdown of major construction and operational activities into sub-components, followed by permits required, field mitigation and contingency planning where appropriate. The objective of the EPP will be to present concise, comprehensive and easily accessed environmental protection information for field use by the target audience.

It is worth noting that the LIM H&S program was successfully implemented at the start of the 2008 geological drilling and field exploration program and the 2008 field program was successfully completed without any lost time incident.

8.2.1 Hazard Identification and Risk Assessment

A preliminary written assessment of all existing or potential health, safety or environmental hazards will be performed before work begins on any work site under LIM control. This assessment will further identify necessary management and / or worker action that may be required to eliminate or mitigate such identified hazards.

The objective in all cases is to ensure that all identified hazards have been eliminated or mitigated to the lowest practicable level. Any remaining hazards that cannot be eliminated or mitigated will be subject to defined safe work procedures, combined with extensive worker training, in order to minimize the potential for worker injury or an environmental incident.

As part of the hazard assessment process the local natural environment will be recognized and assessed as it relates to possible wildlife encounters or possible exposure to extreme weather conditions that periodically occur in the Project area.

Examples of hazards and related emergencies that could potentially occur on a mining site in the Schefferville area are as follows:

- fire or explosion;
- equipment collision;
- collapse of mining slope;
- man overboard / water rescue;
- rescue, extrication or recovery of a worker;
- injury incident or medical emergency;
- wildlife encounter;
- extreme meteorological condition or natural disaster;
- an environmental spill;
- toxic or flammable gas leak;
- mining site evacuation; and
- public complaint regarding the environment or a health and safety concern.

8.2.2 Emergency Response Plan

Emergency Response Plans will be developed to deal with all potential incidents that could occur during Project construction, operation and closure activities. Once the Project has received regulatory approval, and the 2009 phase of Project construction has begun, LIM will monitor the programs and further update and refine its existing Emergency Response Plans to meet future Project requirements as well as implement corrective action, as required. Related plans will include:

- procedures for dealing with identified emergencies;
- available communication devices to summon emergency assistance;
- on-site availability of fire-fighting equipment (such as fire extinguishers, water hydrants and protective gear);
- on-site location of emergency facilities;
- resources and procedures for rescue and evacuation (including means of conveyance, such as an emergency vehicle or helicopter, as applicable);
- an emergency call list containing:
  - The names and contact numbers of emergency personnel
  - The names of all other persons to be informed in case of an emergency (e.g. owner, contractor and regulatory agencies)
  - The names and contact numbers of any external “mutual aid” resources that can provide additional assistance in any case where such assistance is necessary
  - The contact number and the location of any medical facilities capable of treating an injured worker
- an Environmental Response trailer fully equipped to address any environmental incident (including absorbent materials, fabrics and booms, etc);
- first aid services available at each individual work site, compliant with the First Aid Regulation for Newfoundland and Labrador;
- list of available first aid supplies for each work site, compliant with First Aid Regulation for Newfoundland and Labrador; and
- defined accident / incident investigation process for any incident that may occur at an LIM mining site.

8.2.3 Mutual Aid Agreement

Subject to permitting, LIM will proceed to develop mutual aid agreements with local communities and business located within reasonable response distance of the Project area.

It is a mining industry tradition that mutual aid is voluntarily extended in case of dire need and a request for assistance. To date, preliminary discussions have been conducted with the Town of Schefferville Administrator, as well as representatives of the nurses at the Schefferville medical facilities to advise of proposed activities.

At this time the principal parties with whom further discussions will be conducted to provide mutual assistance include, but are not limited to, the following:

- Municipality of Schefferville regarding fire fighting, police, and ambulance service;
- Schefferville Health Clinics for medical aid;
- possible: New Millennium Capital Corporation for potential emergency response on any major mining or environmental incident;

- Wabush Iron (Wabush) for potential emergency response on any major mining incident or environmental incident;
- IOC (Labrador City) for potential emergency response on any major mining incident or environmental incident; and
- Helicopter Services, for medical evacuation.

8.2.4 Contingency Plan

The Contingency Plan, which will be required under the Certificate of Approval for the operation of the mining and beneficiation process for the Project, must be submitted to the NLDEC, Pollution Prevention Division.

The purpose of the Contingency Plan is to outline information and procedures regarding emergency preparedness and response related to the storage and use of fuel, propane, and hazardous spills at the site. The Contingency Plan will also satisfy requirements under the *Canadian Environmental Protection Act* (1999) regarding environmental emergency plans. The plan will define the roles of individuals and departments having particular responsibilities under the plan, and identify an action plan for spill response in any part of the operation.

A copy of the plan will be provided to representatives of the Schefferville Fire Department team. This will ensure cooperation and understanding of responsibilities and emergency response measures to be followed.

8.3 Environmental Monitoring and Follow-Up Programs

LIM will develop details of monitoring and follow-up programs when more information (i.e., conditions of release) becomes available. Objectives, methods, duration, and frequency of the programs will be provided to the Minister of Environment and Conservation as the programs are developed.

8.3.1 Air Quality

If required, an air quality monitoring program will be instituted at the site to determine changes in ambient air quality. This monitoring program would focus on measuring ambient dust level concentrations around the processing area and along the hauling routes between the ore deposits and beneficiation area. Further consultation with the NLDEC is required to discuss and confirm the detailed requirements of a proposed ambient air quality monitoring program.

A monitoring program designed as per the requirements defined under the “National Air Pollution Surveillance Network: Quality Assurance and Quality Control Guidelines” (NAPS) and focusing mainly on particulate emissions, could involve the following:

- measurement of ambient dust concentrations will be made using portable, battery-powered dust monitors. The monitors will be installed at suitable locations near each deposit and the beneficiation area (three stations in total). These samplers will run over a 24-hour period every six days, and the samples will be analyzed at a certified laboratory, similar to that required by the federal NAPS monitoring program; and
- dustfall (mass per unit time per unit area) will be measured using a network of dustfall jars along the roadway connecting the Redmond and James sites to the beneficiation area. Total dustfall will be

determined by laboratory analysis of the jar liners. Dustfall samples will be collected on a monthly basis, for a three month period during the summer months, when production levels would be at their greatest and when meteorological conditions would allow for the highest potential emissions of particulate matter.

8.3.2 Water Quality and Environmental Effects Monitoring

Provincial regulations (Environmental Control, Water and Sewer Regulations) and permits (Certificate of Approval) will require effluent quality monitoring and toxicity testing on a regular basis. Effluent and receiving water quality monitoring and reporting will also be required under the federal MMER. Monitoring details will be determined at the permitting stage in consultation with the Water Resources Management Division. Monitoring will also be coordinated to meet DFO requirements. Preliminary discussions have been held with the Water Resources Management Division and DFO regarding monitoring, and LIM acknowledges that monitoring will be required. The flow rates from Ruth Pit will likely exceed the MMER trigger, and LIM is aware of the monitoring requirements of MMER. Detailed monitoring programs will be developed in consultation with the Water Resources Management Division, and DFO during the permitting stage of the Project. The monitoring programs will involve water quality and quantity measurements.

It is acknowledged that a Site Characterization and Study Design will require Environment Canada's prior approval to completing the biological monitoring components of the MMER for James Creek, as the creek will be the receiving waterbody from Ruth Pit.

LIM is also aware of the regulatory requirements that the Pollution Prevention Division applies to mining operations via the Certificate(s) of Approval. The absence of reference to PPD's jurisdiction and requirements does not imply that PPD does not have jurisdiction and was not a lack of understanding of the requirements. In lieu of the recent change to the Environmental Control Water and Sewage Regulations under the *Water Resources Act*, LIM will meet with the PPD to discuss the PPD's specific permitting requirements as they relate to the Project and water monitoring.

A generic real-time monitoring MOU was provided to LIM by the Water Resources Management Division. This MOU is general in nature and does not contain any specifics with respect to the nature of the monitoring that will be required. These monitoring details are currently being discussed between the Pollution Prevention Department, the Water Resources Management Division, and LIM and further details will continue through the permitting. Monitoring will also be coordinated to meet DFO requirements.

8.3.3 Caribou

Effects of mining activities on caribou is “fragmentary” (Wier et al. 2007) and it is therefore important to understand herd affiliation, distribution of caribou within and around the Project, and to understand the usage of these areas - whether as a travel corridor, overwintering foraging area, or as year-round habitat in the event that sedentary woodland caribou occur.

In May 2009, the Project conducted a strip-transect aerial survey of a 12,900 km^2 area that included the 7,850 km^2 Assessment Area that overlaps both Labrador and northeastern Québec. The objective of the survey was to determine if caribou are present in this area at a time when the GR Herd was not expected to be present (Figure 4.19). The satellite telemetry-collared caribou from this survey and tissue samples retained for genetics analyses will provide information on movements and possible herd affiliation (i.e., whether of the GR Herd or possibly a woodland herd) of the caribou encountered. Morphological measurements suggested the few animals observed were of the migratory ecotype however their behaviour was consistent with woodland caribou. Regardless, the outcome of this ongoing effort will be used to determine if the woodland caribou mitigation should remain or be replaced by that proposed for the migratory caribou of the GR Herd.

Throughout the life of the Project, LIM proposes to maintain liaison with the Provincial Wildlife Division, community representatives and Elders, and other stakeholders and officials regarding the movements of the GR Herd and/or possible woodland caribou in the Project area. Mitigation strategies will be implemented to ensure no harm or harassment of caribou occurs. Through satellite collar and other monitoring and ongoing data collection, LIM will continue to enhance the understanding of caribou activities in the Project Area and will implement an advisory to mine management staff should any herd enter the Assessment Area. Caribou movements, and LIM observations and actions implemented will be recorded and communicated to the Wildlife Division.

8.3.4 Other Wildlife

Consistent with standard procedures advocated by the provincial Wildlife Division, clearing of vegetation around active nests of Osprey or Bald Eagle that may be breeding in the Project area, will be limited to 800m. Should such a nest site occur within the footprint of the Project, it would not be removed until after the breeding season. An alternative artificial nest structure would be established in the immediate area. The existing Osprey nest observed on the existing transmission line corridor to Menihek less than 150 m from the active roadway (connecting the James and Redmond Properties) will not be approached by Project personnel. Standard mitigation measures regarding construction and operation related activities for active Osprey nests are to avoid such areas by at least 200 m.

8.3.5 Employment and Business

LIM will monitor Project employment and expenditures, including the proportions of work going to Labrador and the Innu of Labrador. This information will be compiled on an annual basis and made available to government upon request.

Provisions respecting the employment of women are specified in the Women’s Employment Plan (Appendix D).

8.3.6 Communities

The monitoring of demands on community services and infrastructure is the responsibility of the relevant government departments and agencies, as part of their normal planning processes. LIM will assist by liaising with them, as requested, and through the timely provision of information about Project activity and plans.

8.4 Rehabilitation

Closure rehabilitation, carried out once mining operations have ceased, includes all activities required to fully restore or reclaim the property as close as reasonably possible to its former condition or to an approved alternate condition. This would include demolition and removal of site infrastructure, revegetation and all other activities required to achieve the requirements and goals detailed in the Rehabilitation and Closure Plan.

The primary objective of the rehabilitation and closure planning and implementation is to return the site to pre-mining land contours and drainage patterns, matching the adjacent lands as closely as practical while maintaining long term physical and chemical stability. LIM's approach to rehabilitation at the proposed Silver Yard, James North, James South, and Redmond deposits will be to employ advanced progressive and closure rehabilitation techniques through integrated development, operational, and closure technology and design.

All aspects of mine development including mine design, infrastructure location and design, and operations planning have and will be conducted with full consideration of available progressive rehabilitation opportunities and closure rehabilitation requirements.

8.4.1 Beneficiation Infrastructure

All buildings and surface infrastructure will be dismantled and removed/disposed. All surface buildings and infrastructure to be demolished or removed will be cleaned of process materials and potentially hazardous material.

8.4.2 Salvage

Material and equipment with salvage value will be removed and sold. This expected salvage value will not be used to reduce the decommissioning cost estimate. Equipment and demolition debris with no marketable value will be disposed of in a manner consistent with relevant legislation and guidelines.

8.4.3 Roads, Pipelines and Power Distribution Lines

Roads and culverts will remain intact for post-decommissioning and emergency situations. Water and reject fines wash water pipelines will be emptied and removed from site. Any pipelines deemed necessary to be left in place will be cleaned, and capped.

8.4.4 Stormwater Management Settling Pond and Diversion Ditches

The sediment contained within the settling pond will be left in place unless removal is required to re-establish drainage. The remaining material will be graded and vegetated to reduce erosion and sedimentation.

Diversion ditches will be engineered to permit the re-establishment of natural drainage. On-going assessment of vegetation growth and the general health of the established vegetation will determine if any rehabilitation methods need to be pursued.

8.4.5 Overburden and Waste Rock Stockpiles

The peat and organics stockpile will be active over the life of the Project for use in progressive site reclamation and in the final closure phase. Overburden and waste rock (non-ARD generating) will be used in reclamation throughout the site for regrading or fill where required. Stabilization of remaining waste rock areas by grading and contouring to a stable slope angle to reduce erosion and sedimentation will be performed. The storage pad will be removed and reclaimed through regrading that will promote long term stability. Revegetation will be established on portions of the disposal facilities through a program of top dressing and seeding or transplanting as necessary to encourage the growth of indigenous plant species. Excess non-mineralized mine rock at surface stockpiles will remain on the surface at closure.

8.4.6 Open Pits

Open pits will be decommissioned through a sequence of events designed for their long-term stability. Following the termination of open pit operations, waste rock may be deposited into the pit. Flooding of the pit will be allowed to occur naturally from groundwater inflows, snowmelt and rainfall within the pit catchment area. As per engineering specifications, the pit walls will be excavated to a stable slope angle. Pit water will be monitored on a regular basis as flooding proceeds, and, if required, treated prior to discharge.

8.4.7 Fuel and Hazardous Materials Storage Facilities

All fuel and chemical storage tanks and containers will be emptied and removed from the site by licensed and experienced contractors. Connecting pipelines will be drained, cleaned and removed or capped as required. Any areas of major hydrocarbon or chemical contamination will be remediated through excavation and removal of the soil for off-site disposal in accordance to applicable regulations. Contaminated areas will be graded and contoured to reduce erosion and sedimentation from surface runoff. The areas will be stabilized to allow for revegetation.

8.4.8 Borrow Pits

Overburden that was removed during development of the borrow pits will be used in pit rehabilitation and slope regrading to promote site revegetation.

8.4.9 Explosives Storage

When decommissioned, all explosives in the storage facility will be removed, as well as all equipment that will be emptied, cleaned and removed. Other inert construction debris or materials will be disposed underground with the waste rock. Reclamation methods for the explosives storage facility is similar to that of any plant site building where surficial disturbances have occurred.

8.4.10 Revegetation

In general, site drainage patterns will be re-established, as near as practical, to natural, pre-development conditions.

Grading and/or scarification of disturbed areas to promote natural revegetation will take place. Where natural revegetation is not sufficiently rapid to control erosion and sedimentation, placement and grading of overburden for revegetation in areas may be necessary.

8.4.11 Monitoring

A post-closure monitoring program will continue from the operational monitoring program incorporating appropriate changes to the program. The post-closure monitoring program will continue for a minimum of two years after final closure activities are completed or until LIM and the appropriate regulatory bodies are satisfied that all physical and chemical characteristics are stable. When the site is considered physically and chemically stable, the land will be relinquished to the Crown.

8.5 Environmental Protection Plan

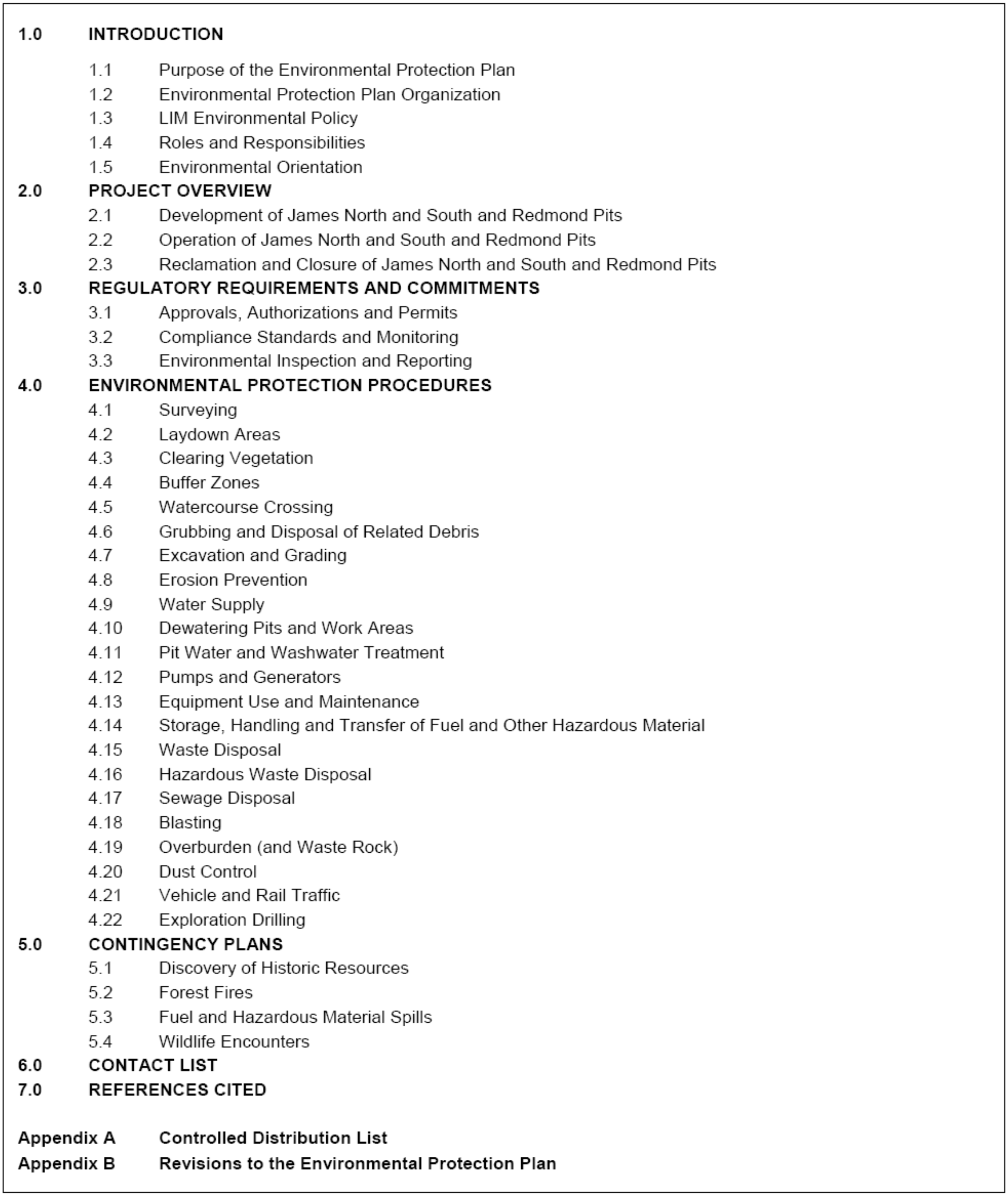
Environmental protection procedures and measures will be implemented for all stages of the Project. The environmental protection measures summarized below will provide the basis for environmental planning and design of the various physical aspects and environmental characteristics of the Project. Detailed environmental protection procedures will be described in the EPP which will be developed prior to commencement of construction for the Project. The following measures will be considered:

- erosion protection measures will be applied for all exposed soil during site earthworks related to site development and construction, quarry and open pit excavation, and rehabilitation and closure activities. Additional measures such as ditch blocks, settling ponds and filter fabrics will be applied in problematic conditions, where high TSS, steep gradients or high volumes of run-off are expected;
- vegetation buffers will be maintained around natural water bodies where alterations or crossings are not required. Maintaining vegetated buffer zones will aid in managing suspended solids in watercourses and reduce erosion and sedimentation;
- open pit design (wall angles and benching) will incorporate erosion control measures;
- access road and rail bed design and construction will focus on protection of the aquatic environment by incorporating buffer zones, drainage and erosion control features and very conservative culvert design criteria. Culverts crossings will be designed and installed with consideration for road and stream gradient, ice conditions, bank stability and, where warranted, protection of fish habitat;
- road maintenance activities, such as grading and ice control (sand/gravel application), may cause sediment to be introduced into watercourses. Reasonable care in the application of sand and controlling erosion from grading will reduce this risk substantially;
- wildlife encounters may impose risk to both wildlife and Project personnel. There will be no fishing, hunting, or trapping by personnel at the Project site. Additional measures will be in place to reduce attraction of wildlife such as black bears to the site (e.g., proper storage and disposal of waste). Prior to site clearing, migratory bird nests will be identified and appropriate buffers applied. To help reduce impacts of vegetation clearing during nesting periods, vegetation clearing will be undertaken outside of breeding season. If this is not possible and a nest is found, the nest and neighbouring vegetation will be left undisturbed until nesting is completed and or, construction activities will be minimized in the immediate are until nesting is completed;
- To address potential interaction with nest sites of bird species, an Avifauna Environmental Management Plan (EMP) to address incidental take (the inadvertent disturbance of a nest site) will be completed consistent with the *Migratory Birds Convention Act*. This Avifauna EMP would be prepared and implemented prior to the start of construction;
- Disturbance to wetlands will be avoided or minimized;

- hydrocarbon (fuels) and hazardous materials required during construction and operation will be stored pursuant to all applicable regulations. Fuel tanks will be located within an impervious berm, founded on compacted sand and will include an impermeable membrane that covers the entire area to prevent seepage of petroleum-based products. Hazardous materials will be stored in appropriate locations/facilities with proper containment and ventilation as required for each product;
- grey water and sewage will be managed in accordance with all applicable regulations. Sewage from the Silver Yard facilities will be treated using biological oxidation technology and the resulting grey water will be disinfected and discharged with the reject fines wash water;
- mine, process and stormwater will be controlled, collected, and treated as follows:
    - reject fines wash water will be pumped via pipeline to Ruth Pit where sufficient retention time is available to allow settlement of solids prior to discharge to the environment (there is no chemistry anticipated);
    - mine dewatering water (precipitation, groundwater) will be pumped to the surface and retained in constructed settling ponds prior to release to the environment;
    - blasting, when required, will be conducted in such a manner as to reduce the potential presence of ammonia and nitrates in pit water;
    - stormwater from the Silver Yard area will be collected and directed to a stormwater management pond located adjacent to the facility for treatment prior to release to the environment. This pond will also serve as the emergency discharge point for reject fines wash water; and
    - for all aspects of the development and operation, measures will be taken to divert water (stormwater runoff, etc.) away from developed areas.
- solid waste produced by site personnel and operations will be collected, hauled, and placed in a landfill facility in Labrador West, in accordance with applicable regulations. Bear-resistant containers will be used on site to prevent environmental or health hazards or conflict with wildlife. A Waste Management Plan will be developed and implemented for the Project to address all aspects of solid waste handling and disposal (except for mine and process waste materials – rock and washwater);
- dust from construction activities will be controlled by using water if required;
- environmental concerns that may arise from the use of mobile or remote pumps and generators will be addressed through the use of drip pans, proper storage of fuel, and routine inspection of equipment;
- noise associated with blasting and heavy equipment will be addressed by adherence to all permits, and approvals; and,
- the location and storage of explosive magazines will abide by the appropriate regulations.

These general environmental protection methods, which have been applied to many resource development and construction projects, will be applied to the specific design and construction criteria to develop a fully integrated EPP for this Project prior to development. The table of contents for the EPP is provided as an outline of how the plan will be structured (Table 8.1)

Table 8.1 Environmental Protection Plan Table of Contents



1.0 INTRODUCTION

- 1.1 Purpose of the Environmental Protection Plan
- 1.2 Environmental Protection Plan Organization
- 1.3 LIM Environmental Policy
- 1.4 Roles and Responsibilities
- 1.5 Environmental Orientation

2.0 PROJECT OVERVIEW
- 2.1 Development of James North and South and Redmond Pits
- 2.2 Operation of James North and South and Redmond Pits
- 2.3 Reclamation and Closure of James North and South and Redmond Pits

3.0 REGULATORY REQUIREMENTS AND COMMITMENTS
- 3.1 Approvals, Authorizations and Permits
- 3.2 Compliance Standards and Monitoring
- 3.3 Environmental Inspection and Reporting

4.0 ENVIRONMENTAL PROTECTION PROCEDURES
- 4.1 Surveying
- 4.2 Laydown Areas
- 4.3 Clearing Vegetation
- 4.4 Buffer Zones
- 4.5 Watercourse Crossing
- 4.6 Grubbing and Disposal of Related Debris
- 4.7 Excavation and Grading
- 4.8 Erosion Prevention
- 4.9 Water Supply
- 4.10 Dewatering Pits and Work Areas
- 4.11 Pit Water and Washwater Treatment
- 4.12 Pumps and Generators
- 4.13 Equipment Use and Maintenance
- 4.14 Storage, Handling and Transfer of Fuel and Other Hazardous Material
- 4.15 Waste Disposal
- 4.16 Hazardous Waste Disposal
- 4.17 Sewage Disposal
- 4.18 Blasting
- 4.19 Overburden (and Waste Rock)
- 4.20 Dust Control
- 4.21 Vehicle and Rail Traffic
- 4.22 Exploration Drilling

5.0 CONTINGENCY PLANS
- 5.1 Discovery of Historic Resources
- 5.2 Forest Fires
- 5.3 Fuel and Hazardous Material Spills
- 5.4 Wildlife Encounters

6.0 CONTACT LIST

7.0 REFERENCES CITED

Appendix A Controlled Distribution List

Appendix B Revisions to the Environmental Protection Plan

9.0 SUMMARY AND CONCLUSION

The following sections provide a summary of proposed mitigation measures, the anticipated residual environmental effects of the Project, and environmental monitoring commitments in relation to the VECs that were considered as part of this assessment.

9.1 Mitigation

Based on the Project-VEC interactions and issues and concerns identified, and existing knowledge regarding these interactions and issues, mitigation measures to reduce or eliminate the potential adverse effects of the Project were identified. Mitigation included the incorporation of environmental considerations into Project design and planning, the implementation of LIM's EMS, and mitigation measures specific to particular VECs.

Where possible, a proactive approach to mitigating the potential environmental effects of the Project has been taken by incorporating environmental considerations directly into Project design and planning. Specific planning initiatives include:

- EPPs;
- Emergency Response and Contingency Plans;
- Occupational Health and Safety Plans;
- Reclamation Plan;
- Caribou mitigation strategy and monitoring development and implementation;
- Other terrestrial and aquatic mitigation strategies and monitoring development and implementation, including avifauna and fish;
- Education and Orientation Plan;
- Mutual Aid Agreement; and
- Monitoring and Follow-up Plans.

A mine decommissioning plan will be developed for the Project site upon mine closure. Progressive reclamation in work areas will occur throughout the life of the Project. The site will be rehabilitated to a safe and environmentally stable condition. LIM is also committed to complying with all relevant environmental legislation and regulations, and the conditions of required permits and approvals. Where required, other measures have been identified in relation to specific VECs. Mitigative measures which are applicable to each of the VECs under consideration are summarized in Table 9.1.

Table 9.1 Mitigative Measures Applicable to Each VEC

VEC	Mitigation/Effects Management Measures
Fish and Fish Habitat	• Erosion and sediment/erosion control (e.g., ditch dams, settling ponds, filter fabric) • Collection and treatment of contaminated water and site drainage • Clean water drainage will be diverted away from active work areas to reduce water treatment requirements • Design and implementation of fuel and other hazardous materials spill/contingency plans and emergency response in the event of an accident • Fishing by Project personnel while at site will be strictly prohibited; • Construction activities around watercourses will not occur during sensitive periods for fish • Maintenance of buffers along watercourses • Use of covered trucks and conveyors
Caribou	• Monitoring movements by the George River Herd, advisory to personnel when herd within Assessment Area; • Reporting observations to Provincial Wildlife Division; • Communicating with the Provincial Wildlife Division about planned blasting activities if caribou are observed within 3 km of the Project site;
Communities	• Use a commute system and camp accommodations for most Project workers • Minimize time commuting workers spend en route in communities • Rigorous occupational health and safety provisions and implementation
Employment and Business	• LIM and its contractors will include a copy of the LIM Benefits Policy in all Project calls for expressions of interest, requests for proposals, and contracts • LIM will liaise with provincial, and especially Labrador, educational institutions and human resources agencies so that they are informed about employment requirements and plans • LIM will liaise with provincial, and especially Labrador, business groups and economic development agencies so that they are informed about goods and services requirements and plans • LIM will monitor the Project labour force to establish the percentage of positions held by residents of the Province • LIM will monitor the award of Project contracts to establish the percentage of the work, by value, awarded to companies based in the Province • LIM will, on an annual basis, compile the above monitoring data, assess them relative to Project benefits targets and, if necessary, review and revise its benefits approach, initiatives and targets • Make the above annual compilation of benefits data available to government departments and agencies, upon request • Implement the provisions of LIM’s Project Women’s Employment Plan

Mitigative measures will be put in place to minimize emissions and resultant fugitive dust near the property limits. These measures will include wet suppression of roads and storage piles to minimize fugitive dust. With such mitigation measures in place, fugitive dust emissions (and resultant off-property PM concentrations) would be reduced to below ambient air quality standards. LIM will implement mitigative measures efficiently and effectively to ensure that no significant adverse environmental effects occur due to Project-related emissions during operation. Follow-up ambient monitoring (as discussed in Section 8.3 of the EIS) will confirm Project-related emissions during construction and operation for additional mitigation development and implementation, if appropriate.

9.2 Residual Environmental Effects

Residual environmental effects predictions were made taking into consideration the identified mitigation measures. Predicted adverse environmental effects were evaluated as significant or not significant based on a set of significance definitions developed for each VEC. The residual effects of each Project phase on each of the VECs under consideration are summarized in Table 9.2 and discussed below.

Table 9.2 Summary of Residual Environmental Effects

VEC	Construction	Operation	Decommissioning	Accidental Events
Fish and Fish Habitat	Not Significant	Not Significant	Not Significant	Not Significant
Caribou	Not Significant	Not Significant	Not Significant	Not Significant
Employment and Business	Not Significant	Not Significant	Not Significant	Not Significant
Communities	Not Significant	Not Significant	Not Significant	Not Significant

The residual adverse environmental effects of the Project's construction, operation and decommissioning phases and those resulting from accidental events on Fish and Fish Habitat and Caribou are evaluated as not significant. The residual environmental effects of the Project's construction, operation and decommissioning phases on Employment and Business, and Communities will be positive. The residual adverse environmental effects on Employment and Business, and on Communities resulting from Project construction, operation, decommissioning, or accidental events is not significant. The Project is therefore not likely to result in significant adverse environmental effects on the environment.

The environmental assessment also considers the likely cumulative environmental effects of the Project in combination with other projects and activities in the area. The Project will not occur in a pristine environment; the natural and human environments in the area have been affected by past mining activities. These existing effects have been considered as part of the baseline environment, and the assessment and evaluation of the cumulative environmental effects of the Project in combination with other projects and activities considers the nature and degree of change from these existing environmental conditions. The cumulative environmental effects of the Project in combination with other projects and activities in the area will be not significant.

9.3 Follow-up and Monitoring

Environmental monitoring (or follow-up) programs ensure that any unforeseen environmental problems can be identified and addressed in an effective and timely manner. Anticipated monitoring includes the following:

- water quality and quantity will be monitored in the receiving environment;
- ambient air quality (particulate matter) will be monitored during Operation to confirm if emissions are causing off-property particulate matter levels to be above regulatory standards.
- toxicity testing may be required on discharges;
- environmental effects monitoring (water, fish, and benthic invertebrates) may be required to determine effects of the discharges;
- implementation of a woodland caribou mitigation strategy pending confirmation of ecotype (anticipated to be at end of Year 1 once outstanding May 2009 survey data is available).

Observations of caribou, as discussed in mitigation strategies, will continue to be reported to the Provincial Wildlife Division during the Project;

- LIM will develop and implement an Avifauna EMP to address the potential disturbance to nesting avifauna;
- progressive site reclamation measures, including the use of native plant species to enhance site revegetation, will be monitored throughout the Project;
- LIM will monitor the Project labour force to establish the percentage of positions held by residents of the Province;
- LIM will monitor the award of Project contracts to establish the percentage of the work, by value, awarded to companies based in the Province;
- LIM will, on an annual basis, compile the above monitoring data, assess them relative to Project benefits targets and, if necessary, review and revise its benefits approach, initiatives and targets;
- make the above annual compilation of benefits data available to government departments and agencies, upon request; and
- LIM will implement the provisions of the Project Women’s Employment Plan.

9.4 Conclusion

Based on the environmental effects assessment taking into consideration the mitigation and effects management measures, overall Project construction, operation and decommissioning are not likely to result in significant adverse environmental effects on any of the VECs identified for the environmental assessment. The potential residual effects of accidental events will be not significant, and unlikely to occur. No significant adverse cumulative effects have been identified for the Project.

The Project will, however, result in considerable socio-economic benefits. It will create considerable direct and indirect employment and business opportunities, and contribute substantially to the economy of the local area, as well as that of the Province of Newfoundland and Labrador as a whole by providing local employment and incomes as well as local business during construction and operation.

10.0 REFERENCES

10.1 Personal Communications

Cochrane, S.	Student Development Officer, College of the North Atlantic, Happy Valley-Goose Bay Campus, Happy Valley-Goose Bay, NL. E-mail. February 9, 2007
Dyson, T.	Regional Director of Community Health and Wellness, Labrador-Grenfell Regional Integrated Health Authority, Happy Valley-Goose Bay, NL. E-mail, August 20, 2007.
Jesseau, S.	Regional Director Acute Care Services, Labrador Health Centre, Happy Valley-Goose Bay, NL. Telephone conversation. January 12, 2007.
Johnson, A.	IOC Security, Telephone conversation. December 5th, 2008.
Johnson, A.D.	CFB Goose Bay, Operations Coordinator. Happy Valley-Goose Bay, NL. E-mail. February 12, 2007
Jerrett, B.	Economic Development Director, Town of Labrador City, Email, November 17, 2008.
Kennedy, S.	Administrator, A.P. Low Primary. Telephone conversation, November 5, 2008.
LaCosta, H.	Principal, J. R. Smallwood Middle School. E-mail, November 13, 2008.
Lapointe, M-S.	CLSC. Schefferville, QC. E-mail. August 20, 2008.
Lee, K.	Assistant Director, RSM Safety Institute, Labrador City, NL. E-mail. August 28, 2008.
McCarthy, K.	Director, RSM Safety Institute, Labrador City, NL. E-mail. October 30, 2006.
McKenzie, R.	Hunting and Fishing in Schefferville, December 5, 2008.
Montague, W.	Campus Administrator, College of the North Atlantic, Happy Valley-Goose Bay, NL. E-mail. July 16, 2008
Normore, S.	Superintendent of Works-Water and Sewer, Town of Happy Valley- Goose Bay, Happy Valley- Goose Bay, NL. E-mail. December 21, 2006 and February 1, 2008.
Parks, D	Senior Aquatic Specialist. AECOM. December 3, 2008
Price, G.	General Manager, Goose Bay Airport Corporation, Happy Valley-Goose Bay, NL. e-mail, May 6, 2008
Pye, T.	Manager of Plants and Facilities, Labrador School Board, Telephone Conversation, November 14, 2008.
Rashleigh, D.	Chief of Medical Staff, Labrador Health Centre, Happy Valley- Goose Bay, NL. E-mail, no date.

Sawyer, R.	Campus Administrator. College of the North Atlantic, Labrador West Campus. E-mail, November 27, 2008.
Simmons, L.	Principal, Menihek High, E-mail, November 12, 2008.
Simpson, O.	Chief Operation Officer (West), Labrador-Grenfell Health, Captain William Jackson Memorial Hospital, E-mail, November 27, 2008.
Squire, J.	Supervisor, Labrador Ambulance Service, Happy Valley- Goose Bay, NL. Telephone conversation. February 13, 2007.
Stacey, J.	Supervisor, Labrador Ambulance Service, Happy Valley-Goose Bay, NL. E-mail. January 21, 2008 and August 26, 2008.
Tee, D.	NLDTW, Happy Valley-Goose Bay, NL. Telephone conversation. November 8, 2007
Webber, D.	Full-time Fire Fighter, Happy Valley- Goose Bay Fire Department, Happy Valley-Goose Bay, NL. Telephone conversation. November 2007.

10.2 Literature Cited

AECOM. 2008. *Labrador Iron Mines Baseline Terrestrial Repor*t – James, Redmond & Silver Yards.

AMEC Earth & Environmental Ltd. and Gardner Pinfold. 2008. *Economic Impact of Flight Training on Labrador, Final Report.* Prepared for the Institute for Environmental Monitoring and Research by AMEC Earth & Environmental and Gardner Pinfold Consulting Economists Limited, St. John's, NL and Halifax, NS.

Aura Environmental Research and Consulting Ltd. 2008. *Lower Churchill Hydroelectric Generation Project: Community Health Study*, prepared for Minaskuat Limited Partnership, Happy Valley-Goose Bay, NL.

Barrow, E., Maxwell, B., and Gachon, P. (Eds). 2004. *Climate Variability and Change in Canada: Past, Present and Future*, ACSD Science Assessment Series No. 2, Meteorological Service of Canada, Environment Canada.

Bergerud, A. T., and Manuel, R. 1968. *Moose damage to balsam fir-white birch forests in central Newfoundland*. Journal of Wildlife Management 32: 729-746.

Bergerud, A. T., Jakimchuk, R.D., and Carruthers, D.R. 1984. *The buffalo of the North: Caribou (Rangifer tarandus) and human developments.* Arctic: 37 (1): 7-22.

Bergerud, A.T. 1996. *Evolving perspectives on caribou population dynamics, have we got it right yet?* Rangifer 9: 95-116.

Bergerud, A.T. and Luttich, S.N. 2003. *Predation risk and optimal foraging trade-off in the demography and spacing of the George River Herd, 1958-1993*. *Rangifer* Special Issue No. 14: 169-191.

Bergerud, A.T., Luttich, S.N., & Camps, L. 2008. *The Return of Caribou to Ungava*. McGill-Queen's. Native and Northern Series 50. McGill-Queen's University Press, Canada.

Black, R.F. 1951. *Permafrost*. Smithsonian Inst. Rept. 1950. Cited in Pryer (1966).

Boulet, M., Couturier, S., Côté, S.D., Otto, R.D., Bernatchez, L., 2007. *Integrative use of spatial, genetic, and demographic analyses for investigating genetic connectivity between migratory, montane, and sedentary caribou herds.* Molecular Ecology, 16(20): 4223-4240.

Brown, R.J.E. 1979. *Permafrost Distribution in the Southern Part of the Discontinuous Zone in Québec & Labrador*. Geotechnical Division, Division of Building Research, National Research Council of Canada.

Cadman, M.D., Sutherland, D.A., Beck, G., Lepage, D., and Coutourier, A. 2007. Atlas of the Breeding Birds of Ontario 2001-2005. Bird Studies Canada, Environment Canada, Ontario Field Ornithologists, Ontario Ministry of Natural Resources, and Ontario Nature. Toronto, xxii + 706 pp.

Chubbs, T.E., Keith, L.B., Mahoney, S.P., and McGrath, M.J. 1993. *Responses of woodland caribou (Rangifer tarandus caribou) to clear-cutting in east central Newfoundland*. Canadian Journal of Zoology 71: 487-493.

CLEDB (Central Labrador Economic Development Board). 2006. *Central Labrador Economic Development Board Business Plan 2006-2008.* Submitted to ACOA November 2006.

Cote, S. D. 1998. *In vitro Digestibilities of Summer Forages Utilized by Riviere George Caribou Herd.* Arctic*:* 51 (1): 48-54.

Couturier, S., Brunelle, J., Vandal, D., and St-Martin, G. 1990. *Changes in the population dynamics of the George River Caribou Herd, 1976-87.* Arctic: 43 (1): 9-20.

Couturier, S., Courtois, R., Leproux, H., Rivest, L.-P., Luttich, S., 1996. Calving photocensus of the Rivière George Caribou herd and comparison with an independent census. Rangifer 9 (special issue) 283-296.

Couturier, S., D. Jean, R. Otto, and S. Rivard. 2004. Demography of the migratory tundra caribou

(Rangifertarandus) of the Nord-du-Québec region and Labrador. Available online, last accessed November 28, 2008: http://bowsite.com/bowsite/features/articles/QLcariboumigrations/Quebec_report.pdf

Crete, M., Hout, J., and Gauthier, L. 1990. *Food selection during early lactation by caribou calving on the tundra in Québec.* Arctic, 43 (1): 60-65.

Crete, M., Ouellet, J.-P., Tremblay, J.-P., Arsenault, R. 2001. Suitability of the forest landscape for coyotes in northeastern North America and its implications for coexistence with other carnivores. Ecoscience 8(3): 311-319.

Curatolo, J.A. and Murphy, S.M. 1986. *The effects of pipeline, roads and traffic on the movements of caribou, Rangifer tarandus.* Canadian Field-Naturalist 100(2): 218-224.

Department of Environment and Lands, Water Resources Division, Government of Newfoundland and Labrador. *Water Resources Atlas of Newfoundland*. 1992.

Dyer, S.J., J.P. O'Neill, S.M. Wasel and S. Boutin. 2001. *Avoidance of industrial development by woodland caribou.* Journal of Wildlife Management 65(3): 531-542.

Dyer, S.J., O'Neill, J.P., Wasel, S.M. and Boutin, S. 2002. *Quantifying barrier effects of roads and seismic lines on movements of female woodland caribou in Northeastern Alberta*. Canadian Journal of Zoology 80: 839-845.

Dzus, E. 2001. *Status of the woodland caribou (Rangiger tarandus caribou) in Alberta*. Alberta Wildlife Status Report No. 30.

Environment Canada, 2008. *National Climate Data and Information Archive Environment Canada,* Meteorological data.

Feldhamer, G.A. and Thompson, B.C. 2003. *Wild Mammals of North America: Biology, Management, and Conservation*. The Wildlife Society. 1216 pages.

Ferguson, S.H. and Elkie, P.C. 2005. *Use of lake areas in winter by woodland caribou*. Northeastern Naturalist 12(1): 45-66.

Folinsbee, J. 1974. *The moose (Alces alces) in the Churchill River valley, Labrador, Newfoundland.* Wildlife Service. 11pp.

Fortier, A. Hotel Royal. Schefferville, QC. E-mail. August 21, 2008.

Foster, D.R. 1985. 1985*. Vegetation development following fire in Picea mariana (black spruce) – Pleurozium forests of south-eastern Labrador, Canada*. *Journal of Ecology* 73(2): 517-534.

Garg, O. P. 1982. *Recently Developed Blasting Techniques in Frozen Iron Ore at Schefferville, Québec.* Iron Ore Company of Canada, Schefferville, Québec, Canada. 4th Canadian Permafrost Conference.

Godfrey, E. 1986. The *Birds of Canada, Revised Edition.* National Museums of Canada.

Goldman, C.R. 1994. Limnology, Second Edition, McGraw Hill, New York, 577 pp.Gosse, M.M., Power, A.S., Hyslop, D.E.,& Pierce, S.L. 1998. Guidelines for Protection of Freshwater Fish Habitat in Newfoundland and Labrador. Fisheries and Oceans, St. John's, NL. X + 105 pp., 2 appendices.

Harrington, F. H. 2003. *Caribou, military jets and noise: The interplay of behavourial ecology and evolutionary psychology*. Rangifer Special Issue No. 14: 73-80.

Hearn, B. J., Luttich, S.N., Crete, M. and Berger, M.B. 1990. *Survival of radio-collared caribou (Rangifer tarandus caribou) from the George River herd*, Nouveau-Québec – Labrador. Canadian Journal of Zoology: 68: 276-283.

Horesji, B.L. 1981. *Behavioural response of barren ground caribou to a moving vehicle*. Arctic 34: 180-185.

Jenness, J.L. 1949. *Permafrost in Canada.* Arctic, Vol. 2. Cited in Pryer (1966).

Klassen, R.A., Paradis, S., Bolduc, A.M., and Thomas, R.D. 1992. *Glacial Landforms and Deposits, Labrador, Newfoundland and Eastern Québec.* Geological Survey of Canada, Map 1814A, scale 1:1 000 000.

Labrador Iron Mines. *Labrador Iron Mines Technical Report of an Iron Project in Northwest Labrador,* Province of Newfoundland and Labrador.

Lines, G.S., Pancura, M., Lander, C. 2005. *Building Climate Change Scenarios of Temperature and Precipitation in Atlantic Canada using the Statistical Downscaling Model (SDSM)*. Environment Canada, Meteorological Service of Canada, Atlantic Region. Science Report Series No. 2005-9.

Loring, S. 2008. At home in the Wilderness: The Mushuau Innu and Caribou. In Bergerud, A.T., Luttich, S.N., & Camps, L. (eds). The Return of Caribou to Ungava. McGill-Queen's Native and Northern Series 50. McGill- Queen's University Press, Canada, pp.123-134.

Mahoney, S. P. and Schaefer, J.A.. 2002. Hydroelectric development and the disruption of migration in caribou. Biological Conservation: 107. 147-153.

Manci, K. M., Gladwin, D.N., Villella, R. and Cavendish, M.G. 1988. Effects of aircraft noise and sonic booms on domestic animals and wildlife: a literature *synthesis*. U.S. Fish and Wildlife Service, National Ecology Research Center, Fort Collins, CO. NERC-88/29. 88pp.

McCarthy, J.H, Grant, C. and Scrutton, D. 2007. *DRAFT Interim Standard Methods Guide for the Classification and Quantification of Fish Habitat in Rivers of Newfoundland and Labrador.*

Messier, F., Huot, J., Le Henaff, D., and Luttich, S. 1988. *Demography of the George River caribou herd.* Evidence of population regulation by forage exploitation and range expansion. Arctic 41(4): 279-287.

Ministry of Natural Resources, 2000. *Significant Wildlife Habitat: Technical Guide*.

Morrissey, P. 2008. *Time ticking for Labrador waste management plan, temporary remedy*. Article in The Aurora, 11 August 2008. Available at: http://www.theaurora.ca/index.cfm?sid=160897&sc=298.

Mowat, G. and Slough, B. 2003. *Habitat preference of Canada Lynx through a cycle in snowshoe hare abundance*. Can. J. Zool. 81: 1736-1745.

Newbury, T., Simon, N.P.P. and Chubbs, T.E. 2008. *(Submitted) Moose, Alces alces, winter browse use in central Labrador*. The Canadian Field Naturalist, Vol. 121. 5 pages

New Millennium Capital Group, in collaboration with Paul F. Wilkinson and Assoc. Inc. 2008. *Project Registration, Direct Shipping Ore Project*.

Nicholson, F.H. 1978. *N.R.C. Special Project. Prediction of Permafrost Distribution for Subarctic Mining Operations*. Final Report. McGill Subarctic Research Station, Schefferville, Québec.

Nicholson, F.H. and Lewis, J.S. 1976. *Active Layer and Suprapermafrost Groundwater Studies, Schefferville, Québec.* Reprinted from Proceedings of the 2nd Conference on Soil Water Problems in Cold Regions, September 1-2, 1976. Edmonton, Alberta. p. 15-30.

NLDEC (Newfoundland and Labrador Department of Environment and Conservation). 1997. The Hydrology of Labrador. June 1997

NLDEC (Newfoundland and Labrador Department of Environment and Conservation). 2006. *Guideline for Plume Dispersion Modelling* (1st Revision). Saint John's, NL.

NLDEC (Newfoundland and Labrador Department of Environment and Conservation). 2008. *Draft Guidelines for Environmental Impact Statement Assessment: Schefferville Area Iron Ore Mine.* Issued to Labrador Iron Mines Limited.

NLDLAA (Newfoundland and Labrador Department of Labrador and Aboriginal Affairs). 2006. *A Northern Strategic Plan for Labrador, Public Discussion Paper, July 2006*.

NLDHCS (Newfoundland and Labrador Department of Health and Community Services). 2004. *Stepping into the Future Strengthening Children, Families and Communities.* Newfoundland and Labrador's Early Childhood Development and Early Learning and Child Care, Annual Report 2003-04.

NLDTW (Newfoundland and Labrador Department of Transportation and Works). 2006. *The Development of a Sustainable Transportation Plan for Labrador, Consultation Document*.

NNK (Naskapi Nation of Kawawachikamach). 2007. Naskapi Nation of Kawawachikamach Annual Report 2006-2007.

NNK (Naskapi Nation of Kawawachikamach). 2008. Naskapi Nation of Kawawachikamach Annual Report 2007-2008.

Pryer, R.W.J. 1966. *Mine Railroads in Labrador-Ungava.* Québec North Shore and Labrador Railway Co., Canada

Revey, G.F.. 1996. Practical Methods to Control Explosive Losses and Reduce Ammonia and Nitrate Levels in Mine Water, Mining Engineering (SME), July 1996.

Schaefer, James A., Alasdair, M.V., Harrington, F.H., Brown, W.K., Theberge, J.B., and Luttich, S.N. 1999. Demography of decline of the Red Wine Mountains Caribou Herd. *Journal of Wildlife Management,* 63(2): 580-587.

Schaefer, James, A., Bergman, A.M., and Luttich, S.N. 2000. *Site fidelity of female caribou at multiple spatial scales.* Landscape Ecology, 15: 731-739.

Schmelzer, I. and Otto, R. 2003. *Winter range drift in the George River Caribou herd: a response to summer forage limitation?* Rangifer Special Issue No. 14: 113-122.

Schmelzer, I., Brazil, J., Chubbs, T., French, S., Hearn, B., Jeffery, R., LeDrew, L., Martin, H., McNeill, A., Nuna, R. Otto, R., Phillips, F., Mitchell, G., Pittman, G., Simon, N., & Yetman, G. 2004. *Recovery strategy for three Woodland Caribou herds (Rangifer tarandus caribou; Boreal population) in Labrador.* Department of Environment and Conservation, Government of Newfoundland and Labrador, Corner Brook.

Smith, K.G., Ficht, E.J., Hobson, D., Sorensen, T.C., and Hervieux, D. 2000. *Winter distribution of woodland caribou in relation to clear-cut logging in west central Alberta*. Canadian Journal of Zoology 78: 1433-1440.

Sooley, D.R., Luiker, E.A., and Barnes, M.A. 1998. *Standard methods guide for freshwater fish and fish habitat surveys in Newfoundland and Labrador: rivers and streams*. Fisheries and Oceans, St. John's, NF.

Statistics Canada. 1991. *1991 Census of Canada*. Statistics Canada: Ottawa, ON.

Statistics Canada. 1996. *1996 Census of Canada*. Statistics Canada: Ottawa, ON.

Statistics Canada. 2001. *2001 Census of Canada*. Statistics Canada: Ottawa, ON.

Statistics Canada. 2006a. *2006 Census of Canada*. Statistics Canada: Ottawa, ON.

Thom, B.G. 1969. *Permafrost in the Knob Lake Iron Mining Region.* 3rd Canadian Conference on Permafrost Proceedings.

Thomas, M.K. 1953. *Climatological Atlas of Canada*. Natural Resources Canada, Ottawa. Cited in Pryer (1966).

Thomas, D.C. and Gray, D.R. 2002. Update – *COSEWIC status report on the woodland caribou Rangifer tarandus caribou in Canada.* Committee on the Status of Endangered Wildlife in Canada. Ottawa, ON. 98 pp.

Toupin, B., Hout, J., and Manseau, M. 1996. *Effect of Insect Harassment on the Behaviour of the Riviere George Caribou*. Arctic, 49 (4): 375-382.

United States Environmental Protection Agency. (USEPA). 1995a. Amended 1996, 1997, 1998, 1999 and 2006. *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition,* Volume I: Stationary Point and Area Sources.

Vistnes, I. and Nelleman, C. 2001. *Avoidance of cabins, roads, and power lines by reindeer during calving.* Journal of Wildlife Management 65(4): 915-925.

Vistnes, I., Nelleman, C., Jordhøy, P., and Strand, O. 2004. *Effects of infrastructure on migration and range use of wild reindeer.* Journal of Wildlife Management 68(1): 101-108.

Vors, L.S., Schaefer, J.A., Rodgers, A.R., and Patterson, B.R. 2007. *Woodland caribou extirpation and anthropogenic landscape disturbance in Ontario*. Journal of Wildlife Management 71(4): 1249-1256.

Weir, J.N., Mahoney, S.P., McLaren, B. and Ferguson, S.H. 2007: *Effects of mine development on Woodland caribou Rangifer tarandus distribution*. Wildlife Biology, 13: 66 74.

Wetzel, R.G. 1983. Limnology, Second Edition, Saunders College Publishing, New York, 767 pp + Appendices.

Wolfe, S.A., Griffin, B. and Wolfe, C. 2000. *Response of reindeer and caribou to human activities.* Polar Research 19(1): 63-73.

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

10.3 Internet Sites

Altman, B. and R. Sallabanks. 2000. Olive-sided Flycatcher (*Contopus cooperi)*. In: A. Poole (ed.). The Birds of North America Online. Cornell Lab of ornithology; Ithaca, NY. Available at:http://bna.birds.cornell.edu.bnaproxy.birds.cornell.edu/bna/species/502doi:bna.

Bowhunting Canada 2008. Bowhunt Québec Labrador Caribou in Schefferville. Available at: http://www.bowhunts.com/index2.html

Canadian Environmental Assessment Agency (CEAA). 1997. *Voisey's Bay Mine and Mill Environmental Assessment Panel Report*. Available at: http://www.ceaa.gc.ca/010/0001/0001/0011/0002/contents_e.htm

Canadian Environmental Assessment Agency (CEAA). 2003. *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners*. Available at: http://www.ceaa.gc.ca/012/014/index_e.htm.

CBC News. 2008a. *Soaring home prices cramping RNC recruitment in Labrador West*. October 2, 2008. Available at: http://news.sympatico.msn.cbc.ca/Home/ContentPosting?newsitemid=rnc-labrador&feedname=CBC-CONSUMER-LIFE&show=False&number=0&showbyline=True&subtitle=&detect=&abc=abc&date=True.

CBC News. 2008b. *Labrador West hospital construction to restart*. September 5, 2008. Available at: http://www.cbc.ca/canada/newfoundland-labrador/story/2008/09/05/lab-hospital.html.

CBC News. 2008c. *Affordable housing shortage pushes families out of Lab West.* August 28, 2008. Available at: http://www.cbc.ca/canada/newfoundland-labrador/story/2008/08/28/housing-delay.html?ref=rss.

CLEDB (Central Labrador Economic Development Board). 2007. The Central Labrador Region. Available at URL: http://www.cledb.ca/home/10.

College of the North Atlantic. 2008. *Labrador West Campus*. Available at: http://www.cna.nl.ca/campus/lw/.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2008. Available at: http://www.cosewic.gc.ca/eng/sct1/searchdetail_e.cfm

Couturier, S., D. Jean, R. Otto, and S. Rivard. 2004. *Demography of the migratory tundra caribou (Rangifer tarandus) of the Nord-du-Québec region and Labrador*. Available at: http://bowsite.com/bowsite/features/articles/QLcariboumigrations/Quebec_report.pdf

DND (Department of National Defence). 2008. Community. Available at: http://www.airforce.forces.gc.ca/5wing/community/community_e.asp.

Environment Canada (EC). 2008. *Canadian Climate Normals; Schefferville, QC.* Available at: http://climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html.

Environment Canada. 2008. *Schefferville A Québec*. Available at: http://www.climate.weatheroffice.ec.gc.ca/climateData/almanac_e.html?timeframe=4&Prov=CA&StationID=6098&Year=2008&Month=11&Day=16

Environment Canada (EC). 2008. *National Air Pollution Surveillance Network*. Available at: http://www.etc-cte.ec.gc.ca/NAPS/index.html.

Environment Canada (EC). 2008. *Canadian Climate Normals 1971-2000*. Available at: http://climate.weatheroffice.ec.gc.ca/climate_normals.

Government of Newfoundland and Labrador Assembly. Available at: http://www.assembly.nl.ca/Legislation/sr/Regulations/rc020057.htm - 3

Government of Québec, Resources Naturelles at Faune. 2005. *Caribou migration monitoring by satellite telemetry.* Available at: http://www.mrnf.gouv.qc.ca/english/wildlife/maps-caribou/index.jsp

Healthy Newfoundland and Labrador. No Date. *Hospitals/Nursing Homes/Clinics/Nursing Stations*. Available at: http://www.healthy.nf.ca/hospitals.html#labrador.

INAC (Indian and Northern Affairs Canada). 2008. Matimekush-Lac John Community Profile. Available at: http://www.ainc-inac.gc.ca/ai/scr/qc/aqc/prof/Matimekush-eng.asp

Labrador-Grenfell Health. 2007. http://www.lghealth.ca/.

Labrador West. 2008. Available at: http://www.labradorwest.com/default.php?ac=changeSite&sid=3.

Labrador Woodland Caribou Recovery Team (LWCRT) 2005. Available at: http://www.sierraclub.ca/national/programs/biodiversity/wilderness/endangered-species/labrador-response.pdf

Larocco, R. 2008. *Québec-Labrador hunting out of Schefferville*. Available at: http://www.hunts.net/caribou%20Quebec%20Labrador%205306.html

Naskapi Nation. 2008. Our Organizations: Corporate. Available at: http://www.naskapi.ca/en/our_organisations/corporate.htm

Nature Serve Global Conservation Status Ranks. Available at: http://www.natureserve.org/explorer/granks.htm

New Millennium Capital Corporation. 2008. *Elross Lake Iron Ore Mine. Project Registration*. Available at: http://www.env.gov.nl.ca/env/Env/EA%202001/Project%20Info/1380.htm.

Newfoundland and Labrador Inland Fish and Wildlife Division. March 2005. *Newfoundland and Labrador Species at Risk: The Woodland Caribou – Mealy Mt., Red Wine, and Lac Joseph Herds*. Available at: www.env.gov.nl.ca/env/wildlife/wildatrisk/woodland_caribou.pdf

Newfoundland and Labrador Statistics Agency/Community Accounts. 2007a. *Community Accounts*. Available at: http://www.communityaccounts.ca/communityaccounts/onlinedata/getdata.asp

Newfoundland and Labrador Statistics Agency/Community Accounts. 2007b. *Tourism Statistics*. Available at: http://www.statistics/Tourism/PDF/EconomicZone1-20Annual,2006.pdf.

Newfoundland and Labrador Statistics Agency/Community Accounts. 2008. Available at: http://www.communityaccounts.ca/communityaccounts/onlinedata/getdata.asp.

Newfoundland and Labrador Statistics Agency. 2006. Number of Businesses by North American Industrial Classification System (NAICS) Code, Newfoundland and Labrador by Economic Zone, December 2006. Compiled by Newfoundland and Labrador Statistics Agency, Economics and Statistics Branch, Department of Finance. Available at: http://www.stats.gov.nl.ca/Statistics/Trade/PDF/BR_Zone_NAICS_2006.pdf.

New Millennium Capital Corporation (NMCC). *2008. NEWS RELEASE 08-05 New Millennium announces production development update of its direct shipping ore project*. Available at: http://www.nmlresources.com/pdfs/news/NR0805.pdf

NLDEC (Newfoundland and Labrador Department of Environment and Conservation). 2008. *Newfoundland and Labrador Hunting Guide 2008-09*. Available at: http://www.env.gov.nl.ca/env/HuntingTrappingGuidePgs.pdf

NLDEC (Newfoundland and Labrador Department of Environment and Conservation (NLDEC). Consolidated Thompson Iron Mines Ltd. 2008. Environmental Preview Report. Bloom Lake Railway (Resubmission). Available at: http://www.env.gov.nl.ca/env/ENV/EA%202001/Project%20Info/1378.htm.

NLDF (Newfoundland and Labrador Department of Finance). 2007. *Budget Highlights*. Available at: http://www.budget.gov.nl.ca/budget2007/highlights.htm.

NLDF (Newfoundland and Labrador Department of Finance). 2008. *The Economy 2008*. Available at: http://www.economics.gov.nl.ca/E2008/.

NLDF (Newfoundland and Labrador Department of Finance). 2008. *The Economy 2008: Major Capital Projects.* Available at: http://www.economics.gov.nl.ca/E2008/majorcapitalprojects.pdf.

NLDF (Newfoundland and Labrador Department of Finance). 2007. *Trade Statistics*. Available at: http://www.stats.gov.nl.ca/Statistics/Trade/.

NLDHCS (Newfoundland and Labrador Department of Health and Community Services). 2004. *Licensed Child Care Centres.* Available at: http://www.health.gov.nl.ca/health/childcare/pdfiles/Child%20Care%20List.pdf.

NLDLAA (Newfoundland and Labrador Department of Labrador and Aboriginal Affairs). 2008. *A Northern Strategic Plan for Labrador.* Available at: http://www.laa.gov.nl.ca/laa/nspl/nspl.pdf.

NLDNR (Newfoundland and Labrador Department of Natural Resources). *Department of Agrifoods. Rabies Information*. Available at: http://www.nr.gov.nl.ca/agric/animal_diseases/rabies/default.stm

NLDTCR (Newfoundland and Labrador Department of Tourism, Culture and Recreation). 2007. *Department of Tourism, Culture and Recreation Backgrounder Year-End Provincial Tourism Performance 2007 and Early Tourism Outlook 2008*. Available at: http://www.stats.gov.nl.ca/Statistics/Tourism/PDF/Tourism%20performance2007.pdf.

NLDTW (Newfoundland and Labrador Department of Transportation and Works). 2008. *Annual Report 2007-08.* Available at: http://www.tw.gov.nl.ca/AnnualReports/TWAnnRep200708.pdf.

Our Labrador. 2004. *Towns and Groups*. Available at: http://www.ourlabrador.ca/member.php?show=communities.

Poulin, R.G., S.D. grindal and R.M. Brigham. 1996. Common Nighthawk (*Chordeiles minor)*. The Birds of North America Online. In: A. Poole (ed.). The Birds of North America, Cornell Lab of Ornithology, Ithaca, NY. Avaialble at http://bna.birds.cornell.edu/bna/species/213doi:10.2173/bna.213.

RCMP (Royal Canadian Mounted Police). 2008. *RCMP Homepage*. Available at: http://www.rcmp-grc.gc.ca/.

Species At Risk Public Registry (SARA). 2008. *Species Profile: Woodland Caribou Boreal Population.* Available at: http://www.sararegistry.gc.ca/species/speciesDetails_e.cfm?sid=636

Statistics Canada. 2006b. *Police Resources in Canada*. Available at: http://dsp-psd.pwgsc.gc.ca/Collection-R/Statcan/85-225-XIE/85-225-XIE2006000.pdf.

Statistics Canada. 2007. *Police Resources in Canada, 2007. Catalogue no. 85-225-XIE*. Available at: http://dsp-psd.pwgsc.gc.ca/collection_2007/statcan/85-225-X/85-225-XIE2007000.pdf.

The Town of Happy Valley-Goose Bay. 2001. *Happy Valley-Goose Bay*. Available at: http://www.happyvalley-goosebay.com/.

TRC Companies Inc. 2008. *CALPUFF Modelling System, Version 6.262*. Available at: http://www.src.com/calpuff/calpuff1.htm.

Wild Species Canada. Available at: http://www.wildspecies.ca/wildspecies2005/Results.cfm?lang=e&sec=9

APPENDIX A

EIS Guidelines and Table of Concordance

Government of Newfoundland and Labrador
Department of Environment and Conservation

Honourable Charlene Johnson
Minister

December 9, 2008

GUIDELINES

for

Environmental Impact Statement

Schefferville Area Iron Ore Mine

INTRODUCTION

Labrador Iron Mines Limited is required through the provincial environmental assessment process to prepare an Environmental Impact Statement (EIS) for the Schefferville Area Iron Ore Mine. The purpose of the EIS is to identify the potential environmental effects associated with the proposed undertaking, identify appropriate mitigative measures and predict the significance of the residual and unmitigable effects. The EIS will contain a review of all available pertinent information or data as provided by the proponent or requested by the Minister of Environment and Conservation. The contents of the EIS will be used by the Minister of Environment and Conservation, in consultation with Cabinet, to determine the acceptability of the proposed project based on its anticipated environmental effects, proposed mitigation and significance of residual environmental effects. The EIS will be as concise as possible while presenting the information necessary for making an informed decision.

As more specific information is provided and as additional baseline information is gathered, other concerns and potential effects may be required to be considered by the Minister as recommended by the Environmental Assessment Committee.

The proponent is required to hold public information sessions on the environmental assessment results in the town of Labrador City-Wabush

The purpose of the Guidelines is to assist the proponent in completing an EIS which conforms to legislative requirements and to address information requirements that will assist in making an informed decision on the undertaking. The contents of the EIS should be organized according to the following format and address the identified information requirements:

1. Executive Summary

The executive summary will contain the following information: identification of the proponent; a project overview; predicted environmental effects (both biophysical and socio-economic); mitigative measures; residual environmental effects; cumulative environmental effects; proposed monitoring programs and response plans and a summary of the fundamental conclusions of the EIS. The summary will allow reviewers to focus immediately on areas of concern.

The summary will be written in terms understandable to the general public.

2. Introduction

2.1 Name of Undertaking

The undertaking has been assigned the Name “Schefferville Area Iron Ore Mine.” The proponent should identify the name which it proposes to use for the undertaking.

2.2 Identification of Proponent

Name the corporate body and state the mailing address.

Name the chief executive officer and state the official title, telephone number, fax number and e-mail address.

Name the principal contact person for purposes of environmental assessment and state the official title, telephone number, fax number and e-mail address.

2.3 Purpose of the Environmental Impact Statement

The purpose of the Environmental Impact Statement is to report on the results of the process by which the change in the present or future environment that would result from an undertaking is predicted and evaluated before the undertaking has begun or occurred.

3. The Proposed Undertaking

3.1 The Prospective Site and Study Area

A precise description of the boundary of the prospective site is to be presented, accompanied by maps of an appropriate scale showing the entire project with principle structures and appurtenant works;

The information on the boundary and extent of the project area is to be in digital form on computer discs in a format suitable for incorporation in a Geographic Information System (GIS). Maps should be at a 1:50,000 scale and possibly in ARC shape format. As a minimum, the information is to consist of sufficient number of geographic coordinates of point locations, line locations and/or spatial extent, as appropriate, of the features at the selected map scale and projection to either re-create the hard-copy versions provided as part of the EIS or to accurately display the features digitally. (Information already available on the National Topographic maps need not be provided.) The information must be organized and labeled such that each unique feature is distinguishable from all others. Appropriate descriptive parameters of each data set such as projection, UTM Zone, datum and data collection method (e.g., GPS, aerial survey, etc.) must also be included. The format should be in ASCII tabular format or in a spreadsheet or database format such as Lotus 1-2-3, Excel, dBase or similar software.

3.2 Rationale/Need/Purpose of the Project

The rationale for the project will describe its perceived benefits, both local and provincial. If the undertaking is in response to an established need, this should be clearly stated.

3.3 Alternative Means of Carrying Out the Project

A detailed discussion of technically and economically feasible alternative means of carrying out the project, and the environmental effects of such alternative means must be provided with supporting argument.

A detailed summary is required of the possible alternatives to the project and/or individual project components which were or could have been considered including but not limited to tailings disposal options   If only one alternative is viable or possible, a statement will be made to this effect with supporting argument.

3.4 Relationship to Legislation, Permitting, Regulatory Agencies and Policies

The EIS will identify and discuss the project within the context of all existing relevant legislation and policies (municipal, provincial and federal). The proponent will provide a comprehensive list of permits and regulatory approvals required for the undertaking. The list will include the following details.

- activity requiring regulatory approval,
- name of permit and/or regulatory approval (e.g. authorization),
- legislation requiring compliance,
- regulatory agency.

3.5 General Project Description

The EIS will describe the scope of the project for which an assessment is being conducted.

The EIS will provide a written and graphic description (e.g. maps and drawings) of the physical features of the undertaking particularly as it is planned to progress through the construction and operation phases of its lifespan. The description should also address other phases of the project as can reasonably be foreseen, including modification, decommissioning and abandonment. Any assumptions which underlie the details of the project design shall be described, including effects avoidance opportunities inclusive of pollution prevention, and adherence to best management practices. Where specific codes of practice, guidelines and policies apply to items to be addressed, those documents shall be cited and included as appendices to the EIS, including mapping at an appropriate scale. Physical features include, but are not limited to:

- access road(s), and intersections, including those which may require upgrading, as well as service roads.
- lighting

- stream(s) or other water bodies to be dewatered
- residue ponds and/or clarification ponds
- stream crossings, including culverts, bridges and fording sites
- temporary stream diversions
- exact locations of mineral licenses and ore bodies to be mined in relation to Newfoundland and Labrador and Quebec provincial geographic boundaries
- borrow pits, major excavations, waste rock disposal locations and their rehabilitation
- temporary sewage and waste disposal facilities
- methods of handling waste and refuse at work and camp locations
- mine infrastructure, including ore crushing, screening and washing facilities, fuel tanks and utilities (including water supply and distribution, water treatment, rock fines and wash water discharges, electricity supply configuration and owner/operator arrangements, substations and/or on-site electricity transmission/distribution lines or alternative generation methods)
- railway infrastructure, including railcar loading station, ties, rails and ballast on rail bed
- ownership of new railway infrastructure, regulatory governing body and designation of common carrier status
- plant and storage facility for manufacturing and storing explosives
- support buildings, including but not limited to, administrative and engineering offices, warehouses, maintenance buildings and laboratory.
- effluent treatment plant components, as well as effluent discharge locations and configuration and including anticipated effluent plume(s)
- planned feasibility studies associated with the project, proposed mineral resources included within the feasibility studies and completion dates
- Clearance/condemnation work in areas underlying proposed waste piles, including in pit or on land disposal of fines and other infrastructure

3.6 Construction

The details, materials, methods, schedule, and location of all planned construction activities related to the physical features will be presented including estimates of magnitude or scale where applicable. This is to include but not be limited to, the following:

- general construction practices incorporating erosion and sedimentation control
- construction schedule, including proposed time frames for right-of-way clearing, slash disposal, construction adjacent to watercourses, utility placement, processing and storage facilities
- worker housing, providing a detailed overview of the housing for workers to be used during the construction and operation phases, including but not limited to location(s), capacity and facilities
- solid waste disposal and disposal of construction waste, as well as identified opportunities for waste recycling

- worker transportation, including details on the methods of transportation used to get workers to and from camps/worksites
- site preparation (i.e., grubbing/clearing of right-of-way, cut and/or fill operations, etc.)
- water body alteration: a 15 metre undisturbed buffer along the high water mark of all water bodies must be maintained. Identify any alterations that must be carried out in the water or within buffer areas, such as for water supply intakes, stream crossings, effluent discharges, storm drainage works or infilling and any stream activities
- design and information regarding the upgrading of any existing watercourse crossing associated with new or existing roads or railway
- location of blasting activities in relation to watercourses/waterbodies
- stream crossing structures: location of watercourse crossings for access and service roads, transmission lines, railroads, as well as any pipeline crossings, their proposed infrastructure (e.g., bridge, culvert), and their proposed specifications (e.g., clearance from watercourse, height, width, length, diameter, and construction materials); infill area or footprint together with design criteria and standards, length, width, cross section and estimated types and amount of fill material required. To avoid impacts on fish and fish habitat it is recommended that all watercourse crossings be designed and installed such that abutments are above the high water mark.
- proposed locations for any de-watering wells, pipelines, and discharge infrastructures
- electrical systems: location of substations, transmission
- estimate all significant emissions during construction, including but not limited to sources from generators, heaters, vents, storage tanks, stockpiles, vehicles, road surfaces, effluent treatment systems, and mobile sources.
- excavations
- blasting operations
- vehicle types, truck routes, hours of operation of vehicles
- transport, storage and use of hazardous materials
- establishment, operation and removal of construction camp and yard areas including their water, sewage and food handling provisions
- sources and estimated volumes of acceptable types of aggregate, ballast and pit-run material with identification of any currently known sources likely to be used
- disposal areas for excess/waste rock and overburden, including locations of any currently known or planned disposal sites
- disposal areas for organic soil, slash and grubbing , including locations of any currently known or planned disposal sites
- plans for harvested wood fibre associated with the project
- removal of temporary operations
- site rehabilitation and monitoring

With a goal of maximizing benefits for the province, the proponent shall present a strategy to ensure Full and Fair Opportunity and First Consideration for employment, contracting and procurement, education and training.

This strategy must identify corporate hiring objectives, quantitative and qualitative goals, special measures and policies; monitoring of compliance with objectives, goals, measures and policies; duration of contracts and/or employment and provide for a communication plan and any required re-evaluation process of objectives, goals, measures and policies. Included will be a Women's Employment Plan as a tool to aid the gender equity objective of the corporate hiring strategy.

In order to properly assess the socio-economic impacts in the province specific information on, but not limited to the 150 construction positions, contracting and procurement, and education and training will be provided, including a benefits statement with a concise description of the proportion of positions, contracting and procurement, and education and training opportunities which will be available to Newfoundland and Labrador residents, contractors, sub contractors and businesses in relation to the project totals.

Specific numbers by National Occupational Classification (NOC-2006), gender and employment equity considerations and period of employment will be provided.

Identify any measures to be implemented that may require contractors and sub-contractors to include employment equity considerations. Initiatives for the hiring of journeypersons, apprentices, engineering and technology students during construction and also those initiatives to increase opportunities for under-represented groups will be described. Provide an analysis of the availability of the skilled workforce necessary to complete the project and how any shortages in skilled trades may be addressed. The analysis is to include all positions associated with the project, listing the province in which they are located.

3.7 Operation and Maintenance

All aspects of the operation and maintenance of the proposed development will be presented in detail, including but not limited to information on the 75 operation and maintenance positions by National Occupational Classification (NOC-2006), gender and period of employment. Operation includes, but is not limited to, product excavation, product processing, product delivery, value-added secondary processing, product export and waste residue disposal. The analysis is to include all positions associated with the project, listing the province in which they are located.

With a goal of maximizing benefits for the province, the proponent shall present a strategy to ensure Full and Fair Opportunity and First Consideration for employment, contracting and procurement, education and training.

This description must identify corporate hiring objectives, quantitative and qualitative goals, special measures and policies; monitoring of compliance with objectives, goals, measures and policies; duration of contracts and/or employment and provide for a communication plan and any required re-evaluation process of objectives, goals, measures and policies. Included will be a Women's Employment Plan as a tool to aid the gender equity objective of the corporate hiring strategy.

In order to properly assess the socio-economic impacts in the province specific information on, but not limited to the 75 operating positions, contracting and procurement, and education and training will be provided, including a benefits statement with a concise description of the proportion of positions, contracting and procurement, and education and training opportunities which will be available to Newfoundland and Labrador residents, contractors, sub contractors and businesses in relation to the project totals.

Information regarding the nature of any cross-border mobility for employees/contractors associated with the project will be provided.

Direct and indirect impacts the project may have on existing mining operations, railway operations, mineral exploration and/or mine development on mineral titles held by other parties in the area and right's of way will be provided. An analysis of the direct and indirect impacts the project may have on the operations or future viability of other mining projects in Labrador West including, but not limited to The Iron Ore Company of Canada, Wabush Mines and New Millennium Capital Corporation and the capacity of the QNS&L, Tshiuetin Rail Transportation and Wabush Mines Arnaud railways, will be required.

Estimate all significant emissions during operation, including but not limited to, sources from ore crushing screening and washing facilities, heaters, vents, storage tanks, stockpiles, ponds, basins, vehicles, road surfaces, cooling towers, effluent treatment systems, and mobile sources. Emissions from on-site thermal generation of supplied power must be incorporated if such a power source is being considered

The use of Best Available Control Technology (BACT) is required for all new emission sources. The EIS must identify the control technology to be applied at each emission source.

All sources of effluent must be identified and characterized, including handling methods, flow rates and treatment efficiencies for each component of the treatment system. Effluent includes, but is not limited to, process tailings and water, storm water, sewage, pit de-watering and surface runoff. Estimated annual quantities of each effluent must be provided. Cleaning methods and residue disposal options must also be described. In addition proposed sampling parameters and schedule must be provided for discharges.

Fully describe chemical storage facilities indicating how chemicals, reagents, catalysts and other potentially hazardous or toxic materials are to be handled, stored, segregated and contained. Identify chemicals by their Chemical Abstract Service Registry Number (CASRN) together with associated quantities, characteristics and toxicities.

Include in operational details water use for domestic and non-domestic purposes, including water used in the ore beneficiation process under consideration. Provide water withdrawal requirements throughout the year in consideration of hydrology of ponds and supporting watersheds and the ability of the basin to support daily demand and recharge throughout the year. Identify water level variations in ponds as a result of water extraction throughout the year. Include locations of the intake structure and proposed dams. If any conservation or technology measures are to be employed they should be identified. Identify the existing water quality from all sources, the required water quality for its desired use and any treatment processes required to meet its required water quality.

Identify the expected locations and number of de-watering wells, the volume of water to be pumped and the location/use of this water.

Include information on any food handling provisions during both construction and operation as well as disposal provisions for associated wastes.

Initiatives through such measures as training initiatives and skills upgrading for the hiring of journeypersons, apprentices and engineering and technology students during operation and maintenance, as well as initiatives to increase opportunities for under-represented groups in occupations in which they are under-represented will be described. Under-represented groups are to be identified through both census data demographic characteristics and labour force data for census subdivisions in the employment catchment area.

Identify the operational emergency response, safety and fire fighting facilities as well as preventative operating practices and support services. This will include on-site as well as regionally supplied training and preventative measures.

Maintenance includes, but is not limited to, routine ongoing maintenance of the mine and site infrastructure (including redeveloped railway) and machinery as well as periodic maintenance requiring plant closure or processing shut down. In addition to the employment information related to operation and maintenance it is important to include environmentally relevant information such as the location of maintenance support areas, material storage locations, and the likely maintenance and winter treatment.

Also documentation to demonstrate the Iron Ore Company of Canada/Quebec North Shore and Labrador Railway, Tshiuetin Rail Transportation and Wabush Mines Arnaud railway's agreement/acceptance of the railway line connection to existing railway line infrastructure and agreement/acceptance to provide transportation of Labrador Iron Mines iron ore and agreement of associated parties for access to port facilities in the Sept Isles region will be provided. This analysis is to consider the cumulative increased railway traffic from the proposed Bloom Lake Railway and the Elross Lake Mine.

3.8 Abandonment

The predicted lifespan of temporary facilities and the mine, processing facilities, and railway will be indicated. Details regarding decommissioning and abandonment will be presented. The maintenance and management of residue ponds left after closure will be described. Identify, at least in general terms, the issues requiring consideration in decommissioning based on current legislation for hazardous and other materials and structural requirements.

Rehabilitation, closure plans and financial assurances will be required by the Department of Natural Resources.

4. Environment

4.1 Existing Environment

The EIS will identify the study area and will describe the existing biophysical and socio-economic environment of the study area, and the resources within it, emphasizing Valued Ecosystem Components (VEC's) (as defined by Beanlands and Duinker, 1983). In addition, the EIS will describe environmental interrelationships and sensitivity to disturbance. The identification of known data gaps is imperative.

The timing and extent of any surveys for flora, fauna and ecologically sensitive areas must be provided.

A qualitative and quantitative description of the present environment will include, but is not limited to:

- meteorological conditions, including weather patterns as they relate to processing operation and routine and periodic maintenance
- atmospheric conditions, including wind speeds and directions, precipitation amounts. Particular attention is to be paid to ambient dust levels in areas where construction activities may contribute to increased dust levels
- ambient air quality baseline assessment for common air contaminants prior to construction.
- ambient water quality baseline assessment for common water quality parameters prior to construction.
- site information on each stream or wetland crossing including: water depth, width, flow rate, substrate type, and potential obstructions to navigation. Hydrologic information on each body of water within the project footprint or within the predicted zone of influence.
- identification of wetland resources including location, size and class, classified using the Canadian Wetland Classification System, of any wetland within a predicted zone of influence and conduct of a wetland evaluation. The true ecosystem value of each wetland is to be examined using comprehensive valuation methodology that assesses component, functional and attribute values, including their wildlife habitat potential (including wildlife at risk), groundwater recharge role and potential, and their role in surface water flow regulation (storm

water retention and flood control). Field surveys and investigations required to supplement available data must be completed in an acceptable manner.

- flora, including typical species, species-at-risk, and potential habitat for flora species-at-risk. Flora species at risk include those species listed under the federal Species at Risk Act and the provincial Endangered Species Act as well as COSEWIC listed species. Current information can be obtained from appropriate sources and augmented by field surveys and investigations required to supplement available data. Available data, survey results and detailed mitigation measures that demonstrate a special emphasis on avoidance of environmental effects is to be included in the EIS.
- fauna (including migratory species), fauna species-at-risk, and potential habitat for fauna species-at-risk. Fauna species at risk include those species listed under the federal Species at Risk Act and the provincial Endangered Species Act as well as COSEWIC listed species. Fauna and avifauna in this context includes, but is not limited to, eagles, osprey, and woodland caribou. Current information can be obtained from appropriate sources and augmented by field surveys and investigations required to supplement available data. Available data, survey results and detailed mitigation measures that demonstrate a special emphasis on avoidance of environmental effects is to be included in the EIS.
- fish and fish habitat, which includes a description of fish species and any fisheries, commercial, recreational or aboriginal, which occur within the lakes, ponds and streams in the vicinity of the proposed project. As well as a description and quantification of fish habitat with the potential to be impacted by project operations, such as but not limited to, mining, storage, infrastructure, access roads, railway construction and in particular the existing flooded pits to be used for water extraction and residue disposal and the stream on James Property which has the potential to be dewatered due to mining activities
- identify the type, location, and magnitude/extent of existing, past and potential commercial, recreational and aboriginal fisheries within the proposed project area. Address the extent to which these fishing activities will be disrupted during both the construction and operation phases of the project

Discussion of the description of the existing environment will be developed for each alternative, drawing specific reference to the VECs. Detailed discussions will be developed for the following VECs:

- Socio-economic, demonstrating a goal of maximizing benefits for the province. The discussion will include corporate hiring objectives and policies, employment of under-represented groups, the effects the mine may have on existing industry and services and the ability of existing infrastructure to service the proposed construction and operation. The feasibility of the project will be included in this analysis.
- Fish and fish habitat
- Caribou species and habitat, including the applicability of the Endangered Species Act. In consideration of the predicted effects of the mine and associated infrastructure on woodland and/or migratory caribou, the potential impact of rail

traffic and blasting operations will be included. The potential effects on woodland caribou in Labrador as well as in Quebec will be described.

4.2 Data Gaps

Information gaps from a lack of previous research or practice will be described.

4.3 Future Environment

The predicted future condition of the environment described under 4.1 within the expected life span of the undertaking, if the undertaking were not approved, will be described. This information is required when attempting to distinguish project-related environmental effects from environmental change due to natural processes.

5. Environmental Effects

The EIS will describe the scope of the assessment being conducted for the undertaking.

The EIS will contain a comprehensive analysis of the predicted environmental effects of each project alternative for the VEC's. If the impacts are attributable to a particular phase of the project (construction, operation, maintenance or decommissioning) then they will be designated as such.

The EIS will also assess the effects of the environment on the mine. In particular the EIS must identify the vulnerability of the mine to climatic elements (including wind, weather and global climate change) and describe the provisions for minimizing any identified risk.

The EIS will characterize the disposal area for process tailings including the hydraulic conductivity of the base of the pit, and the potential to impact on groundwater and surrounding watersheds. Control technologies in consideration are also to be described.

Information will be included regarding methods to prevent suspended solids and other contaminants (originating from areas including but not limited to waste rock and overburden piles, tailings storage areas, crushing and washing areas) from migrating to nearby water bodies. The acid generating potential of waste rock will also be provided.

Identify the potential impacts of ammonia discharges from blasting operations and prepare an ammonia control strategy.

Predicted environmental effects (positive and negative, direct and indirect, short and long-term) will be defined quantitatively and qualitatively for each project alternative and for each valued ecosystem component. In this regard, the EIS will offer the study strategy, methodology and boundaries of the assessment which includes the following considerations:

- the VEC within the study boundaries and the methodology used to identify the VEC;
- definition of the spatial and temporal study boundaries for the interactions of the project, as proposed or subject to subsequent modification, with VECs and the methodology used to identify the study boundaries;
- the temporal boundaries (i.e., duration of specific project activities and potential effects) for construction and operation;
- the strategy for investigating the interactions between the project and each VEC and how that strategy will be used to coordinate individual studies undertaken;
- the strategy for assessing the project’s contribution to cumulative effects on each VEC;
- the strategy for predicting and evaluating environmental effects, determining necessary mitigation, remediation and/or compensation, and for evaluating residual effects;
- definition of impact significance criteria against which to evaluate the potential impact of interactions;
- description of potential interactions;
- discussion of issues and concerns which relate to specific interactions;
- discussion of the existing knowledge on information related to the interactions;
- analysis of potential effects (significance, positive or negative, etc.);

In the latter regard, the proponent will offer a definition of significance for each category examined (e.g. biophysical or socio-economic).

Environmental effects will be defined and discussed in the following terms for the phases of the project (construction, operation, modification and decommissioning): nature, spatial extent, frequency, duration, magnitude (qualitative and quantitative), significance, and level of certainty.

The environmental effects of the project, including the environmental effects of malfunctions or accidental events that may occur in connection with the project will be discussed with respect to risk, severity and significance. Consequences of low probability, high impact events, including design failure, will also be described. In relation to accidents and malfunctions provide the following information to support an assessment of potential effects on the environment, including but not limited to species at risk and their habitat(s):

- discussion of accidents and malfunctions that could occur related to processing and transport activities, the probability of such events occurring, the fate of any hazardous materials that could be released as a result of such events, and the potential interactions with environmental features
- reference to the standards, codes and regulations applicable to governance of the project

Environmental effects from emissions estimates are required as part of the assessment. Preliminary dispersion modeling, incorporating baseline measurements as background values for construction and operation, must be presented. The modeling must also account for combined effects of other significant air contaminant emission sources within the general project area. The proponent is advised that stack emission tests and accompanying dispersion models and/or ambient air monitoring may be required following commencement of mining and processing operations to demonstrate compliance with ambient air quality standards.

A discussion of environmental effects on freshwater quantity and quality is required as part of the assessment for all water bodies within the project footprint or influence zone of the project.

Environmental effects on the socio-economic environment are to be detailed and include, but will not be limited to, training needs, public health services in relation to potential demand as a result of the mine, adequacy of existing acute care services, potential need for an increase in community health support services.

Environmental effects on freshwater fish habitat, fish species and any existing or potential commercial, recreational or aboriginal fisheries that occur in the area of the proposed infrastructure, plant and mine location, water supply and residue disposal (i.e. tailings) location must be evaluated. As part of the evaluation any effects associated with water withdrawal must be examined, as must the potential effects on any downstream habitat.

5.1 Cumulative Environmental Effects

Consideration of any cumulative effects on valued ecosystem components that are likely to result from the project in combination with other projects or activities that have been or will be carried out (e.g., existing and proposed industrial activity in the area) will be discussed in the EIS. Other projects or activities that should be considered include the New Millennium proposal for the Elross Lake area and increased railway traffic as a result of the proposed Bloom Lake Railway.

Addressing cumulative environmental effects will involve considering:

- temporal and spatial boundaries;
- interactions among the project's environmental effects;
- interactions between the project's environmental effects and those of existing projects and activities;
- interactions between the project's environmental effects and those of planned projects and activities; and,
- mitigation measures employed toward a no-net-loss or net-gain outcome (e.g., recovery and restoration initiatives pertinent to a VEC that can offset predicted effects).

6. Environmental Protection

6.1 Mitigation

Mitigative measures that are technically and economically feasible, that have or will be taken, to avoid, minimize or eliminate the negative, and enhance the positive environmental effects, will be described and discussed with emphasis on pollution prevention, avoidance of environmental effect and best management practices. Mitigation includes the elimination, reduction or control of the adverse effects or the significant environmental effects of the project and may include restitution for any damage to the environment caused by such effects through replacement, restoration, compensation or any other means.

Mitigation will be evaluated based on the use of best available and economically achievable technologies (BATEAs) and best management practices (BMPs) to minimize adverse environmental effects.

Mitigative measures specific to the following must be addressed in particular:

- air quality including dust emissions from crushing operations, emissions from any on-site generation of power, aggregate and overburden stockpiles, unpaved roadways and cleared areas. Include dust control;
- water quality and quantity: outline siltation, erosion and run-off control features, storm drainage management procedures and measures, including specific reference to seasonal variation, that will be used in the following situations: (a) installation of watercourse structures; (b) construction of service roads; and (c) any in water works;
- blasting operations
- process effluent and sewage;
- flora species: discuss measures to be taken to minimize effects. Include any plans for landscaping and preservation of existing vegetation. Demonstrate how priority will be placed on the use of native species for revegetation efforts.
- fauna species: describe measures to be taken to minimize effects on terrestrial and aquatic fauna (including avifauna). Two caribou mitigation strategies must be proposed, one for woodland animals and one for migratory animals. The EIS should include a commitment to apply the mitigation plan developed for woodland caribou while a monitoring plan is undertaken to determine the identity of any caribou using the area. Include any plans for preservation of existing habitat and compensation for loss or degradation of aquatic and terrestrial habitat (i.e., habitat rehabilitation or replacement);
- fish and fish habitat: describe measures to be taken to minimize effects on freshwater fish and fish habitat, including, if necessary, compensation for losses that cannot be mitigated.

Proposed mitigative strategies integral to the phases of the project (construction, operation, maintenance and decommissioning) will be clearly identified and addressed. The effectiveness of the proposed mitigative measures will be discussed and evaluated.

Where possible and appropriate, compensation for losses that cannot be mitigated by any other means will be examined. Mitigation failure will be discussed with respect to risk and severity of consequence.

There must be full consideration for the precautionary principle which states, “where there are threats of serious or irreversible damage, lack of full scientific certainty shall not be used as a reason for postponing cost-effective measures to prevent environmental degradation”. The best available technology and best management practices must be considered. Consideration must be given for pollution prevention opportunities.

6.2 Emergency Response/Contingency Plan

An emergency response plan will be outlined that details measures to be taken to effectively respond to any foreseeable mishap that may occur as a result of the undertaking. In addition the outline will describe any partnering opportunities with area communities and other industry that may be affected by any emergency or be expected to respond to, and recover from, an emergency response.

6.3 Environmental Monitoring and Follow-up Programs

Environmental compliance, effectiveness and effects monitoring programs for construction, operation, maintenance and decommissioning phases of the project will be described. Compliance monitoring is conducted to ensure compliance with appropriate legislation and/or ensure commitments made in the EIS are fulfilled. Monitoring and follow-up programs must allow for testing of the accuracy of effects prediction and effectiveness of mitigation measures. Programs must support an adaptive management approach and demonstrate preparedness for a range of potential outcomes to be confirmed through follow-up.

Important ingredients of monitoring programs include:

- elements of the environment (i.e., air emissions, freshwater quantity and quality, habitat, etc.) that are to be monitored;
- where monitoring will occur;
- frequency and duration of monitoring;
- identification of resource agencies that will review program design and results;
- detailed statement of objectives;
- submission of results, and
- protocols for the interpretation of results and subsequent actions to be taken based on findings.

Details of a proposed environmental effects monitoring program for effluent discharge must be presented. It is expected that the effluent discharge environmental effects monitoring program will incorporate a commitment to full community disclosure.

Details of a proposed environmental effects monitoring program for fish habitat must be provided.

Details of a proposed caribou monitoring program must be provided.

A monitoring plan for employment, contracting and procurement, education and training will be required. This plan should include succession planning and opportunities for advancement and training upgrades.

Known or planned follow-up programs specifically related to detecting and monitoring cumulative environmental effects are to be described. Objectives, methodology, duration and reporting covered by the program evaluating effectiveness of avoidance and mitigation measures on long-term effects from the project are to be described. Programs may be proposed specifically for wildlife (including migratory birds) and their habitats, species-at-risk and their habitat, wetlands, air quality and water quality.

6.4 Rehabilitation

A plan of proposed rehabilitation measures for the activities associated with the project will be given with an explanation of how the measures will reduce or eliminate various negative effects during construction, operation, maintenance and decommissioning.

It is recommended that the use of native vegetation (seed) that is natural to the area be used in all revegetation efforts.

7. Residual Effects and Selection Criteria for Preferred Option

7.1 Residual Effects

All remaining effects after mitigation has been applied should be presented. The residual effects should be defined in terms of nature, spatial extent, frequency, duration, magnitude (qualitative and quantitative), significance and level of certainty. Those effects that cannot be mitigated or avoided will be clearly distinguished from those effects that will not be mitigated or avoided.

7.2 Effects Evaluation and Selection of Preferred Alternative

This section (as compared to Section 3.3 - Alternatives) is intended to provide a detailed discussion and comparison of the residual effects relative to the preferred option and viable alternatives (as applicable).

All selection criteria, including biophysical, socio-economic and technical, will be presented and discussed in sufficient detail to allow a comparative analysis with regard to costs, benefits and environmental risks associated with both the preferred and alternative options.

8. Public Participation

A proposed program of public information will be outlined. Open House Public Information Sessions will be held to present the proposal and to record public concerns. The proponent will hold public information sessions in the town of Labrador City-Wabush. Consideration should also be given to the holding of public information sessions in Schefferville, P.Q. Public concerns will be addressed in a separate section of the EIS. Protocol for these sessions will comply with Section 10 of the Newfoundland and Labrador Environmental Assessment Regulations, 2000. Public notification specifications are outlined in Appendix B.

8.1 Consultation with Aboriginal Groups and Communities

The EIS shall demonstrate the Proponent's understanding of the interests, values, concerns, contemporary and historic activities, Aboriginal traditional knowledge and important issues facing Aboriginal groups and indicate how these will be considered in planning and carrying out the Project.

To assist in ensuring the EIS provides the necessary information to address issues of potential concern, the Proponent shall consult with Aboriginal groups for the purpose of:

- Familiarizing Aboriginal groups with the Project and its potential environmental effects;
- Identifying any issues of concern regarding potential environmental effects of the Project; and
- Identifying what actions the Proponent is proposing to take to address each issue identified, as appropriate.

If the Proponent is not able or cannot address any particular issue(s), the EIS will include supporting information.

The results of these consultations are to be presented in a separate chapter of the EIS with individual sections for each of the affected Aboriginal groups. The Proponent must refer readers to the relevant sections of the EIS as appropriate.

9. Environmental Protection Plan

A site specific Environmental Protection Plan (EPP) for the proposed undertaking must be submitted to, and approved by, the Minister of Environment and Conservation before any construction on the project begins. For the purposes of the EIS, an outline of the EPP will be included. The EPP will be a "stand alone" document with all relevant maps and diagrams. Statements regarding the commitment to and philosophy of environmental protection planning and self-regulatory and compliance monitoring will be restricted to the EIS. The target audience for the EPP will be the resident engineer, site foreman/supervisor, proponent compliance staff and the provincial environmental inspector(s). Therefore the EPP will concentrate on addressing such issues as construction/operation mitigation, permit application and approval planning, monitoring activities, contingency planning for accidental and unplanned events and contact lists. In addition, the EPP will contain a tabular breakdown of major construction and operational activities into sub-components, followed by permits required, field mitigation and contingency planning where appropriate. The objective is to present concise, comprehensive and easily accessed environmental protection information for field use by the target audience.

10. References Cited

Provide a bibliography of all citations in the EIS. Provide a bibliography of all project-related documents already generated by or for the undertaking.

11. Personnel

Brief descriptions of the expertise and qualifications of personnel involved in the completion of the EIS will be provided.

12. Copies of Reports

Copies of reports produced for any studies undertaken specifically in connection with this Environmental Impact Statement Report will be submitted.

APPENDIX A

Public Notices

Under the provisions of the Environmental Assessment Regulations 2003, Section 10, and where the approved Guidelines require public information session(s), the following specified public notification requirements must be met by the proponent prior to each meeting:

PUBLIC NOTICE

Public Information Session on the Proposed

Name of undertaking
Location of undertaking

shall be held at
Date and Time
Location

This session shall be conducted by the Proponent,
Proponent name and contact phone number,
as part of the environmental assessment for this Project.
The purpose of this session is to describe all aspects of the proposed Project,
to describe the activities associated with it, and to provide an opportunity for all interested
persons to request information or state their concerns.

ALL ARE WELCOME

Minimum information content of public advertisement - (Proponent to substitute appropriate information for italicized items):

Minimum newspaper ad size: 2 column widths.

Minimum posted ad size: 7" x 5"

Minimum newspaper ad coverage: Weekend preceding meeting and 3 consecutive days prior to meeting date; to be run in newspaper locally distributed within meeting area or newspaper with closest local distribution area.
Minimum posted ad coverage: Local Town or City Hall or Office, and local Post Office, within town or city where meeting is held, to be posted continually for 1 full week prior to meeting date.

Any deviation from these requirements for any reason must receive prior written approval of the Minister of Environment and Conservation.

Table of Concordance

EIS and Guidelines

Guideline Requirement		EIS Section
Section 1: Executive Summary		
1	Executive Summary	Executive Summary
2	Table of Concordance	Appendix A
Section 2: Introduction		
1	Name of Undertaking	Section 1.1
2	Identification of Proponent	Section 1.2
3	Purpose of the Environmental Impact Statement	Section 1.4
Section 3: The Proposed Undertaking		
1	The Prospective Site and Study Area	Section 2.1.1
2	Rationale/Need/Purpose of the Project	Section 2.1.3
3	Alternative Means of Carrying out the Project	Section 2.3
4	Relationship to Legislation, Permitting, Regulatory Agencies and Policies	Section 2.4
5	General Project Description: The EIS will provide a written and graphic description (e.g. maps and drawings) of the physical features of the undertaking particularly as it is planned to progress through the construction and operation phases of its lifespan. The description should also address other phases of the project as can reasonably be foreseen, including modification, decommissioning and abandonment. Any assumptions which underlie the details of the project design shall be described, including effects avoidance opportunities inclusive of pollution prevention, and adherence to best management practices. Where specific codes of practice, guidelines and policies apply to items to be addressed, those documents shall be cited and included as appendices to the EIS, including mapping at an appropriate scale.	Section 3.0
	(a) Access road(s), and intersections, including those which may require upgrading, as well as service roads.	Section 3.1.4
	(b) Lighting	Section 3.1.4.8
	(c) Stream(s) or other water bodies to be dewatered	Section 3.1.3
	(d) Residue ponds and/or clarification ponds	Section 3.1.4
	(e) Stream crossings, including culverts, bridges and fording sites	Section 7.1.3.3
	(f) Temporary stream diversions	N/A
	(g) Exact locations of mineral licenses and ore bodies to be mined in relation to Newfoundland and Labrador and Quebec provincial geographic boundaries	Section 3.1.1
	(h) Borrow pits, major excavations, waste rock disposal locations and their rehabilitation	Sections 3.1.2 and 3.1.7.5
	(i) Temporary sewage and waste disposal facilities	Section 3.1.7.1
	(j) Methods of handling waste and refuse at work and camp locations	Section 3.1.7.2

	Guideline Requirement	EIS Section
	(k) Mine infrastructure, including ore crushing, screening and washing facilities, fuel tanks and utilities (including water supply and distribution, water treatment, rock fines and wash water discharges, electricity supply configuration and owner/operator arrangements, substations and/or on-site electricity transmission/distribution lines or alternative generation methods)	Sections 3.1.3 and 3.1.4
	(l) Railway infrastructure, including railcar loading station, ties, rails and ballast on rail bed	Section 3.1.4.9
	(m) Ownership of new railway infrastructure, regulatory governing body and designation of common carrier status	Section 3.1.4.9 and 3.1.4.11
	(n) Plant and storage facility for manufacturing and storing explosives	Section 3.1.4.4
	(o) Support buildings, including but not limited to, administrative and engineering offices, warehouses, maintenance buildings and laboratory.	Section 3.1.4
	(p) Effluent treatment plant components, as well as effluent discharge locations and configuration and including anticipated effluent plume(s)	Section 3.3.5
	(q) Planned feasibility studies associated with the project, proposed mineral resources included within the feasibility studies and completion dates	Section 3.1.1
	(r) Clearance/condemnation work in areas underlying proposed waste piles, including in pit or on land disposal of fines and other infrastructure	Section 3.1.6
6	Construction	
6.1	The details, materials, methods, schedule, and location of all planned construction activities related to the physical features will be presented including estimates of magnitude or scale where applicable. This is to include, but not be limited to, the following	Section 3.2
	(a) General construction practices incorporating erosion and sedimentation control	Section 3.2
	(b) Construction schedule, including proposed time frames for right-of-way clearing, slash disposal, construction adjacent to watercourses, utility placement, processing and storage facilities	Section 3.2.1
	(c) Worker housing, providing a detailed overview of the housing for workers to be used during the construction and operation phases, including but not limited to location(s), capacity and facilities	Section 3.2.5
	(d) Solid waste disposal and disposal of construction waste, as well as identified opportunities for waste recycling	Section 3.1.7
	(e) Worker transportation, including details on the methods of transportation used to get workers to and from camps/worksites	Section 3.2.5
	(f) Site preparation (i.e., grubbing/clearing of right-of-way, cut and/or fill operations, etc.)	Section 3.2.2
	(g) Water body alteration: a 15 metre undisturbed buffer along the high water mark of all water bodies must be maintained. Identify any alterations that must be carried out in the water or within buffer areas, such as for water supply intakes, stream crossings, effluent discharges, storm drainage works or infilling and any stream activities	Section 3.3.5
	(h) Design and information regarding the upgrading of any existing watercourse crossing associated with new or existing roads or railway	Section 3.1.4.9

Guideline Requirement		EIS Section
	(i) Location of blasting activities in relation to watercourses/waterbodies	Section 7.1
	(j) Stream crossing structures: location of watercourse crossings for access and service roads, transmission lines, railroads, as well as any pipeline crossings, their proposed infrastructure (e.g., bridge, culvert), and their proposed specifications (e.g., clearance from watercourse, height, width, length, diameter, and construction materials); infill area or footprint together with design criteria and standards, length, width, cross section and estimated types and amount of fill material required. To avoid impacts on fish and fish habitat it is recommended that all watercourse crossings be designed and installed such that abutments are above the high water mark.	Section 7.1.3.3
	(k) Proposed locations for any de-watering wells, pipelines, and discharge infrastructures	Section 3.3.5
	(l) Electrical systems: location of substations, transmission	Sections 3.1.3 and 3.1.4
	(m) Estimate all significant emissions during construction, including but not limited to sources from generators, heaters, vents, storage tanks, stockpiles, ponds, basins, vehicles, road surfaces, effluent treatment systems, and mobile sources.	Section 3.2.6
	(n) Excavations	Section 3.1.2 and 3.3.1.1
	(o) Blasting operations	Section 3.3.1.3
	(p) Vehicle types, truck routes, hours of operation of vehicles	Sections 3.2.3 and 3.3.1.2
	(q) Transport, storage and use of hazardous materials	Section 3.1.7.3
	(r) Establishment, operation and removal of construction camp and yard areas including their water, sewage and food handling provisions	Section 3.2.3 and 3.2.5
	(s) Sources and estimated volumes of acceptable types of aggregate, ballast and pitrun material with identification of any currently known sources likely to be used	Section 3.2.2.4 and 3.2.3
	(t) Disposal areas for excess/waste rock and overburden, including locations of any currently known or planned disposal sites	Section 3.1.2.5 and 3.1.5.5
	(u) Disposal areas for organic soil, slash and grubbing, including locations of any currently known or planned disposal sites	Section 3.2.2.2
	(v) Plans for harvested wood fibre associated with the project	Section 3.2.2.1
	(w) Removal of temporary operations	Section 3.2.7
	(x) Site rehabilitation and monitoring	Sections 3.2.7 and 3.4
6.2	The proponent shall present a strategy to ensure Full and Fair Opportunity and First Consideration for employment, contracting and procurement, education and training.	Sections 2.2 and 3.2.10
6.3	Included will be a Women's Employment Plan as a tool to aid the gender equity objective of the corporate hiring strategy.	Sections 7.4.2, 2.2.3, 9.3 and Appendix D
6.4	Employment and benefits	Sections 3.2.10 and 7.3
	(a) Including local allocation	Section 7.3
	(b) Identify any measures to be implemented that may require contractors and sub-contractors to include employment equity considerations.	Section 7.3
	(c) Initiatives for the hiring of journeypersons, apprentices, engineering and technology students during construction	Section 7.3
	(d) Initiatives to increase opportunities for under-represented groups will be described	Section 7.3

Guideline Requirement		EIS Section
6.5	Provide an analysis of the availability of the skilled workforce necessary to complete the project and how any shortages in skilled trades may be addressed. Include all positions associated with the project, listing the province in which they are located.	Section 3.28, 3.2.10 and 4.3.3
7	Operation and Maintenance	
7.1	All aspects of the operation and maintenance of the proposed development will be presented in detail, including but not limited to information on the 75 operation and maintenance positions by National Occupational Classification (NOC-2006), gender and period of employment. Operation includes, but is not limited to, product excavation, product processing, product delivery, value-added secondary processing, product export and waste residue disposal. The analysis is to include all positions associated with the project, listing the province in which they are located.	Section 3.3.7
7.2	With a goal of maximizing benefits for the province, the proponent shall present a strategy to ensure Full and Fair Opportunity and First Consideration for employment, contracting and procurement, education and training. This description must identify corporate hiring objectives, quantitative and qualitative goals, special measures and policies; monitoring of compliance with objectives, goals, measures and policies; duration of contracts and/or employment and provide for a communication plan and any required re-evaluation process of objectives, goals, measures and policies. Included will be a Women’s Employment Plan as a tool to aid the gender equity objective of the corporate hiring strategy.	Sections 2.2 and 3.2.10
7.3	In order to properly assess the socio-economic impacts in the province specific information on, but not limited to the 75 operating positions, contracting and procurement, and education and training will be provided, including a benefits statement with a concise description of the proportion of positions, contracting and procurement, and education and training opportunities which will be available to Newfoundland and Labrador residents, contractors, sub contractors and businesses in relation to the project totals. Information regarding the nature of any cross-border mobility for employees/contractors associated with the project will be provided	Section 7.3
7.4	Direct and indirect impacts the project may have on existing mining operations, railway operations, mineral exploration and/or mine development on mineral titles held by other parties in the area and right’s of way will be provided. An analysis of the direct and indirect impacts the project may have on the operations or future viability of other mining projects in Labrador West including, but not limited to The Iron Ore Company of Canada, Wabush Mines and New Millennium Capital Corporation and the capacity of the QNS&L, Tshiuetin Rail Transportation and Wabush Mines Arnaud railways, will be required.	Sections 1.1 and 2.1.3
7.5	Estimate all significant emissions during operation, including but not limited to, sources from ore crushing screening and washing facilities, heaters, vents, storage tanks, stockpiles, ponds, basins, vehicles, road surfaces, cooling towers, effluent treatment systems, and mobile sources. Emissions from on-site thermal generation of supplied power must be incorporated if such a power source is being considered The use of Best Available Control Technology (BACT) is required for all new emission sources. The EIS must identify the control technology to be applied at each emission source.	Section 3.3.2

Guideline Requirement		EIS Section
7.6	All sources of effluent must be identified and characterized, including handling methods, flow rates and treatment efficiencies for each component of the treatment system. Effluent includes, but is not limited to, process tailings and water, storm water, sewage, pit de-watering and surface runoff. Estimated annual quantities of each effluent must be provided. Cleaning methods and residue disposal options must also be described. In addition proposed sampling parameters and schedule must be provided for discharges.	Sections 3.1.3.5, 3.2.4, 3.2.6, 3.3.3, and 3.3.5
7.7	Fully describe chemical storage facilities indicating how chemicals, reagents, catalysts and other potentially hazardous or toxic materials are to be handled, stored, segregated and contained. Identify chemicals by their Chemical Abstract Service Registry Number (CASRN) together with associated quantities, characteristics and toxicities.	Section 3.3.4
7.8	Include in operational details water use for domestic and non-domestic purposes, including water used in the ore beneficiation process under consideration. Provide water withdrawal requirements throughout the year in consideration of hydrology of ponds and supporting watersheds and the ability of the basin to support daily demand and recharge throughout the year. Identify water level variations in ponds as a result of water extraction throughout the year. Include locations of the intake structure and proposed dams. If any conservation or technology measures are to be employed they should be identified. Identify the existing water quality from all sources, the required water quality for its desired use and any treatment processes required to meet its required water quality.	Section 3.3.5
7.9	Identify the expected locations and number of de-watering wells, the volume of water to be pumped and the location/use of this water. Include information on any food handling provisions during both construction and operation as well as disposal provisions for associated wastes.	Section 3.3.5.6
7.10	Initiatives through such measures as training initiatives and skills upgrading for the hiring of journeypersons, apprentices and engineering and technology students during operation and maintenance, as well as initiatives to increase opportunities for under-represented groups in occupations in which they are under-represented will be described. Under-represented groups are to be identified through both census data demographic characteristics and labour force data for census subdivisions in the employment catchment area.	Sections 3.2.10 and 3.3.7
7.11	Identify the operational emergency response, safety and fire fighting facilities as well as preventative operating practices and support services. This will include on-site as well as regionally supplied training and preventative measures.	Section 8.2
7.12	Maintenance includes, but is not limited to, routine ongoing maintenance of the mine and site infrastructure (including redeveloped railway) and machinery as well as periodic maintenance requiring plant closure or processing shut down. In addition to the employment information related to operation and maintenance it is important to include environmentally relevant information such as the location of maintenance support areas, material storage locations, and the likely maintenance and winter treatment.	Section 3.1

Guideline Requirement		EIS Section
7.13	Demonstrate the Iron Ore Company of Canada/Quebec North Shore and Labrador Railway, Tshiuetin Rail Transportation and Wabush Mines Arnaud railway's agreement/acceptance of the railway line connection to existing railway line infrastructure and agreement/acceptance to provide transportation of Labrador Iron Mines iron ore and agreement of associated parties for access to port facilities in the Sept Isles region will be provided. This analysis is to consider the cumulative increased railway traffic from the proposed Bloom Lake Railway and the Elross Lake Mine.	Section 3.1.4.9
8	Abandonment	
8.1	The predicted lifespan of temporary facilities and the mine, processing facilities, and railway will be indicated. Details regarding decommissioning and abandonment will be presented. The maintenance and management of residue ponds left after closure will be described. Identify, at least in general terms, the issues requiring consideration in decommissioning based on current legislation for hazardous and other materials and structural requirements. Rehabilitation, closure plans and financial assurances will be required by the Department of Natural Resources.	Section 3.4
9	Worker's Accommodation Camp	
9.1	A written and graphic description of the proposed work camp(s) and any related appurtenances	Section 3.1.4.6 Figure 3.9
9.1	A detailed overview of the work camp(s) to be used during the construction and operation phases, including location, capacity, facilities, solid waste and sewage disposal of construction waste, as well as identified opportunities for waste recycling	Section 3.1.4.6
9.2	Methods of transportation used to get workers to and from camps;	Section 3.1.4.6 and 3.1.4.7
9.3	Water and food handling provisions	Section 3.1.4.6
Section 4: Environment		
1	Existing Environment	
1.1	The EIS will identify the study area and will describe the existing biophysical and socioeconomic environment of the study area, and the resources within it, emphasizing Valued Ecosystem Components (VEC's) (as defined by Beanlands and Duinker, 1983). In addition, the EIS will describe environmental interrelationships and sensitivity to disturbance. The identification of known data gaps is imperative.	Section 4.0
1.2	The timing and extent of any surveys for flora, fauna and ecologically sensitive areas must be provided. A qualitative and quantitative description of the present environment will include, but is not limited to:	Section 4.2
	(a) Meteorological conditions, including weather patterns as they relate to processing operation and routine and periodic maintenance	Section 4.1.1
	(b) Atmospheric conditions, including wind speeds and directions, precipitation amounts. Particular attention is to be paid to ambient dust levels in areas where construction activities may contribute to increased dust levels	Section 4.1.1
	(c) Ambient air quality baseline assessment for common air contaminants prior to construction.	Section 4.1.2.1
	(d) Ambient water quality baseline assessment for common water quality parameters prior to construction.	Section 4.1.5

Guideline Requirement		EIS Section
	(e) Site information on each stream or wetland crossing including: water depth, width, flow rate, substrate type, and potential obstructions to navigation. Hydrologic information on each body of water within the project footprint or within the predicted zone of influence.	Section 4.1.4
	(f) Identification of wetland resources including location, size and class, classified using the Canadian Wetland Classification System, of any wetland within a predicted zone of influence and conduct of a wetland evaluation. The true ecosystem value of each wetland is to be examined using comprehensive valuation methodology that assesses component, functional and attribute values, including their wildlife habitat potential (including wildlife at risk), groundwater recharge role and potential, and their role in surface water flow regulation (storm water retention and flood control). Field surveys and investigations required to supplement available data must be completed in an acceptable manner.	Section 4.2.1.4
	(g) Flora, including typical species, species-at-risk, and potential habitat for flora species-at-risk. Flora species at risk include those species listed under the federal Species at Risk Act and the provincial Endangered Species Act as well as COSEWIC listed species. Current information can be obtained from appropriate sources and augmented by field surveys and investigations required to supplement available data. Available data, survey results and detailed mitigation measures that demonstrate a special emphasis on avoidance of environmental effects is to be included in the EIS.	Section 4.2.1
	(h) Fauna (including migratory species), fauna species-at-risk, and potential habitat for fauna species-at-risk. Fauna species at risk include those species listed under the federal Species at Risk Act and the provincial Endangered Species Act as well as COSEWIC listed species. Fauna and avifauna in this context includes, but is not limited to, eagles, osprey, and woodland caribou. Current information can be obtained from appropriate sources and augmented by field surveys and investigations required to supplement available data. Available data, survey results and detailed mitigation measures that demonstrate a special emphasis on avoidance of environmental effects is to be included in the EIS.	Sections 4.2.2 and 4.2.3
	(i) Fish and fish habitat, which includes a description of fish species and any fisheries, commercial, recreational or aboriginal, which occur within the lakes, ponds and streams in the vicinity of the proposed project. As well as a description and quantification of fish habitat with the potential to be impacted by project operations, such as but not limited to, mining, storage, infrastructure, access roads, railway construction and in particular the existing flooded pits to be used for water extraction and residue disposal and the stream on James Property which has the potential to be dewatered due to mining activities	Section 4.2.4
	(j) Identify the type, location, and magnitude/extent of existing, past and potential commercial, recreational and aboriginal fisheries within the proposed project area. Address the extent to which these fishing activities will be disrupted during both the construction and operation phases of the project	Section 4.2.4.4
1.3	Discussion of the description of the existing environment will be developed for each alternative, drawing specific reference to the VECs. Detailed discussions will be developed for the following VECs:	Section 4.0
	(a) Socio-economic, demonstrating a goal of maximizing benefits for the province. The discussion will include corporate hiring objectives and policies, employment of under-represented groups, the effects the mine may have on existing industry and services and the ability of existing infrastructure to service the proposed construction and operation. The feasibility of the project will be included in this analysis.	Section 4.3
	(b) Fish and fish habitat	Section 4.2.4

Guideline Requirement		EIS Section
	(c) Caribou species and habitat, including the applicability of the Endangered Species Act. In consideration of the predicted effects of the mine and associated infrastructure on woodland and/or migratory caribou, the potential impact of rail traffic and blasting operations will be included. The potential effects on woodland caribou in Newfoundland and Labrador as well as in Quebec will be described.	Section 4.2.2.1
2	Data Gaps	Section 4.4
3	Future Environment	Section 4.5
Section 5: Environmental Effects		
1	Comprehensive analysis of the predicted environmental effects of each project alternative for the VEC's.	Section 2.3
2	The effects of the environment on the mine. In particular the EIS must identify the vulnerability of the mine to climatic elements and describe the provisions for minimizing any identified risk.	Section 7.7.3
3	Characterize the disposal area for process tailings including the hydraulic conductivity of the base of the pit, and the potential to impact on groundwater and surrounding watersheds. Control technologies in consideration are also to be described.	Section 4.1.4
4	Information will be included regarding methods to prevent suspended solids and other contaminants (originating from areas including but not limited to waste rock and overburden piles, tailings storage areas, crushing and washing areas) from migrating to nearby water bodies. The acid generating potential of waste rock will also be provided.	Sections 4.1.3.6, 4.1.4, and 7.1
5	Identify the potential impacts of ammonia discharges from blasting operations and prepare an ammonia control strategy.	Sections 7.1, 8.1.1
6	Boundaries of the assessment which includes the following considerations:	See below
6.1	VEC within the study boundaries and the methodology used to identify the VEC	Section 5.4
6.2	Definition of the spatial and temporal study boundaries for the interactions of the project, as proposed or subject to subsequent modification, with VECs and the methodology used to identify the study boundaries	Sections 4.2.2, 4.2.4.2, 7.1.1, 7.2.1, 7.4, and 7.5
6.3	The temporal boundaries for construction and operation	Section 3.2.1
6.4	The strategy for investigating the interactions between the project and each VEC and how that strategy will be used to coordinate individual studies undertaken	Appendix S Environmental Assessment Methods Sections 7.1.3, 7.1.5.1, 7.2.2, 7.2.4, 7.4.1, 7.4.2, 7.4.1, and 6.5.2
6.5	The strategy for assessing the project’s contribution to cumulative effects on each VEC	
6.6	The strategy for predicting and evaluating environmental effects, determining necessary mitigation, remediation and/or compensation, and for evaluating residual effects	
6.7	Definition of impact significance criteria against which to evaluate the potential impact of interactions	
6.8	Description of potential interactions	
6.9	Discussion of issues and concerns which relate to specific interactions	Appendix R
6.10	Discussion of the existing knowledge on information related to the interactions	Sections 7.1.4, 7.2.6.4, 7.4, and 7.5
6.11	Analysis of potential effects (significance, positive or negative, etc.)	Sections 7.1.5.2, 7.1.5, 7.4.2 and 7.5.2

Guideline Requirement		EIS Section
7	Definition of significance for each category examined	Sections 7.1.5.1, 7.2.4, 7.4, and 7.5
8	Environmental effects will be defined and discussed in the following terms for the phases of the project (construction, operation, modification and decommissioning): nature, spatial extent, frequency, duration, magnitude (qualitative and quantitative), significance, and level of certainty.	Sections 7.1, 7.2, 7.4, and 7.5
9	The environmental effects of the project, including the environmental effects of malfunctions or accidental events that may occur in connection with the project will be discussed with respect to risk, severity and significance. Consequences of low probability, high impact events, including design failure, will also be described. In relation to accidents and malfunctions provide the following information to support an assessment of potential effects on the environment, including but not limited to species at risk and their habitat	Section 7.6
9.1	Discussion of accidents and malfunctions that could occur related to processing and transport activities, the probability of such events occurring, the fate of any hazardous materials that could be released as a result of such events, and the potential interactions with environmental features	Section 7.6
9.2	Reference to the standards, codes and regulations applicable to governance of the project	Section 1.3.2, 2.4, and 3.1.6
10	Environmental effects from emissions estimates are required as part of the assessment. Preliminary dispersion modeling, incorporating baseline measurements as background values for construction and operation, must be presented. The modeling must also account for combined effects of other significant air contaminant emission sources within the general project area. The proponent is advised that stack emission tests and accompanying dispersion models and/or ambient air monitoring may be required following commencement of mining and processing operations to demonstrate compliance with ambient air quality standards.	Section 4.1.2.5
11	A discussion of environmental effects on freshwater quantity and quality is required as part of the assessment for all water bodies within the project footprint or influence zone of the project.	Section 7.1 and 7.3
12	Environmental effects on the socio-economic environment are to be detailed and include, but will not be limited to, training needs, public health services in relation to potential demand as a result of the mine, adequacy of existing acute care services, potential need for an increase in community health support services.	Sections 7.4 and 7.5
13	Environmental effects on freshwater fish habitat, fish species and any existing or potential commercial, recreational or aboriginal fisheries that occur in the area of the proposed infrastructure, plant and mine location, water supply and residue disposal (i.e. tailings) location must be evaluated. As part of the evaluation any effects associated with water withdrawal must be examined, as must the potential effects on any downstream habitat.	Section 7.1
14	Cumulative Environmental Effects	See below
14.1	Consideration of any cumulative effects on valued ecosystem components that are likely to result from the project in combination with other projects or activities that have been or will be carried out (e.g., existing and proposed industrial activity in the area) will be discussed in the EIS.	Sections 7.1.6, 7.2.7, 7.4.3 and 7.5
14.2	Temporal and spatial boundaries;	
14.3	interactions among the project's environmental effects;	

	Guideline Requirement	EIS Section
14.4	interactions between the project's environmental effects and those of existing projects and activities;	
14.5	interactions between the project's environmental effects and those of planned projects and activities; and,	
14.6	mitigation measures employed toward a no-net-loss or net-gain outcome (e.g., recovery and restoration initiatives pertinent to a VEC that can offset predicted effects).	Section 8.1
Section 6: Environmental Protection		
1	Mitigation	See below
1.1	Mitigative measures that are technically and economically feasible, that have or will be taken, to avoid, minimize or eliminate the negative, and enhance the positive environmental effects, will be described and discussed with emphasis on pollution prevention, avoidance of environmental effect and best management practices. Mitigative measures specific to the following must be addressed in particular:	Section 8.1
1.2	Air quality including dust emissions from crushing operations, emissions from any on-site generation of power, aggregate and overburden stockpiles, unpaved roadways and cleared areas. Include dust control;	Section 8.1.6
1.3	Water quality and quantity: outline siltation, erosion and run-off control features, storm drainage management procedures and measures, including specific reference to seasonal variation, that will be used in the following situations: (a) installation of watercourse structures; (b) construction of service roads; and (c) any in water works;	Sections 8.1.2, 8.1.3, 8.1.4, and 8.1.5
1.4	Blasting operations	Section 8.1.1
1.5	Process effluent and sewage;	Section 8.1.3 and 8.1.5
1.6	Flora species: discuss measures to be taken to minimize effects. Include any plans for landscaping and preservation of existing vegetation. Demonstrate how priority will be placed on the use of native species for revegetation efforts.	Sections 4.2.1, 8.4.10 and 8.5
	(a) Fauna species: describe measures to be taken to minimize effects on terrestrial and aquatic fauna (including avifauna). Two caribou mitigation strategies must be proposed, one for woodland animals and one for migratory animals. The EIS should include a commitment to apply the mitigation plan developed for woodland caribou while a monitoring plan is undertaken to determine the identity of any caribou using the area. Include any plans for preservation of existing habitat and compensation for loss or degradation of aquatic and terrestrial habitat (i.e., habitat rehabilitation or replacement);	Sections 8.3.3 and 7.2.5
	(b) Fish and fish habitat: describe measures to be taken to minimize effects on freshwater fish and fish habitat, including, if necessary, compensation for losses that cannot be mitigated.	Section 7.1.5
2	Emergency Response/Contingency Plan	Section 8.2
3	Environmental Monitoring and Follow-up Programs	Section 8.3
3.1	Environmental compliance, effectiveness and effects monitoring programs for construction, operation, maintenance and decommissioning phases of the project will be described. Compliance monitoring is conducted to ensure compliance with appropriate legislation and/or ensure commitments made in the EIS are fulfilled. Monitoring and follow-up programs must allow for testing of the accuracy of effects prediction and effectiveness of mitigation measures. Programs must support an adaptive management approach and demonstrate preparedness for a range of potential outcomes to be confirmed through follow-up. Important ingredients of monitoring programs include:	Section 8.3

Guideline Requirement		EIS Section
	(a) Elements of the environment (i.e., air emissions, freshwater quantity and quality, habitat, etc.) that are to be monitored;	
	(b) Where monitoring will occur;	
	(c) Frequency and duration of monitoring;	
	(d) Identification of resource agencies that will review program design and results;	
	(e) Detailed statement of objectives;	
	(f) Submission of results; and	
	(g) Protocols for the interpretation of results and subsequent actions to be taken based on findings.	
3.2	Details of a proposed environmental effects monitoring program for effluent discharge must be presented. It is expected that the effluent discharge environmental effects monitoring program will incorporate a commitment to full community disclosure.	Section 8.3.2
3.3	Details of a proposed environmental effects monitoring program for fish habitat must be provided.	Section 8.3.2
3.4	Details of a proposed caribou monitoring program must be provided.	Section 8.3.3
3.5	A monitoring plan for employment, contracting and procurement, education and training will be required. This plan should include succession planning and opportunities for advancement and training upgrades.	Sections 8.3.5 and 8.3.6
3.6	Known or planned follow-up programs specifically related to detecting and monitoring cumulative environmental effects are to be described. Objectives, methodology, duration and reporting covered by the program evaluating effectiveness of avoidance and mitigation measures on long-term effects from the project are to be described. Programs may be proposed specifically for wildlife (including migratory birds) and their habitats, species-at-risk and their habitat, wetlands, air quality and water quality.	Sections 8.3
4	Rehabilitation	Section 8.4
Section 7: Residual Effects and Selection Criteria for Preferred Option		
1	Residual Effects	Sections 2.3, 7.1, 7.2, 7.4 and 7.5
2	Effects Evaluation and Selection of Preferred Alternative	
Section 8: Public Participation		
1	Consultation with Aboriginal Groups and Communities	Sections 5.0 and 6.0
1.1	The EIS shall demonstrate the Proponent's understanding of the interests, values, concerns, contemporary and historic activities, Aboriginal traditional knowledge and important issues facing Aboriginal groups and indicate how these will be considered in planning and carrying out the Project.	Section 5.1.6
1.2	To assist in ensuring the EIS provides the necessary information to address issues of potential concern, the Proponent shall consult with Aboriginal groups for the purpose of:	Section 5.2 and 6.0
	(a) Familiarizing Aboriginal groups with the Project and its potential environmental effects;	Section 5.2 and 6.0
	(b) Identifying any issues of concern regarding potential environmental effects of the Project; and	Section 5.1.6

Guideline Requirement		EIS Section
	(c) Identifying what actions the Proponent is proposing to take to address each issue identified, as appropriate.	Section 8.0
Section 9: Environmental Protection Plan		
1	An outline of the EPP will be included	Section 8.5
Section 10: Reference Cited		
1	Provide a bibliography of all citations in the EIS	Section 10
2	Provide a bibliography of all project-related documents already generated by or for the undertaking.	Appendix C
Section 11: Personnel		
1	Brief descriptions of the expertise and qualifications of personnel involved in the completion of the EIS will be provided.	Appendix B
Section 12: Copies of Reports		
1	Copies of report produced for any studies undertaken specifically in connection with this Environmental Impact Statement Report will be submitted.	Appendices

APPENDIX B

EIS Study Team

EIS Study Team

Key Personnel

Labrador Iron Mines Limited

John F. Kearney, Chairman & CEO

Mr. Kearney has 30 years experience in the mining industry. He is currently the Chairman of Canadian Zinc Corporation, Conquest Resources Limited, Scandinavian Minerals Limited, Sulliden Exploration Inc. and Anglesey Mining plc. In addition, Mr. Kearney is currently a director of Avnel Gold Mining Limited and Minco plc. Previously, he was Chairman, President and Chief Executive Officer of Northgate Exploration Limited; Campbell Resources Inc. and Sonora Gold Corp. He also currently serves as a director of the Mining Association of Canada. Mr. Kearney holds degrees in law and economics from University College Dublin and an M.B.A. degree from Trinity College Dublin. He qualified as a solicitor in Ireland and as a chartered secretary with the Institute of Chartered Secretaries and Administrators in London. Mr. Kearney is also a member of the Canadian Institute of Mining and Metallurgy, the Prospectors and Developers Association of Canada and the Law Society of Ireland.

Bill Hooley, Director, President & COO

Mr. Hooley is currently Executive Director of Anglesey Mining plc. Previously, he was the Managing Director of Micon International Ltd from 2000 to 2005. In addition, he held various management and executive posts with mining and service companies in the UK and Australia from 1975 to 1999. Mr. Hooley is a professionally qualified mining engineer and has 39 years of experience in the world-wide mineral industry. He holds a degree in mining engineering from the Royal School of Mines, Imperial College London. Mr. Hooley is also a Fellow of the Australasian Institute of Mining and Metallurgy.

Terence McKillen, Director & Vice-President

Mr. McKillen is a professional geologist and has 39 years of experience in the mining industry. He holds degrees in geology from the University of Dublin (Trinity College) and a Masters degree in mining geology and mineral exploration from the University of Leicester. He is a registered Professional Geoscientist in the Provinces of Ontario and Newfoundland and Labrador. Mr. McKillen is currently Director, President and CEO of Conquest Resources Limited and Director of Exploration and Business Development for Minco plc. He was formerly Vice-President Exploration of Northgate Exploration Limited and Vice President Exploration and Development of Campbell Resources Inc. He was Director, President and CEO of Rift Resources Ltd., and Director of EXP Resources Inc.

Mathew Coon Come, Director

Dr. Mathew Coon Come is a Board Member of the Grand Counsel of the Crees (Eeyou Istchee) and the Cree Regional Authority. He was National Chief of the Assembly of First Nations from 2000 to 2003 and previously was Grand Chief of the Grand Counsel of the Crees in Québec for 12 years from 1987 to 1999. Earlier he served two terms as Chief of the Mistassini First 66 Nation. Mr. Coon Come is a Founding Member of the Board of

Compensation of the Cree Nation and has been a director of Creeco; AirCreebec, Cree Regional Intercompany Enterprise Company and Cree Construction Company and Chairman of Cree Housing Corporation and James Bay Native Development Corporation. He was a founding director of the First Nations Bank of Canada. In 1998 he was awarded the Goldman Prize (Environmental Award) in recognition of his leadership in northern Québec. He was awarded Honorary Doctorate of Laws degrees by Trent University in 1998 and by the University of Toronto in 2000.

Don Hindy, P.Eng

Don Hindy is a professional engineer and manager with over 30 years of experience in the Canadian mining industry, including oil sands, iron ore, base metals and coal. A longtime former resident of Schefferville, Mr. Hindy worked for the Iron Ore Company for over 16 years, during which occupied various mine operations and engineering positions including Supervisor of Mine Engineering, Mine Operations General Foreman, Mine Foreman, Supervising Engineer of Mine Planning, Supervising Engineer of Mines, Dewatering Engineer, Ore Grading Engineer, Pit Engineer and Surveyor. During this period, Mr. Hindy was personally involved in deposit assessment and overall surface mine design for many of the iron ore mines in the Schefferville area of the Labrador Trough.

He has extensive experience in engineering and operational positions, covering most aspects of mining, from project planning through project start up and full production operations. Senior management positions occupied include Manager of Mine Operations, Manager of Mine Maintenance and Manager of Mine Engineering/Chief Mine Engineer. Recently retired from his position as Mines Health and Safety Program Coordinator and designated Director of Mines for the Province of Alberta, Mr. Hindy was responsible for the application and enforcement of mine-related safety regulations in Alberta. In addition, as the Director of Mines, he represented the Province of Alberta on a Committee of Provincial Chief Mine Inspectors and on the Western Regional Mine Rescue Committee and fulfilled the role of Chair of the Board of Examiners - Mining, under the Alberta Occupational Health Regulation.

Linda Wrong, P.Geo., Vice-President Environment & Permitting

Linda Wrong is a professional geoscientist with an Honours B.Sc. (Geol.) from the University of Toronto. Linda is a former senior exploration geologist with over 20 years experience in remote and northern locations and specific experience over the last five years in Labrador, including work relating to the Company’s project. Complementing her direct experience in the mining industry, she has over 15 years experience in the fields of environmental assessment, environmental baseline program development, community consultation, hydrogeology, environmental management system design and implementation and contaminated site assessment and management with major international consulting firms and mining companies, most recently as Mining Technical Program Lead, North America, with Earth Tech Canada and Manager Environmental Baseline and Engineering Liaison with Aurora Energy Resources Inc.

Marc Duclos, Vice-President Transportation Services

Mr. Marc Duclos, MBA, brings over 30 years experience in rail, port, and truck transportation management to Labrador Iron Mines. Amongst his extensive experience, Mr. Duclos was previously General Manager for the Sept-Iles operations of the Iron Ore Company of Canada and, as such, was responsible for the overall operations of the 600 km Sept-Iles to Schefferville railroad and the Sept-Iles port terminal. Marc was also previously employed by both Canadian National Railway and Via Rail. In addition to Marc's invaluable and extensive site-specific experience, he also brings a strong background in regulatory knowledge, project management, planning and successful project execution to the Labrador Iron Mines Project team.

Erick Chavez, Senior Geologist

Mr. Chavez is a professional geologist with 14 years international exploration experience. He is a graduate of Universidad Nacional de San Agustin de Arequipa, Peru and holds a M.Sc. degree from the University of Toronto. He has been Senior Exploration geologist with Conquest Resources Limited since 2003. Prior to 2000, Mr. Chavez was an exploration geologist with Cominco (Peru) SRL.

Joseph Lanzon, Government & Corporate Affairs

Mr. Lanzon has extensive experience in governmental affairs and in facilitating the development of community partnerships in the natural resource sector. Mr. Lanzon is Senior Advocate, Homeland Security for Canadian Advanced Technology Alliance. He has held management positions at CGI and General Electric with mandates for business development and government affairs. Mr. Lanzon has worked for the Federal Government of Canada, the NWT Government, the House of Commons and the Senate of Canada and has held senior positions as advisor and executive assistant. He has extensive knowledge of the workings of government at all levels.

Joanne Robinson, Senior Mine Engineer

Ms. Robinson is a professional engineer (P.Eng.) and a graduate of Queen's University (B.Sc. Mining Engineering) with 11 years experience in the Canadian mining industry. She has most recently been Senior Mine Engineer with the Ledcor Group in charge of an open pit metallurgical coal mine. Prior to 2006, Joanne held progressively senior engineering positions with Quintette Operation Corp., Trow Associates Inc., Huckleberry Mines Ltd. and Century Mining Corp.

Jacques Whitford Ltd.

Colleen Leeder, M.Sc.

Colleen Leeder is a Principal with Jacques Whitford in St. John's, NL, where she is the Environmental Planning and Permitting Group Leader, and Practice Director for Environmental Assessment. She has over 20 years experience in federal and provincial environmental assessment procedures and policies, including cumulative environmental effects assessment. Ms. Leeder was the EIS Manager for the Voisey's Bay Mine/Mill EIS, and the Liquefied Natural Gas Receiving, Storage and Processing Facility in Saint

John, New Brunswick. Both of these projects were subject to federal and respective provincial environmental assessment legislation. Ms. Leeder was also part of the environmental assessment team that prepared the Development Application and Comprehensive Study for Husky Energy's White Rose oilfield development, providing direction on environmental assessment methods, and support to Husky Energy. Prior to joining Jacques Whitford in 1995, she worked with the Environmental Assessment Division of the Newfoundland and Labrador Department of Environment and Labour. As Section Head, Ms. Leeder was responsible for the administration of the environmental assessment process and supervised the assessment of numerous developments.

Bruce Bennett, B.Sc. Hons.

Bruce Bennett is a Principal and senior scientist with Jacques Whitford St. John's office, who has a solid background in environmental assessments – including site inspections, feasibility studies, land and resource use reviews, baseline surveys, regulatory (and permitting) reviews and environmental protection planning. He was involved in provincial and federal environmental assessments of Hope Brook Gold mine/mill, Voisey's Bay mine/mill, IOC's Luce Pit Development, IOC's Tailings Management Plan, Nugget Pond Gold mine/mill, and Duck Pond Copper-Zinc Mine. Mr. Bennett has completed the one-day CEAA Training Course that is provided by the federal office. Since the enactment of CEAA, several of the assessments have been screening, comprehensive study and panel level assessments. Beyond Mr. Bennett's assessment experience for mining clients, he has been involved in baseline studies for: Voisey's Bay Mine/Mill Project, Voisey's Bay (Proposed) Smelter, Voisey's Bay Pilot Hydrometallugical Facility, Voisey's Bay (Proposed) Long Harbour Commercial Nickel Processing Facility, Hope Brook Gold Mine, Cape Ray (Proposed) Mine; Tally Pond (Proposed) Mine and Duck Pond Copper-Zinc Project.

As part of the assessment process, or complementary to the process, Mr. Bennett has developed environmental protection plans (EPPs) for Pine Cove Gold Mine, Nugget Pond Gold Mine, Hammerdown Gold Mine, Beaver Brook Antimony Mine, IOC Luce Pit and Duck Pond Copper-Zinc Mine.

Among the mine projects that have progressed to an operational stage, Mr. Bennett has assisted in the permitting stage and performed or managed EEM studies for: Voisey's Bay Mine, Hope Brook Gold Mine, Nugget Pond Gold Mine, Hammerdown Gold Mine, Wabush Mines, Iron Ore Company of Canada Carol Project, ASARCO Mine at Buchans, Rambler Mines, Ming Mines and Beaver Brook Antimony Mine.

With the recent formalization of EEM requirements under the Metal Mines Effluent Regulations (MMER) in June 2002, Mr. Bennett has participated in two working sessions with Environment Canada aimed at familiarizing the mining sector with the MMER requirements. Mr. Bennett has provided strategic advice regarding the implementation of MMER and regulatory liaison on behalf of, or for, mining clients such as Aur Resources, Iron Ore Company of Canada, Richmont Mines, Anaconda Gold Corp, Crew Gold Corp. and Voisey's Bay Nickel Company Limited. He participated in the design of the Voisey's Bay Mine/Mill Cycle 1 Marine EEM and later he managed the implementation of that program as well as the Cycle 1 for Nugget Pond Gold Mine. He has managed programs to design and implement Cycle 1 EEM for Duck Pond Project and Cycle 2 for Voisey's Bay and Nugget Pond mines. Mr. Bennett has worked with the Jacques Whitford team that developed the decommissioning plans for Duck Pond Mine and Pine Cove Gold Mine.

Mark Shrimpton, M.A.

Mark Shrimpton (Principal, Jacques Whitford) has over 25 years experience in socio-economic consultant research, assessing, planning and managing the impacts of resource industry activities. This has included work for the mining, petroleum and hydro-power industries, and for governments, international agencies and communities.

In Canada, Mark has played a lead role in preparing: socio-economic impact assessments of the Voisey's Bay mine/mill and processing plant, LabMag iron ore mine, Lower Churchill hydro project, and the Hibernia, Terra Nova, White Rose, Hebron, Newfoundland Transshipment Terminal and Newfoundland LNG petroleum projects; industrial benefits, human resources and diversity plans for the White Rose project; infrastructure and labour requirements studies for various mining, petroleum and hydro projects; and, studies monitoring the socio-economic effects of resource development activity. He has also worked in the US, Iceland, the Faroe Islands, France, Switzerland, the Falkland Islands and Australia, including managing the preparation of socio-economic impact assessments of the smelter and hydro projects in Iceland. Mark has also completed various studies of the effects of remote mines, including research into operations in Canada, US and Australia. The clients for this work have included: Labour Canada; Energy, Mines and Resources Canada; Health and Welfare Canada; the Centre for Resource Studies, Queen's University; the Government of the Yukon; the Australian Mines and Metals Association; and, the UN International Labour Office. These studies involved site visits to remote mines and adjacent communities across Canada and in Western Australia, South Australia and Queensland.

Mark has published widely and made presentations on his research at conferences in Canada, the US, the UK, France, Norway, Lithuania, Russia, Malaysia and Australia. In addition to his consulting work, he is an Adjunct Professor of Geography and Associate of the Centre for International Business Studies at Memorial University.

Michael C. Murphy, PhD, P.Eng.

Dr. Mike Murphy is a Principal of Jacques Whitford AXYS Ltd. and the Senior Service Director for the Atmospheric Environment Group company-wide, working out of the Fredericton, New Brunswick office. He graduated from the University of Waterloo in 1987 with a Ph.D. in Chemical Engineering, specializing in energy analyses, fluid modelling and boiling heat transfer. With more than 23 years of experience in Canada, USA and international, Dr. Murphy has managed air quality and engineering studies on: emissions inventories of air pollutants and greenhouse gases, source emissions testing, dispersion modelling, dispersion and deposition modelling for human health and ecological risk assessments, ambient air quality, noise, odour, climate analysis, greenhouse gas management, flow profiling, indoor air quality and environmental assessments.

Dr. Murphy has worked on large environmental assessment (EA) projects including the NB Power Coleson Cove Refurbishment and the largest natural gas treatment plant in the world in Qatar, in the Middle East. He has conducted air quality studies for the shipping industry in Atlantic Canada (Saint John Port Authority), N.B. Power, Irving Oil Limited and in British Columbia (Vancouver Port Authority).

Dr. Murphy participated in the full EA for the LNG facility proposed for New Brunswick, and a similar one in Kitimat, B.C., including dispersion modelling, air quality assessments and public consultation on all air quality aspects. He acted as senior reviewer on the air quality and human health and ecological risk assessment for a pulp mill in Crofton, B.C. Recently, he has conducted a comprehensive review of the Draft Air Pollution Rules (2005) for the Government of Trinidad and Tobago and is assisting with policy development to protect the environment in light of continued industrial expansion. He is a member of the Environment Committee for the Road Builders Association of New Brunswick. Dr. Murphy maintains close ties with the University of New Brunswick and has given courses on air pollution, process safety, and mass and energy balances.

Benjamin Coulson, M.A.Sc., P.Eng.

Benjamin Coulson joined Jacques Whitford in 2005 as the Atmospheric Environment Group Leader and a Senior Engineer specializing in air quality, climate change, noise and acoustics issues. He has conducted dozens of environmental impact studies and regulatory compliance projects for a variety of industry sectors, including: institutions; power generation; manufacturing; medical research and health care; and transportation. His air quality experience includes numerical and physical dispersion modeling, regional airshed and photochemical modeling, emission inventory development, field measurement, and public and agency consultations. Ben has given lectures and presentations on a variety of air quality issues, including the development and teaching of training courses on air quality theory and dispersion modeling.

Benjamin Burkholder, B.Sc.

Benjamin Burkholder is an Air Quality Specialist with Jacques Whitford Limited. He has over six years experience conducting boundary layer meteorological and air quality dispersion modelling, ambient air quality monitoring and assessment, and emissions inventories. He has provided air quality emissions/modelling support for numerous environmental impact and risk assessment projects. Mr. Burkholder specializes in High Performance Computing (HPC) technology and has substantial experience running advanced dispersion, meteorological, and photochemical models on such platforms. He has worked on emissions and dispersion modelling assessments for a wide range of industries including the oil and gas, mining, power generation utility, pipeline utility and forest products sectors. Prior to joining Jacques Whitford, Mr. Burkholder worked as an Air Quality Scientist with the University of British Columbia and the British Columbia Ministry of Environment.

Jim Knight, P.Eng.,

Mr. Knight is Jacques Whitford's Senior Climate Specialist. As a former air quality and energy regulator, Mr. Knight has designed and implemented national and provincial emissions inventory, ambient air quality and acid rain programs. He has managed databases and progress tracking mechanisms and developed air quality, energy and energy efficiency legislation. He has lead public consultations on diverse issues including a national acid rain program, permitting of a coal-fired power plant, mining operations, the Petitcodiac Causeway and others. He recommended environmental priorities for a municipality (*A View of the City* (Saint John)), created Air Resource Management Areas (ARMA) across New Brunswick and drafted the Climate Change Action Plan for New Brunswick. He represented New Brunswick nationally and internationally on air quality, acid rain, ozone depleting substances and climate change matters. While at NB Executive Council, in 2001, he was a key Policy Analyst in the completion of a government-wide, department by department, program review. He co-authored the New Brunswick Energy Policy (1990; 2001) and worked directly with legal drafters on significant energy and environmental legislation (Clean Air Act, Electricity Act). He developed policy support documentation for the creation of Efficiency New Brunswick and the Renewable Portfolio Standard Regulation. He is an engineer, meteorologist, and a trained GHG Emissions Validation and Verification auditor with experience with the federal and provincial governments and with an electric utility.

At Jacques Whitford, Jim has worked with municipalities, institutions, commercial operations and heavy industries to establish and verify their GHG emissions inventories / intensities, identify potential emission reduction opportunities and quantified carbon offset credits, while assisting clients to prepare for proposed GHG and air pollutant regulations. He has worked with industries to address Climate Change and GHG Management Plans in Environmental Assessments on large construction projects (fossil and hydro-electric generation, LNG, pipelines, oil sands). He has assisted the Government of Trinidad and Tobago to develop new air quality standards and emissions regulations. He is responsible for the development and staffing of Jacques Whitford's Climate Services Line.

AECOM

Gary Epp Ph.D. (Project Manager)

Dr. Epp is the Technical Practice Group Leader for AECOM's Ecological Services Practice Group with the responsibility of coordinating global ecological services. He is also the Manager of Ecological Services for AECOM Kitchener and a senior ecologist, with the overall responsibility for providing comprehensive and integrated ecological assessment services to our clients. As head of the Ecological Services Group, Dr. Epp is directly responsible for the management and coordination of a wide range of ecological assessment assignments including natural heritage studies, environmental impact studies, watershed management plans, wetland evaluations & assessments, re-vegetation plans, aquatic & terrestrial habitat studies, natural resources screening, and bio-monitoring studies. Dr. Epp's experience has frequently involved an integrated approach where ecological studies have been strategically coordinated with a variety of other scientific, engineering and planning disciplines. Dr. Epp has extensive experience negotiating with a wide range of review agencies, naturalist groups, and the public. Dr. Epp is recognized as an expert in ecological assessment before the Ontario Municipal and Environmental Assessment Boards.

Derek Parks, B.Sc. (HON), M.Sc. (Fish habitat, water quality, sediment, wildlife, field work, report preparation and logistical support)

Mr. Derek Parks is currently employed as a senior aquatic specialist within AECOM, with more than ten years of experience and whose specialties and interests include fisheries and fish habitat, water-quality, environmental effects monitoring, bioengineering and habitat assessment and enhancement. These skills provide Mr. Parks the ability to complete permitting approvals from various government agencies. He also has experience in the use of GIS to evaluate a range of fisheries issues. His previous employment includes AMEC Earth and Environmental, the Ontario Ministry of Natural Resources, the Township of Goulbourn and Niblett and Associates. He is also certified by MNR in the use of electrofishers and the Southern Ontario Rapid Stream Assessment Protocol and has extensive experience with a wide range of environmental studies. With a strong technical and academic background in fisheries resources, Mr Parks has applied this knowledge to plan, design and monitor a variety of projects to meet the needs of the client. He acted as a liaison for the client between regulatory agencies such as; Department of Fisheries and Ocean, Ontario Ministry of Natural Resources, and several Conservation Authorities, to provide the required information to be submitted to the appropriate agency. Once approvals have been granted, Mr. Parks has carried out over 15 monitoring programs to confirm work proposed and compensation and mitigation measures used were successful in protecting fish and fish habitat.

Jillian deMan (B.Sc.). (Vegetation field work, laboratory plant identification and report preparation) is a terrestrial ecologist with AECOM's Environmental Division based out of Kitchener, Ontario. With the company for over 12 years, her expertise has a wide range of scope within the environmental, engineering and waste management fields enabling her to be involved with numerous projects across Canada that incorporate natural heritage issues/planning and restoration. Consequently gaining familiarity with the Mixed wood Plains, Boreal Shield, Taiga Shield, Atlantic Maritime and Hudson Plains ecozones of Canada. Her technical skills include; wetland boundary delineation, evaluation, monitoring and restoration, soils identification, air-photo interpretation, multi-scale floral inventories, amphibian surveys, woodland evaluations and biomass fish sampling through seine net, minnow trap or electrofishing methods. These skills facilitate in the preparation of comprehensive Environmental Baseline studies.

James Holdsworth (Avifauna field work and report preparation)

James Holdsworth has over 33 years of field based experience with special emphasis on population dynamics in South Western Ontario. He possesses a wide variety of skills and specializes in point-counts, breeding and migratory bird surveys, and butterfly, dragonfly, mammal, reptile and amphibian surveys. Mr. Holdswroth has also co-authored " Checklist of the Birds of Oxford County " published in spring 2007, serves as sub-regional editor, Oxford County, for American Birds, Field Notes and North American

Birds magazines, has participated in both Ontario Breeding Bird Atlas projects, providing survey data on the breeding birds of Oxford County and is currently compiling and editing "The Birds of Oxford County", a definitive work on the history, abundance and diversity of the birds in the county of Oxford. He has worked on numerous projects including a sub-watershed study of the Greensville area, for the City of Hamilton, which included a migrant and breeding bird study, as well as inventories of butterflies, dragonflies, mammals, reptiles and amphibians in the Alvar communities. The design and implementation of a breeding and migratory bird survey for a proposed CPR rail extension in PIttock Lake, near Woodstock and served as a consulting breeding bird surveyor for the Red Hill Expressway project within the City of Hamilton.

David Praskey, B.Sc. (Fish habitat, water quality and sediment field work and data summarization)

Mr. Praskey is an aquatic ecologist with AECOM's Ecological Services group in Kitchener, Ontario. He has over six years experience in the aquatic biology field including lake and stream fisheries and habitat assessments, Lake Ontario wetland fish sampling, aquatic habitat mapping, Ontario Benthos Biomonitoring Network sampling, BC stream classification, and aquatic biological toxicity testing. Mr. Praskey's fish sampling experience includes index trapnetting and gillnetting, backpack and boat electrofishing, as well as seine and fyke netting. He also has more than 20 years of safe boating experience and has operated various sized boats for several professional and volunteer projects. He also has experience preparing project and client reports.

Intermesh Enterprises

Paul Thibaudeau, Ph.D

Paul Thibaudeau is an anthropologist (PhD Anthropology, University of Toronto), consultant (Intermesh Enterprises) and adjunct research professor (Department of Sociology/Anthropology and the School of Industrial Design at Carleton University) with a background in native ethno-history, archaeology and contemporary political affairs as well as experience in researching product design. He has provided consultation to both the private and public sector on different aboriginal and socio-economic issues including self-government, land claim resolution, litigation and history of residential school abuse and Aboriginal literacy and essential skills development. Paul also teaches courses on product design and anthropology and provides lectures and graduate advisement in the Master's of Design program.

SNC-Lavalin

Claude Beaulé

Mr. Claude Beaulé is an Engineering Project Manager and Team Leader. He's driven towards results with more than 20 years of relevant experience. His more important career accomplishments were in industrial process and utilities engineering: power plants – steam – natural gas – pumping and heat transfer.

His communication skills and leadership motivation abilities were key benefits in multidisciplinary team work.

Daniel Dufort

Mr. Daniel Dufort is a Project Manager in the Mining and Metallurgy Division of SNC-Lavalin, based in Montreal. Prior to his current appointment, he held Senior Executive positions in the mining industry and possesses more than 25 years of experience in production, operations, sales, marketing and project management. He has earned a solid reputation as an experience hands-on professional who can quickly motivate and rally a team around a common vision and business goals. Driven by continuous improvements, he focused on delivering strong results.

Stéphane Rivard

Mr. Stéphane Rivard has 14 years of experience as an engineer in the mining and metallurgy sector. He has extensive experience in copper; from chalcopyrite flotation to copper metal smelting, as well as in hydrometallurgy and production of copper rods. He also has over 7-year experience with zinc flotation (sphalerite). He has been involved in three plant start-ups, specifically the concentrator at the Bouchard-Hébert mine, the concentrator at the Horne smelter for the Gallen mine and the slag milling circuit for Fondicion Altonorte in Chile. He is a Six-Sigma Black Belt and took DFSS training with the Bismuth input/output management team including business modeling for Altonorte, Antamina, Gaspé, Horne and Kidd Creek (regarding minor elements in concentrates, smelters and refineries). More recently he has been involved either as Process Lead and Process Manager for several studies for SNC such as Mine Raglan Phase 2, Canadian Royalties Bankable Feasibility Study on their nickel project in Nunavik, Guelb El-Aouj (BFS) iron ore project in Mauritania and Silvermet's zinc fuming BFS in Turkey. Since 1994, Mr. Rivard has risen from Production Metallurgist to Senior Metallurgist, Head Metallurgist and Black Belt. More recently, he was an Engineer part of the production management team with a copper rod producer.

Jean Routhier

Mr. Jean Routhier has over 24 years of experience in the following process industries: petrochemical, mining, aluminum and pulp and paper. He has worked on multidisciplinary projects having undertaken numerous assignments in design, engineering, procurement, project controls, project management, construction management, commissioning and start-up. He has been involved in major capital projects in Canada, USA and overseas, including EPC projects.

Michaela Ilie

Mrs. Michaela Ilie has over 10 years of experience at increasing levels of responsibility in the Health, Safety and Environment field for industrial firms.

Her experience has mainly been gained in managing corporate Health, Safety and Environment programs and the development of HSE programs in both the operations and construction phases of projects. She is familiar with leading systems and procedures used in implementing and monitoring HSE, including behavioural based safety program (STOP), OSHA, OHSAS, ISO 14001, and in carrying out Job Safety Analysis, Process Safety Analysis, HAZOP and FMEA.

Her core skills include her experience in the implementation of management systems, environmental permitting, strategic planning, providing supporting to higher management and teamwork supervision in unionized environments. In continuously undertaking more challenging mandates, she has proven her capability to provide multi-unit support, to multi-task and to work independently in a fast-paced environment.

Jean-Sébastien Tremblay

Mr. Jean-Sébastien Tremblay, M. Eng., is a mining engineer with 8 years of experience in the mining and metallurgy field. He worked as much on the building sites, the existing mining installations and with the design of the future mines. In the 3 last years, it contributed to the development of a database making it possible to accelerate the calculation of the costs of operation relative to a plan of mining. He can measure the improvement of this tool for 3 different projects. He also integrated the design of the infrastructures relating to the supply of fuels and water for the periods of construction and operation for a mine and a mill. Moreover, Mr. Tremblay is familiar with the Whittle software of GEMCOM allowing optimizing the methods of mining. He also has acts as controller of project within the framework of a feasibility study adding up nearly 20000 hours.

WESA

Byron O’Connor, P.Eng.

Byron O’Connor is a Principal with WESA Inc. and licensed professional engineer in the Provinces of Ontario, New Brunswick, the Northwest Territories and Nunavut, and Newfoundland and Labrador. He has degrees in geology and geological engineering from the University of New Brunswick. He has worked in the mineral exploration and environmental fields since 1987. He has conducted environmental work at mine sites, industrial facilities and other sites throughout Ontario, across the Arctic, in Quebec, Alberta, Northwest Territories, New Brunswick, Labrador, Missouri, Delaware, Jamaica, Turks and Caicos, and St Lucia.

APPENDIX C

List of Documents

Other Related Documentation

Bauer, A. The Status of Rock Mechanic in Blasting, Drilling Considerations.

Bish Canada 2002. Assessment Report for an Investment Proposal for the Hollinger Iron

Ore Development Project. A report prepared for Soquem Inc.

Blais, R.A. & Stubbins, J.B. 1962. Role of mine geology in the exploration of iron deposits of the knob lake range, Canada. Transactions.

Bradbury, J., & St-Martin.2008. Winding Down in a Quebec Mining Town: a Case Study of Schefferville. Canadian Geographer, 27 (2), pp. 128-144.

Brouillette, Benoit. 1969. Le mineral de fer du Venezuela et du Labrador, Actualite Economique, 45 (1), p. 105.

Brown, D.D. 1981. The St. Lawrence Seaway tolls and the Quebec-Labrador iron ore industry. Mineral Policy Sector Internal report, Ottawa Energy, Mines and Resources Canada, Minerals, vi. 11p.

Burger, J. 1981. The Labrador Trough- Roads of Iron. E&MJ-Engineering and Mining Journal. 182, 11, pps.133-133.

CABO Drilling Corporation.2008. Health, Safety, and Environmental Policies and Procedures.

Centre de Recherches Minerales. 1996. Memorandum Technique. Preparation d'un Echantillon de Minerai de Fer de Schefferville. A report prepared for Fonteneau Resources Ltd. Report No. 7224M016.

Chavez, E. 2006. Feasibility Study for the Labrador Iron Ore Project, Province of NL, Canada. Vol 1. For Labrador Iron Mines Limited.

Chavez, E., & McKillen, T.N. 2007. Labrador Iron Mines Limited, Scoping study for the Labrador Iron Ore project, Province of NL, Canada. Energold Minerals Inc.

Clark-Jones, Melissa, McDonald, J.A. 2003. Globalization and the single industry town: an annotated bibliography. Journal of eastern townships, Issue 22.

Coates, D.F., Gyenge, M., Stubbins, J.B. Slope stability studies at Knob lake.

Coutes, D.F., McRorie, K.L. & Stubbins, J.B. 1963. Analyses of pit slides in some incompetent rocks. Transactions, Society of mining engineers.

Des Roches, M. & Therriault, Y. 2005 A Demographic and Health Profile, North Shore population. North Shore Local Health and Social Services Network Development Agency, 14p.

Dufort, D., & Kroon, A.S. 2007. Labrador Iron Mines Limited Technical Report of an Iron Project in Northwest Labrador Province of NL. Mining and Metallurgy. SNC-Lavalin.

Durrell, W. 1954. Quebec-Labrador Iron Ore Potential Dwarfs Mesabi Range. Journal of metals, 6 (4), pp.452-454.

Earth Tech Canada Inc. doing business as AECOM (2008). *Labrador Iron Mines Baseline Terrestrial Report- James, Redmond & Silver Yards*.

Earth Tech. 2008 (received).Iron Mountain Project. Schefferville Socio-Economic Background Information.

Earth Tech Canada Inc. 2006. Labrador Iron Mines Limited Environmental and Engineering Baseline Work Plan.

Elalfy, SE., Atkinson, T. 1993. The Carol Lake Mine of the Iron Ore Company of Canada. Transactions of the Institution of Mining and Metallurgy. Section A, Mining Industry, 102, A1-A14.

Fahraeus-Van Ree, G., & Payne, J.F. 2005. Endocrine disruption in the pituitary of white sucker (catostomus commersoni) caged in a lake contaminated with iron-ore mine tailings. Hydrobiologia 532, 221-224.

Fenwick, F.R. (2001). Sorrow in Sheshatshiu: the Innu of Labrador, 25 (5), p.38.

Garg, O.P. 1982. Recently developed blasting techniques in frozen iron ore at Schefferville, QC. Engineering Applications in Permafrost Areas. 4TH Canadian Permafrost Conference.

Garg, O.P. Successful Implementation of steeper slope angles in Labrador, Canada, Chapter 30, Third Stability in Surface Mining.

Garg, O.P.& Devon, J.W. 1978. Practical Applications of recently improved pit slope design procedures at Schefferville. Open Pit operations. CIM Bulletin.

Garg, O., & Kalis, T. Slope Stability Studies in the Schefferville Area.

Gauthier, G. 2004.Memorandum on Sawyer Lake Hematite Deposit, Labrador. Prepared for Energold Minerals Inc.

Gilders, R., & Cheung, L. 2007. Labrador Iron Mines Metallurgical Testing. Reference number: PET-J1577. Research and Productivity Council. Prepared for Labrador Iron Mines Ltd.

Gross, G.A. 1965. Geology of Iron deposits in Canada, Vol. 1. General Geology and Evaluation of Iron Deposits. Geological Survey of Canada, Economic Geology Report 22, p 181.

Hatch Mott MacDonald. 2006. Transportation and Tunnels. Assessment of Rail Infrastructure Conditions of the Menihek Subdivision of Tshiuetin Rain Transportation Inc. for Labrador Iron Ore Mines Limited, Rail Systems.

Hatch, W.R. 1989. Wet Spiral Classification of Iron Ores for LaFosse Platinun Group Inc.

Hatch, W.R. 1989. Wet Spiral Classification of Iron Ores. Report for LaFosse Platinum Group Inc.

Indian and Northern Affairs Canada, 2006a. http://www.ainc-inac.gc.ca/qc/gui/Map/naskapis_e.html

Indian and Northern Affairs Canada, 2006b. www.ainc-inac.gc.ca/qc/gui/matimekush_e.html

Iron Ore Company of Canada. 1979. Development Project Report on the James Mine Area. IOCC Engineering Department, Report No. 1975-11.

Iron Ore Company of Canada. 1983. Reserves and Stripping Estimates for Barney #2, North Ferriman, Ferriman #4, South Ferriman, Burnt Creek, Fleming #7, Retty, Knox, Fleming #9, Sawmill #1, Barney #1, Houston #2, Star Creek #1, Lance Ridge #1, Knob Lake #1, Redmond #5, Redmond #2, Wishart, & Timmins iron deposits. IOCC Engineering Department, Report. Kilborn Inc. 1995. Iron Ore Project Development Plan. Prepared for Hollinger North Shore Exploration Inc. Kilborn Report No. 3941-15.

Janssen, A.T. Long range production planning of direct shipping ore from several deposits.

Kearney, J. 2006. L.I.M. Limited. Labrador Iron Mountain Iron Ore Project Overview Report.

King, M.S., & Garg, O.P. (1983). Compressive strengths and dynamic elastic properties of frozen and unfrozen iron ore from northern Québec. Laboratory Testing of frozen Soils. 4TH Canadian Permafrost Conference.

Klein, C. 1966. Mineralogy and Petrology of Metamorphosed Wabush Iron Formation Southwestern Labrador. Journal of Petrology, 7 (2), 1966, p.246.

Kosovac, M., & Kundu, S. 1978. Iron Ore Co. of Canada's Computerized Analysis Method Speeds mine Planning and Pit Design. Society of Mining Engineers.

Labrador Iron Mines Limited Schefferville Project. 2008. Registration Pursuant to Section 3 of the Newfoundland and Labrador Regulation 54/03. Environmental Assessment Regulations, 2003, Under the Environmental Protection Act for the Proposed Labrador Iron Mines Limited, Schefferville Project.

Labrador Iron Mines Limited. 2005. Scoping Study for the Labrador Iron Mountain Project, Schefferville Area, Labrador.

Labrador Iron Mines, 2005. Iron Mountain Iron Ore Project review of First Nations Communities in the

Quebec-Labrador Peninsula

McKillen, T.N. 2005. Labrador Iron Mines PLC. Labrador Iron Ore Project. Summary Report.

Met-Chem Canada Inc. 2006. Labrador Iron Mines Limited High Level Review of Transportation Options.

Meyer, T. 2005. Baffinland Iron Mines Corporation, Research Report by First Associates

Inc. Midland Standard, Inc. 1990. Technical Review of La Fosse Platinum Group Inc. Iron Ore and Manganese Ore Project, Volume 1. A report prepared for Kidder Peabody & Co. Inc. MSI Report No. 40-01-138.

Midland Standard, Inc. 1990. Development Project Report on the James Mine Area. Technical Review of La Fosse Platinum Group, Incorporated Iron Ore and Manganese Ore Project for Kidder Peabody & Co., Inc. Iron Ore Company of Canada Engineering Department Development Section, Report No. 1975-11.

Naskapi Nation, 2006. http://www.naskapi.ca/en/our_organisations/corporate.htm

Neal, H.E. 2000. Explor. Mining Geol., Vol. 9, No. 2, pp. 113-121.

Neil, C., Tykkylainen, M., Bradbury, J. 1992. Coping with Closure: An International Comparison of mine town experiences. Routledge.

Nichols, L. 1968. Field techniques for the economic and geotechnical evaluation of mining property for opencast mine design, Knob lake, Québec. Journal of Engineering Geology, Vol.1. pp. 169-180.

Quebec Secretariat aux affaires Autochones, 2006. http://www.versuntraite.com/innus/matimekosh_en.htm

Retty, J., Moss, A (1951). Iron Ore Deposits of New Quebec and Labrador. Geological Society of America Bulletin, 62 (12), pp.1471-1472.

Risto, R.W., Neal, H.E. & Kociumbas, M.W. 2005. Technical Review and Mineral Resource Estimate for the Bloom Lake Iron Deposit, Quebec. A report prepared for Consolidated Thompson- Lundmark Gold Mines Limited by Watts, Griffis & McOuat Limited.

Risto, R.W. &, Neal, H.E. 2004. Amended Technical Report on the Howells River Iron Ore Project, Labrador . A report prepared for New Millennium Capital Corp. by Watts, Griffis & McOuat Limited.

RSM Mining Services Inc. 2007. Environment Health and Safety Program Manual.

Scales, M. 2007. IOC begins $60-million expansion. Canadian Mining Journal, 128 (7), p 20.

Scott, F. 2000. Overview Report on Hollinger Knob Lake Iron Deposits

Scott, F. 1990. Environment Preview Report for Temporary Access Road to Dyke Lake Area, Labrador. A report prepared for Fonteneau Resources Limited.

Scott, F. 2000. Overview Report on Hollinger Knob Lake Iron Deposits.

Scott, F. 2004. Report on Resources at Sawyer Lake Deposit, Labrador. A report prepared for Fonteneau Resources Limited.

Snelgrove, A. 1953. The Role of Geologists in the Development of the Labrador- Quebec Iron Ore Districts- Discussion. Transactions of the American Institute of mining and metallurgical engineers. 196 (11), pp. 1129-1130.

Stubbins, J. Dewatering and Flood Control. Auxiliary Operations, Chapter 11.4.

Stubbin, J.B. & Munro, P. 1965. Open pit mine dewatering-Knob Lake. Transactions, Vol LXVIII, pp.229-237.

Studeignesellshaft Fur Eisenerzaufbereitung. 1985. Report on the Use of Schefferville Iron Ore in the Standard Sinter Mixture. Prepared for Hollinger north Shore Exploration Company Ltd.

Swierkot, G., & Taciuk, W. 1970. Problems Associated with Flow of Bulk Solids at Iron Ore Company of Canada, Labrador City. Canadian Mining and Metallurgical Bulletin, 83 (695), 1970, p.304.

Toth, P. 2005. Production and Market Strategies in a Changing Iron Ore World. AJM Global Iron Ore and Steel Forecasting Conference, Perth, W.A.

Toth, P. 2005. Iron Ore Market Update. Presentation to Analysts by BHP Billiton.

Valliant, W. 2004. Memorandum on the Sawyer Lake Deposit. Prepared for Energold Minerals Inc. Studiengesellschaft fur Eisenerzaufbereitung 1989. Report on the use of Schefferville Iron Ore in the Standard Sinter Mixture ’85 of the Studiengesellschaft Fur Eisenerzaufbereitung. Report prepared for Hollinger North Shore Exploration Company.

Wardel, R.J. 1979. Geology of the Eastern Margin of the Labrador Trough, Mineral Development Division, Department of Mines and Energy, Government of Newfoundland and Labrador, Report 78-9.

Williams, G.E., & Schmidt, P.W (2004). Paleomagneticm of the 1.88-Ga Sokoman Formation in the Schefferville-Knob Lake area, Quebec, Canada, and implications for the genesis of iron oxide deposits in the central New Quebec Orogen. Precambrian Research, 128, pp. 167-188.

Zajac, I.S. 1974. The stratigraphy and mineralogy of the Sokoman Formation in the

Knob Lake area, Quebec and Newfoundland, Geological Survey of Canada, Bulletin 220.

APPENDIX D

Newfoundland and Labrador Benefits Policy and Women's Employment Plan

Labrador Iron Mines Limited

220 Bay Street
Suite 700
Toronto ON   M5J 2W4

Schefferville Area Iron Ore Mine
(Western Labrador)

Newfoundland and Labrador Benefits Plan

August 21 2009

Table of Contents

List of Tables

1.0 INTRODUCTION

Labrador Iron Mines Limited (“LIM”) understands the importance of the Schefferville Area Iron Ore Mine Project in Western Labrador (the “Project”) to the people of the Province of Newfoundland and Labrador (the “Province”). LIM is committed to the maximization of associated benefits – including employment, procurement, education, training and economic development - to the Province and, in particular to Labrador, and is committed to providing full and fair opportunity and giving first consideration to residents and businesses of the Province to participate in, and benefit from, the Project.

LIM has accordingly established a **Labrador Iron Mines Limited Newfoundland and Labrador Benefits Policy** (Benefits Policy) that will apply to LIM and to all Project contractors and subcontractors and has developed this Newfoundland and Labrador Benefits Plan to implement the Benefits Policy.

LIM has entered into an Impact Benefits Agreement with Innu Nation of Labrador under which LIM has agreed to commitments and undertakings with regard to business opportunities, employment and other matters.

LIM has committed to project employment targets and goods and services procurement targets within the Newfoundland and Labrador Benefits Plan. The targets represent minimum levels of participation by residents of the Province in Project employment and for business opportunities for Newfoundland and Labrador companies in Project activity and LIM commits to achieve or exceed these targets.

Regardless of any other provision or statement set out in this Newfoundland and Labrador Benefits Plan, LIM shall, in all cases, meet or exceed all specific targets provided for in this Newfoundland and Labrador Benefits Plan relating to employment and procurement of goods and services.

This Newfoundland and Labrador Benefits Plan presents the **Benefits Policy** in Section 2.0 and describes the **processes and procedures** that will be used in implementing the Benefits Policy in Section 3.0, outlines specific initiatives with respect to opportunities for **employment** in Section 4.0 and with respect to the **procurement of goods and services** in Section 5.0.

The Project has been planned with the objective of maintaining a small footprint to minimise environmental and social impacts. To achieve this, the Project has been deliberately designed with the following specific characteristics:

- Small size of the operation.
- Phased development: LIM holds eight different properties in the area at varying stages of exploration and evaluation. The James and Redmond properties, which comprise the first phase of what it is hoped will become a multi–phase long term development, are located in an area of existing historical mining impacts with extensive existing infrastructure (access roads, existing water crossings, rail, etc). This existing infrastructure reduces the need for extensive new construction typically associated with new mine development. By using a phased development approach, starting with the James and Redmond properties, LIM hopes to facilitate the

adjustment by the community and regional support systems to the reintroduction of sustainable mining in the Schefferville Area of Western Labrador.

- Commute Operation: It is not intended that there will be a Project mining community where employees and their families will live. Instead, most workers will alternate between periods working at the site, living in LIM-provided accommodations in Labrador, and periods at home with their families.
- Staffed by contractors: The development and operation of the James and Redmond mines will be conducted using mining contractors that have knowledge and experience in the region. Labrador West has a long history of mining and related expertise and many experienced contractors are available.
- Mobile and semi-mobile equipment: There will be no permanent buildings on the mine sites. Equipment and structures will be mobile and semi-mobile, allowing these to be moved to where they are needed, reducing transportation-related impacts and facilitating progressive rehabilitation.
- Seasonal: During the five years of planned operations in the First Phase, mining operations will be carried out on a seasonal basis, from mid-April to mid-November each year. Project construction will be very short-term (approximately 8 weeks) and is planned to occur during the ice-free period.

In the foregoing respects, the Project differs in scale and character from the historical mining activities in Western Labrador, and is very different from most other mines currently operating in the Province of Newfoundland and Labrador.

LIM's commitment to delivering economic benefits to Newfoundland and Labrador is set out in this Newfoundland and Labrador Benefits Plan under which LIM has committed to several strategies summarised as follows:

Employment and Training:

LIM will implement an employment strategy that ensures residents of the Province are given full and fair opportunity and first consideration for employment. LIM will also implement training programs that allow for employment of residents within all levels of the Project.

Procurement Policies and Procedures:

LIM will establish and implement procurement policies and procedures to ensure opportunities for provincial benefits. Provincial suppliers will be provided full and fair opportunity and first consideration to participate on a competitive basis for the supply of goods and commercial services.

Construction Facilities:

LIM recognizes the existence of significant construction, fabrication and assembly infrastructure within the Province and will maximise its use whenever possible. This includes requiring that potential contractors bid work on the basis of using competitive qualified provincial suppliers of construction, fabrication and assembly services, where available on a full and fair opportunity and first consideration basis.

Engineering:

LIM will ensure that management, engineering, procurement and service activities are to the greatest extent possible carried out in the Province. This work will be undertaken by, or have significant participation of, provincial suppliers on a full and fair opportunity and first consideration basis.

Supplier Development:

LIM recognizes that the availability of competent and competitive suppliers in the Province is a key element in the long term success of the Project and will implement procedures and practices that will enhance supplier capability on the basis of full and fair opportunity and first consideration to participate.

Labrador Offices:

LIM will establish and maintain two offices in the Province to serve as information centres and facilitate communication and will staff these offices with appropriate skilled residents appropriate to the nature of the Project and, so far as possible, provide management to the Project from these offices.

This Newfoundland and Labrador Benefits Plan reflects the distinctive nature of the Project and the specific opportunities and some constraints that the Project creates for the provision and delivery of benefits, including employment, education, training, business opportunities and economic development, to the Province of Newfoundland and Labrador.

2.0 LABRADOR IRON MINES – NEWFOUNDLAND AND LABRADOR BENEFITS POLICY

Labrador Iron Mines understands the importance of the Project to the Province of Newfoundland and Labrador and in line with the principles and targets described in this Policy will provide full and fair opportunity and first consideration for the people, businesses and companies of the Province to secure employment and to participate in and benefit from the business opportunities associated with the Project.

Specifically, LIM is committed to:

- the delivery of associated benefits, including employment, education, training and business and economic development to the Province and in particular to Labrador on a full and fair opportunity and first consideration basis;
- the encouragement and assistance of residents of the Province, and in particular of Labrador, to receive the education and training necessary to maximize their opportunities for employment, retention and advancement on the Project;
- the procurement of goods and services from within the Province and, in particular from Labrador, and provincial suppliers will be provided full and fair opportunity and first consideration for the supply of goods and commercial services to the Project on a competitive basis;
- the implementation of policies and practices in connection with the procurement of goods and services for the project that enhance economic and business opportunities in Labrador, including the identification and support of industry businesses that would generate long-term economic benefits to Labrador;
- the provision of timely Project-related information to encourage the participation of all potential employees, businesses and contractors in the economic opportunities of the Project;
- and in all cases, LIM will attain or exceed minimum project employment targets and goods and services procurement targets as set out in this Newfoundland and Labrador Benefits Plan.

In addition LIM will also comply with the undertakings, commitments and obligations of the Impact and Benefits Agreement (IBA) entered into with the Innu Nation of Labrador, and with the provisions of LIM's Women's Employment Plan.

The IBA is a life of mine agreement that establishes the processes and sharing of benefits that will ensure an ongoing positive relationship between LIM and the Innu Nation, through which the Innu Nation and their members will benefit through employment, training, business opportunities and financial participation in the Project.

The Women's Employment Plan details LIM's approach to employment equity, identifies occupations in which women are under-represented, uses this to establish appropriate initiatives and targets and describes a process for achieving these targets, monitor success in meeting these targets, and reviewing and revising equity initiatives where appropriate.

3.0 BENEFITS PROCEDURE - TO BE USED IN IMPLEMENTING THE BENEFITS POLICY

The provisions of this Newfoundland and Labrador Benefits Plan apply to LIM itself, and all contractors and subcontractors undertaking Project construction or operations work. The Newfoundland and Labrador Benefits Plan will be implemented and administered by LIM with the support of the selected contractors.

In implementing the Newfoundland and Labrador Benefits Plan, LIM will:

- Ensure that all contractors and subcontractors working on the Project abide by this Newfoundland and Labrador Benefits Plan.
- Communicate all material (greater than $100,000) Project labour, contracts, goods and services requirements on its website and in newspapers in the Province, and especially in Labrador, and require its contractors and subcontractors to comply with this Policy.
- Ensure that full and fair opportunity and first consideration principles and procedures for Newfoundland and Labrador residents and businesses are applied to any Project labour, contracts, and goods and services requirements with a dollar value of less than $100,000.
- Meet targets for Project employment and for goods and services procurement, for both Project construction and operations. The targets represent minimum levels of participation by residents of the Province in Project employment and for business opportunities for Newfoundland and Labrador companies in Project activity and LIM commits to achieve or exceed these targets. Residents of Newfoundland and Labrador, at point of hire, will be determined according to the principles established in The Elections Act, SNL 1992, CE-3.1 as being “ordinarily resident.”
- Include a copy of this Newfoundland and Labrador Benefits Plan in all Project calls for expressions of interest, requests for proposals or contracts, and require that its contractors do the same.
- Require that prospective contractors indicate in bids how they would address the requirements of this Newfoundland and Labrador Plan.
- Monitor Project employment and the supply of goods and services and, on a monthly basis for construction and initial operations and on a frequency to be agreed with the Government of Newfoundland and Labrador for subsequent operations, prepare concise reports assessing actual outcomes relative to the Benefits targets.
- Provide copies of the above-noted employment and business reports to the Department of Human Resources, Labour and Employment and to the Department of Natural Resources on this agreed basis and be available to discuss these reports, including LIM’s level of success in meeting targets, and appropriate responses.

- Review and, as necessary, revise LIM's benefits procedures and initiatives to ensure that LIM's commitments under this Benefits Plan including the attainment of minimum targets, have been achieved.

Information Centres and Communication:

In support of its commitment to the maximization of benefits to Newfoundland and Labrador, LIM will establish and maintain offices in Labrador West and Happy Valley-Goose Bay to serve as centers of information about the Project and about requirements for labour and requirements for goods and services and also to provide local administration and procurement services to LIM.

LIM will provide Project employment and business opportunity information and computer and internet facilities and personnel at its offices in Happy Valley Goose Bay and Labrador West to assist provincial suppliers and/or residents of the Province to access applicable information and will also post information on its website and make applicable information available by mail to potential employees, provincial suppliers and residents of the Province at their request.

LIM will establish an Information Centre in Happy Valley – Goose Bay to make available to the general public of the Province information concerning the status of and major developments relating to the Project. The Information Centre will also provide information relating to employment and supplier participation opportunities for the Project and will also serve as a receiving point for resumes and pre-qualification documentation. The Goose Bay office will also coordinate LIM's partnership with the Innu of Labrador and will focus on business, training and employment opportunities for Aboriginal participation in the Project.

LIM will also establish and maintain an office in Labrador City / Wabush which, to the greatest extent possible, will provide management services to the Project, and will staff such office with residents having skills appropriate to the stage of development, construction and operation activities taking place at the Project. The primary function of the Labrador City office will be to focus on procurement activities and on personnel, and on human resource management including, training and coordinating the fly-in-fly-out transportation arrangements and contractor's procurement activities.

4.0 EMPLOYMENT

In order to recruit, develop and maintain the highest levels of commercial, technical, environmental and personnel management at all times, it is LIM's general policy to employ people of the highest possible calibre available for each position, consistent with sound economic and management principles.

LIM will provide full and fair opportunity and first consideration to residents of the Province of Newfoundland and Labrador for Project related employment, recognizing its legal obligations under the Canadian Charter of Rights and Freedoms and applicable laws, including those relating to accommodation of Aboriginal First Nations, and complying with its commitments under the Impacts Benefits Agreement signed with the Innu Nation of Labrador.

It is estimated that the Project will employ approximately 40 people during the Construction Phase and approximately 109 people during the Operations Phase. Overall, LIM has committed to achieving a minimum of 78 percent of Construction, 78 percent of Operations Phase employment and corresponding person-days accruing to residents of Newfoundland and Labrador.

Regardless of any other provision or statement set out in this Newfoundland and Labrador Benefits Plan, LIM shall, in all cases, meet or exceed all specific targets provided for in this Newfoundland and Labrador Benefits Plan relating to employment.

Consistent with its legal and corporate social responsibilities it is expected that LIM and its contractors will offer employment to Aboriginal First Nations throughout all phases of the Project. LIM has entered into an Impacts Benefits Agreement with the Innu Nation of Labrador that amongst other matters includes commitments for Aboriginal employment.

LIM has also entered into Memoranda of Understanding with other adjacent First Nations who claim traditional and aboriginal rights in the area and who may be impacted by the Project. The other First Nations, based in Quebec, are the Innu Nation of Matimekush, located immediately adjacent to the Project area in or around the town of Schefferville, and the Naskapi Nation located at Kawawachikamach about fifteen kilometers from the Project area. LIM has also entered into negotiations with the Innu Nation of Uashat, who also claim traditional Aboriginal rights in the Project area. LIM expects to convert these MOUs to formal co-operation agreements in the near future and these agreements will address employment opportunities for those Aboriginal First Nations.

It is expected that during both the Construction Phase and Operations Phase approximately 25 percent of total employees will be Aboriginal First Nations comprising all of the various Aboriginal groups noted above including the Innu Nation of Labrador. Success in achieving this will be dependent on progress in implementing the employment related provisions of the IBA Agreement with the Innu Nation of Labrador.

It is expected that the great majority of both construction and operations workers will commute to and from the mine site using a 'fly-in' rotation, alternating between periods of work, during which they will live in LIM provided camp accommodation in Labrador and periods living in their home communities.

During the Construction Phase ahead of Operations some commute workers will be temporarily housed in LIM provided accommodation while a new trailer camp with accommodation for up to sixty operations personnel is erected in or near to the Silver Yards area in Labrador, and which will be in service ahead of mine Operations.

In the Operational phase of the Project the commute schedule will generally see most workers following a standard rotation of four weeks on and two weeks off. The commute system will be designed based on the residential locations of the labour force, and is expected to include the provision of air transportation to and from Labrador City – Wabush and Happy Valley - Goose Bay and from the island of Newfoundland, if so required, and the use of the railway from Labrador City. LIM expects to employ workers from the adjacent communities of Matimekush and Kawawachikamach on a daily commute basis.

LIM intends to follow an adjacency policy in selecting commute employees. First priority in the employment of these commute workers will be given to qualified residents of Western and Central Labrador. Second priority will be given to qualified residents of other parts of Labrador, and third priority to qualified workers from elsewhere in the Province of Newfoundland and Labrador.

In keeping with LIM's commitment to providing full and fair opportunity and giving first consideration for employment to residents of the Province, LIM will:

- communicate information on the Project job opportunities and labour requirements in a timely manner;
- develop and implement a human resources plan and appropriate training programs;
- develop and implement policies and procedures to encourage the participation of Aboriginal First Nations and disadvantaged individuals and groups;
- develop an employment equity policy and implementation plan that addresses recruitment, training and advancement of women.

In order to encourage and facilitate the training and skill development of Labradorians and Newfoundlanders, LIM will:

- Implement human resources initiatives (e.g. mentoring, succession planning, orientation and cultural diversity programs and work schedules) that will facilitate the hiring, retention and promotion of Labrador and Newfoundland resident employees, including the Innu of Labrador.
- Ensure that Project human resources initiatives address any labour market under-representation of Labradorians and Newfoundlanders, including the Innu of Labrador and women, in engineering, design, management, skilled trades and other occupations.
- Implement the employment-related provisions of its IBA with the Innu Nation of Labrador. LIM will work with the Innu Nation to develop pre-employment and training programs that meet both the specific needs and the culture of the Innu of Labrador. LIM will also work with the Innu schools to develop specific Aboriginal employment programs.

- Maintain an ongoing liaison and communication with the Labrador Regional Economic Development Zone Boards and the Department of Human Resources, Labour and Employment, and the Innu Nation, so that they are informed about Project employment requirements, opportunities and plans.

- Work with the above institutions and agencies to help them develop and implement training initiatives that will facilitate the availability of qualified Labradorians and Newfoundlanders, including the Innu of Labrador, to work on the Project.

- Develop and implement training initiatives for all phases of the Project in co-operation with the Government of Newfoundland and Labrador, provincial suppliers and educational and training institutions in the Province. These initiatives will include pre-employment and employment training programs utilizing in house expertise and external training organizations. LIM will make maximum use of existing provincial education facilities in Labrador City and Happy Valley Goose Bay and establish specific programs for training at the mine site.

- LIM will work with the College of North Atlantic to develop technical courses specific to LIM and initially will focus training programs on an Environmental Monitoring program and a Health and Safety Training program.

- Work together with Labrador schools and colleges to establish scholarships in mining and geology-related subjects with eligibility for Labrador residents.

LIM has adopted a Women's Employment Plan.

- The Women's Employment Plan details LIM's approach to employment equity, identifies occupations in which women are under-represented, uses this to establish appropriate initiatives and targets and describes a process for achieving these targets, monitor success in meeting these targets, and reviewing and revising equity initiatives where appropriate.

The Women's Employment Plan describes:

- the LIM women's employment planning process, including: the responsibilities of LIM and its main contractors; the process for identifying and implementing targets and initiatives; and, the process for monitoring and reporting the implementation of those initiatives and success in achieving targets;

- the types of information and communications; employee recruitment and selection; employee development; working environments and community outreach initiatives that LIM and its contractors will use to achieve employment equity for women;

- specific LIM initiatives such as an anti-harassment program; community sensitivity program and a review of childcare services available; and

- LIM will maintain an ongoing liaison and communication with the Women's Policy Office, the Department of Natural Resources Women's Policy Group and the Women in Resource

Development Committee (WRDC), so that they are informed about Project employment requirements, opportunities and plans.

4.1 Construction Phase Employment

Project construction will be of limited duration (approximately eight weeks) and will overlap with the initial year of operations. It is estimated that the Project will employ approximately 40 people during the Construction Phase from several occupational categories, including direct and indirect building and technical trades, engineering, procurement and construction management (Table 4.1). It is intended that most of these positions will be supplied by the main contractors or subcontractors.

Overall, LIM has a target commitment of having a minimum of 78 percent of construction phase employment and corresponding person-days accruing to Newfoundland and Labrador residents, most of it to Labrador. Specific targets with respect to women's employment are outlined in the Women's Employment Plan.

LIM will require its contractors and subcontractors to abide by the provisions of this Newfoundland and Labrador Benefits Plan with regard to maximizing employment of construction personnel from within the Province.

There is an adequate supply of labour in the Province to meet most project construction demands. However it is recognized that there are specific skill shortages throughout the construction industry and, with the limited size of the mining industry in the Province and the short duration of the Construction Phase of the Project, it is anticipated that a number of Project specific specialized positions may not be able to be filled by residents of the Province. Not withstanding this, the 78 percent minimum Newfoundland and Labrador resident employment commitment will apply.

The Project Construction labour force is described in Table 4.1. It should be noted that, with the exception of the General Site Management, the positions that will be required throughout the Construction Phase will involve short periods of work (i.e. between about two days and four weeks) on site.

Given the small numbers of trades-persons involved, it may be difficult to employ apprentices for some trades, in the journeyperson to apprentice ratios determined in accordance with the provincial general conditions concerning apprenticeship. However, LIM will strive to maintain the journeyperson to apprentice ratios where possible.

The labour demand for the Construction Phase of the Project is not expected to affect labour supply in the Province. Potential labour demands from other major projects could affected skilled construction labour supply.

The labour market in Canada for skilled trades is facing shortages and there is competition for labour across the country, given the compounding effects of an aging population, declining birth rates and a general lack of interest in skilled trade occupations. All existing and new major industrial projects are expected to experience skilled labour shortages. It is expected that there will be a shortage of civil engineers, electricians, plumbers, iron workers, welders, concrete finishers, carpenters and engineers in particular. The skilled labour market in Canada and particularly in Newfoundland and Labrador is dynamic and labour supply and demand present difficulties across the country. Emigration of skilled workers from Newfoundland, especially to Alberta, has been noticed in recent years but this has declined in the current year.

It is planned that Construction Phase of the Project will be completed by mid-2010. As such, it is expected that construction of the Project will be completed in advance of the anticipated construction labour requirements of other major proposed Labrador projects, such as the Lower Churchill Hydroelectric Generation Project (peak employment 1,700, construction period 2010 to 2018) and Aurora Energy project (peak employment 700, construction period 2011 to 2014). Additional projects planned for development in Western Labrador include the Elross Lake DSO iron ore project and Consolidated Thompson's Bloom Lake railway. Given its short construction duration LIM's Project will therefore not be in competition for labour with these other Labrador construction projects.

The Project will provide some Labrador residents, including some workers in Labrador West who have recently become unemployed, with an opportunity to further develop their skills and employment experience, thereby assisting in the development of the labour force for subsequent construction projects in the Province.

Table 4.1 Construction Phase Employment

POSITION	NUMBER	NOC
Site Manager	1	
Clerk	1	
Lead Foreman	1	0721
Surveyor	1	2254
Equipment Operator – heavy	4	7421
Equipment Operator – light	3	7421
Truck Drivers	3	7411
Labourers-specialized	2	7611
Labourers	6	7612
Carpenter	2	7215
Welders	2	7265
Electricians	1	7241
Electrical Helper	1	7611
Crane Operator	1	7371
Boilermakers	1	7262
Ironworkers - steel reinforcement	1	7264
Ironworkers - steel reinforcement-helper	1	7611
Cement Finisher	2	7282
Structural Steel Workers	2	7263
Structural Steel Worker – apprentice	1	7611
Pipe Fitters	2	7252
Pipe Fitter-helper	1	7611
TOTAL - CONSTRUCTION	**40**	

4.2 Operations Phase Employment

It is expected that during mine operations the Project will provide employment for a total of approximately 109 personnel (100 on mine operations + 9 spur line operations), including allowance for the commute roster (Table 4.2).

LIM will provide full and fair opportunity and first consideration to residents of the province of Newfoundland and Labrador for operations related employment. LIM is committed to a minimum of 78 percent of employment and corresponding person-days accruing to residents of Newfoundland and Labrador, together with approximately 25 percent Aboriginal First Nation employment participation.

Operations will generate an important level of longer-term (estimated five-year duration) seasonal (approximately seven months per year) employment benefits to Labrador and the Province as a whole. Table 4.2 includes the total workforce including those personnel away from the site, on rostered time-off, at any time. It is expected that most workers will generally be employed on a four weeks on and two week off schedule. With the exception of the owner management positions, which will be full-time office positions, these personnel will be employed on a full-time seasonal basis.

Given the small numbers of trades-persons involved, it may be difficult to employ apprentices for some trades, in the journeyperson to apprentice ratios determined in accordance with the provincial general conditions concerning apprenticeship. However, LIM will strive to maintain the journeyperson to apprentice ratios where possible.

In addition to direct project employees there will be significant indirect employment created in both Labrador West and in Happy Valley-Goose Bay as a result of the supply of goods and services. Using a conservative economic multiplier of 2, it is estimated that at least an additional 100 operations phase jobs would be created across both Labrador communities.

LIM will use every effort to provide ongoing training and development for its employees and will:

- maintain a safe work environment that provides employees with the opportunity to achieve their career goals, and the training and support they need to meet personal objectives;
- provide competitive wages and benefits and a progressive work environment;
- create a welcoming and respectful work place, and adopt policies and initiatives that incorporate the Company's commitment to support training and development;
- work with Government, education institutions, women's organizations and industry associations to advance gender diversity on the Project;
- develop a human resources plan in support of its commitment to women's employment which will include targets and initiatives with respect to women as specified in the Women's Employment Plan.

Table 4.2 Operation Phase Employment

Positions	Number	NOC Code
Mine Operations		
Mine Operation Foreman	1	8221
Foreman	3	8221
Drill Operator	3	7372
Blaster	2	7372
Blaster Helper	1	8411
Loader Operator	3	7421
Haulage Truck Operator	9	7411
Dozer Operator	3	7421
Grader Operator	3	7421
Sampler	3	8614
Subtotal	31	
Mine Engineering		
Mine Engineer	2	2143
Mine Technician	1	2212
Surveyor	2	2254
Draftsman CAD	1	2253
Subtotal	6	
Beneficiation Operation		
Plant Manager	1	0721
Process Technician	1	2243
Chemical Technician (Lab)	3	2211
Labourer	1	7612
Administrative Assistant	1	1441
Warehouse Person	3	1472
Maintenance Foreman	1	7211
Utility Crew (pipeline, pumps, etc.)	1	
Primary Crusher Operator	6	9411
Secondary Crusher Operator	3	9411
Secondary Crusher Helper	2	9611
Belt Filter & Load-out Operator	6	9411
Mechanic	2	7312
Mechanic Helper	1	7612
Safety/First Aid personnel	3	
Electrician/Instrumentation	2	7241
Locomotive Engineers	3	7361
Brakemen	3	7362
Yard Workers	3	7432
Subtotal	46	
Owner Management		
General Manager	1	0721
Geologist	3	2113
Environmental Technician	1	
Clerk	1	
Mine Engineer	1	2143
Innu Liaison	1	
Labrador offices	3	
Subtotal	11	
Contractor Management		
Site Manager	1	0711
Secretary	1	1241
Bookkeeper/Accountant	1	1231
Camp operations	12	
Subtotal	15	
TOTAL - OPERATION	**109**	

5.0 PROCUREMENT OF GOODS AND SERVICES

Overall, LIM has committed to achieving a minimum of 85 percent of total value of construction and 85 percent of total value of operations phase contracts and goods and services being awarded/procured through companies and suppliers based in the Province.

Regardless of any other provision or statement set out in this Newfoundland and Labrador Benefits Plan, LIM shall, in all cases, meet or exceed all specific targets provided for in this Newfoundland and Labrador Benefits Plan relating to procurement of goods and services.

Labrador Iron Mines will require a wide range of goods and services during both the construction phase and the subsequent ongoing operation of the Project. LIM's policy in the procurement of goods and services will be on a basis which will enable the Project to be and remain competitive.

As a general principle, suppliers that maintain business operations and employees in the Province of Newfoundland and Labrador will be provided full and fair opportunity and first consideration on a competitive basis for the supply of goods and services for the Project during both the construction and operation phase.

The IBA signed with the Innu Nation of Labrador provides first opportunity to Innu Businesses for the supply of goods and services It is also anticipated that some goods and services will be procured from the Aboriginal communities of Matimekush and Kawawachikamach close to the mine site, and from the town of Schefferville. It is expected that substantially all of both construction and operations goods and services will be procured from business and suppliers in the Province of Newfoundland and Labrador.

LIM will use an adjacency policy in selecting suppliers to provide goods and services. First priority, in terms of supply of goods and services, will be given to qualified businesses located in Central and Western Labrador, second priority will be given to qualified companies in other parts of the Labrador, and third priority to qualified companies from elsewhere in the Province of Newfoundland and Labrador.

LIM will select the businesses and suppliers based on criteria which will provide best overall value and service to the Project and the Province taking all factors into consideration, including technical expertise, experience, quality of work, environmental and social responsibility, track record, health and safety record and localized sourcing of goods and services. LIM will retain the right to make decisions in a businesslike manner, relating to the qualifications, competence and suitability of any prospective supplier or contractor. In all cases, selection of suppliers for goods and services will be made based on such goods and services meeting the required specifications and availability on a commercially reasonable and timely basis. LIM may award contracts for goods and services from outside the Province where no provincial supplier can supply such goods and services on competitive terms, including LIM's required delivery schedule.

Procurement Procedures:

In furtherance of the principle of full and fair opportunity and first consideration to residents and business of the Province, LIM will implement procurement policies which reflect the following:

- Identify on a timely and ongoing basis, opportunities for the supply of goods and commercial services during all phases of the Project and communicate these to potential Provincial suppliers to enable such suppliers to identify and evaluate those opportunities of interest;
- Commit to work co-operatively with the Government agencies and industry organizations to jointly identify suppliers of goods and commercial services;
- For all Major Contracts (defined as any contract for the supply of goods or services with a price or value of more than $250,000), excluding iron ore transportation on the existing TSH, QNS&L and Arnaud railways, LIM will develop and apply a competitive bidding process incorporating the pre-qualification of the potential suppliers. LIM may award a major contract for goods and commercial services without a competitive bidding process where the contract is awarded under the terms of the IBA with the Innu Nation of Labrador.
- Include in each contract provisions requiring the supplier to adhere to this Benefits Policy. Suppliers will be required to incorporate similar provisions in any sub-contract arrangements;
- Ensure that LIM's procurement personnel are familiar with the capacities and capabilities of Newfoundland and Labrador suppliers;
- Ensure that LIM's procurement policies and procedures are posted on its website to promote supplier awareness;
- Ensure that the names and locations and contact details of LIM's procurement personnel are known to local business organizations and economic development groups and are available on the Company's website and at LIM's Labrador offices;
- Participate in trade shows, business conferences, and other business promotion events in the Province.
- Ensure the inclusion of qualified Newfoundland and Labrador suppliers on appropriate bid lists.
- Provide business groups, economic development agencies and the Innu Nation of Labrador with information on upcoming contracts, pre-qualification lists, and final bid lists.
- Meet and maintain an ongoing liaison with provincial, and especially Labrador, business groups and economic development agencies, and with the Innu Nation of Labrador, so that they are informed about goods and services requirements and plans, and to help identify potential Newfoundland and Labrador suppliers.
- Provide feedback to all unsuccessful bidders on Project contracts.

- Monitor, review and, as necessary, revise LIM's benefits procedures and initiatives to ensure that LIM's commitments under this benefits plan including the attainment of minimum targets have been achieved.

Supplier Development:

- LIM recognizes that the availability of competitive and competent suppliers in the Province, and particularly Labrador, is a key element in the long term success of the Project. LIM is committed to enhancing the capability of Provincial suppliers where possible.
- LIM will work with the Government of Newfoundland and Labrador to identify the capabilities of provincial suppliers and provide recommendations to, and assist the Government of Newfoundland and Labrador to develop, initiatives to improve the capacity of provincial suppliers to provide goods and services to the Project.
- LIM will develop, and update, lists of potential requirements for the supply of goods and commercial services for the operation phase of the Project and will communicate these lists in a timely manner.

5.1 Construction Phase Procurement

The construction phase of the Schefferville Area Iron Ore Project will see the procurement of goods and services, most of which are available in Newfoundland and Labrador. They include:

- earthworks;
- site construction;
- buildings construction;
- camp supply;
- plant construction;
- mine preliminary works and overburden stripping;
- fuel and refuelling services;
- welding and machining goods and services;
- land surveying;
- catering services
- vehicle rental;
- blasting;

- pipe-laying;
- road construction;
- electrical and mechanical contracting;
- miscellaneous tools and small equipment;
- heavy equipment rental (cranes, excavators, loaders);
- independent environmental monitoring; and
- air transportation.

LIM will ensure that construction management, engineering, procurement and project service activities for the construction phase of the Project shall, to the greatest extent possible, be carried out in the Province. LIM recognizes the existence of significant construction, fabrication and assembly infrastructure within the Province and will encourage utilization of such infrastructure. Specifically, LIM will require that potential contractors bid work on the basis of utilizing, qualified, competitive provincial suppliers of construction, fabrication and assembly services, where available. All material and major construction and supply contracts will be advertised within the Province and potential provincial based contractors and suppliers will be given every opportunity to provide competitive quotations.

Some Project materials and services are not available in Labrador or, indeed, elsewhere in the Province, and there is no reasonable expectation of this changing as a result of the Project or any foreseeable level of demand. The following materials and services may in all likelihood need to be brought to the Project site from outside the Province:

- crusher and beneficiation plant and major open-pit mining equipment;
- rails, rail ties and other track materials;
- rail cars and power units; and
- specialized mine engineering and consulting services.

Where it is not possible to source any of these items from within the Province these goods or services will be procured through Newfoundland and Labrador based distributors or agents whenever economically available.

LIM will make potential contractors from outside the Province aware of the Province's construction, fabrication and assembly infrastructure and provide qualified provincial suppliers of construction, fabrication and assembly services a full and fair opportunity to bid on construction, fabrication and assembly services. Where any such contract for construction, fabrication and assembly services is performed in the Province, LIM will require the supplier carrying out such services to locate, where possible, its fabrication, engineering and procurement activities relating to such contract in the Province.

Based on the Project parameters LIM has established a Benefits Plan target commitment of having 85 percent of the total value of construction contracts and supply of goods and services , excluding the four items noted above, being awarded to companies and suppliers based in the Province.

5.2 Operations Phase Procurement

Mine and railway spur line operations will require a wide range of goods and services, substantially all of which are available in Newfoundland and Labrador.

A review of local capabilities indicates that the following will be available on a commercial basis from within Newfoundland and Labrador:

- fuel and refuelling services;
- welding and machining goods and services;
- catering services and camp management;
- vehicle rental, rail passenger and air transportation services;
- maintenance operations;
- hardware stores miscellaneous tools and small equipment;
- heavy equipment rental (e.g. cranes, excavators and loaders);
- local contracting services (e.g. construction, electrical and mechanical);
- Mine contractors;
- Beneficiation Equipment operation; and
- Power Supply.

LIM has established a Benefits Plan target commitment of having 85 percent of the total value of operations phase contracts, goods and services (excluding iron ore transportation on the existing TSH, QNS&L and Arnaud railways, locomotive and rail car maintenance and port operations) being procured from companies or businesses based in Newfoundland and Labrador.

Should locomotive and rail car maintenance facilities or services become available in Labradror, LIM commits to ensure that these facilities/services be provided every opportunity to offer competitive quotations for these services.

All material and major construction and supply contracts will be advertised within the Province and potential provincial based contractors and suppliers will be given every opportunity to provide competitive quotations.

For those items that it is not possible to source directly from within the Province then these goods or services will be procured through Newfoundland and Labrador based distributors or agents whenever possible and whenever economically available.

Schefferville Area Iron Ore Mine
Western Labrador
Women's Employment Plan

PREPARED BY:

Labrador Iron Mines
Suite 700-220 Bay Street
Toronto, Ontario
M5J 2W4

TELEPHONE: 647-728-4107
FAX: 416-368-5344

Website: www.labradorironmines.ca

August 21, 2009

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

This Women's Employment Plan covers the construction and operations phases of the Schefferville Area Iron Ore Mine Project (the "Project"). It has been prepared in response to the Guidelines for the Project environmental assessment, and describes how Labrador Iron Mines Limited (LIM) will ensure that the employment of women on the Project is fully promoted and supported throughout the Project.

The Plan is in four main sections. The first (Section 2.0) describes the Project and the occupations required for the construction and operations phases. This is followed, in Section 3.0, by a description of the women's employment planning process, including: the responsibilities of LIM and its main contractors; the process for identifying and implementing women's employment goals and initiatives, including the initial goals; and, the process whereby the implementation of those initiatives, and success in achieving these goals, are monitored and reported. Section 4.0 identifies and describes possible initiatives that LIM and its contractors can use to achieve employment equity for women. Lastly, Section 5.0 summarizes a number of initiatives LIM has already adopted with the aim of delivering employment equity on the Project.

The encouragement of women in the workplace is an important goal of LIM. In respect of LIM's commitment to employment equity, it should be noted that 33% of technical and management positions at the company are currently occupied by women.

2.0 THE PROJECT

The Project is being developed by LIM, which is a wholly-owned subsidiary of Labrador Iron Mines Holdings Limited, a public company listed on the Toronto Stock Exchange. LIM has identified eight separate ore grade deposits located across a 100km strike length all in Labrador. The first phase of the Project involves the development and mining of four 'direct shipping' iron ore deposits in western Labrador in an area of previous iron ore mining.

The James North, James South, Redmond 2B and Redmond 5 deposits are all located within 10 kilometres of the Silver Yard, Labrador, which is some three kilometres west of Schefferville, Quebec. Mining will be carried out in a sequential manner using conventional open pit mining methods. When mined, the rock will be crushed and washed (beneficiated) at Silver Yard. The resultant products will include lump ore and sinter fines for direct rail transport to port and shipping to end users in Europe and possibly Asia. The size of the operation proposed for this Project is modest by world-wide iron ore standards and as compared to other iron ore projects carried out elsewhere in the Province and previously in this area.

Subject to approval, construction of the Project is scheduled to start in 2009/2010, and has an estimated five-year operational life. The LIM operation has been planned with the objective of maintaining a reduced footprint. To achieve this objective, the proposed development has been planned as a small phased seasonal operation, staffed primarily by contractors, and using primarily mobile to semi-mobile equipment. In this respect, the Project differs in scale and character from the historical mining activities in the area as well as other current mines operating in the Province of Newfoundland and Labrador. With the exception of the owner management positions, which will be full-time management positions, operational positions will be held on a seasonal and rotational fly-in fly-out basis. This will limit the opportunities for the employment of apprentices and some other groups. It will also mean that families associated with the Project are unlikely to settle in the Project area. Although the small numbers of trades-persons involved will make it unlikely to employ apprentices in the journeyperson to apprentice ratios identified by the provincial general conditions concerning apprenticeship, LIM will establish and maintain communication with the Office to Advance Women Apprentices in the event that future opportunities present themselves.

The required LIM and contractor construction phase labour force, by occupation including NOC-2006 codes, is presented in Table 1. The construction phase of the program is expected to last for only a short period of time, currently estimated at eight weeks.

Table 1 Construction Phase Employment

POSITION	NUMBER	NOC
Site Manager	1	0711
Clerk	1	1441
Lead Foreman	1	0721
Surveyor	1	2254
Equipment Operator – heavy	4	7421
Equipment Operator – light	3	7421
Truck Drivers	3	7411
Labourers-specialized	2	7611
Labourers	6	7612
Carpenter	2	7215
Welders	2	7265
Electricians	1	7241
Electrical Helper	1	7611
Crane Operator	1	7371
Boilermakers	1	7262
Ironworkers - steel reinforcement	1	7264
Ironworkers - steel reinforcement-helper	1	7611
Cement Finisher	2	7282
Structural Steel Workers	2	7263
Structural Steel Worker –assistant	1	7611
Pipe Fitters	2	7252
Pipe Fitter-helper	1	7611
TOTAL - CONSTRUCTION	**40**	

The Project operation phase employment, by occupation including NOC-2006 code, is presented in Table 2. Most workers will be employed on a rotational basis for about seven months a year during operations.

Table 2 Operation Phase Employment

Positions	Number	NOC Code
Mine Operations		
Mine Operation Foreman	1	8221
Foreman	3	8221
Drill Operator	3	7372
Blaster	2	7372
Blaster Helper	1	8411
Loader Operator	3	7421
Haulage Truck Operator	9	7411
Dozer Operator	3	7421
Grader Operator	3	7421
Sampler	3	8614
Subtotal	31	
Mine Engineering		
Mine Engineer	2	2143
Mine Technician	1	2212
Surveyor	2	2254
Draftsman CAD	1	2253
Subtotal	6	
Beneficiation Operation		
Plant Manager	1	0721
Process Technician	1	2243
Chemical Technician (Lab)	3	2211
Labourer	1	7612
Administrative Assistant	1	1441
Warehouse Person	3	1472
Maintenance Foreman	1	7211
Utility Crew (pipeline, pumps, etc.)	1	
Primary Crusher Operator	6	9411
Secondary Crusher Operator	3	9411
Secondary Crusher Helper	2	9611
Belt Filter & Load-out Operator	6	9411
Mechanic	2	7312
Mechanic Helper	1	7612
Safety/First Aid personnel	3	
Electrician/Instrumentation	2	7241
Locomotive Engineers	3	7361
Brakemen	3	7362
Yard Workers	3	7432
Subtotal	46	
Owner Management		
General Manager	1	0721
Geologist	3	2113
Environmental Technician	1	
Clerk	1	
Mine Engineer	1	2143
Innu Liaison	1	
Labrador offices	3	
Subtotal	11	
Contractor Management		
Site Manager	1	0711
Secretary	1	1241
Bookkeeper/Accountant	1	1231
Camp operations	12	
Subtotal	15	
TOTAL - OPERATION	**109**	

3.0 THE PLANNING PROCESS

The Schefferville Area Iron Ore Mine Western Labrador Project Women's Employment Plan process requires the involvement of LIM and its Project contractors. This section of the Plan describes the planning process, including: the ways in which it is reflected in the selection of Project contractors; the involvements and responsibilities of contractors; equity goals and initiatives; and, monitoring and reporting.

It should be noted that, as part of its initiatives with the Aboriginal peoples of the region, LIM will promote gender equality in the Project workforce and increase participation of Innu Nation of Labrador women and those of the participating First Nations. The company will develop in cooperation with these Aboriginal groups, and enforce, a policy with respect to all employees that will ensure zero tolerance for discrimination on the basis of race ethnicity, gender, sexual orientation or origin on the Project.

3.1 Selection of Project Contractors

LIM is committed to employment equity. Employment equity involves a systematic approach to achieving fairness in employment, including the elimination of systemic, structural and attitudinal discrimination. Furthermore, LIM's policy is that no one should be denied access to employment opportunities for reasons unrelated to ability. In support of this, LIM:

- Requires the same commitment to employment equity from its contractors; and
- Will take account of employment equity considerations in the awarding of contracts.

This Women's Employment Plan, and hence this commitment and preference, will be attached to relevant Project requests for proposals (RFPs), and all bidders will be required to outline their approach to employment equity.

3.2 Selection of Contractors for Women's Employment Planning Purposes

LIM will identify its main contractors for employment equity planning purposes based on their share of Project employment. This will normally be measured in terms of the person-years of employment involved. The list of main contractors will be reviewed and, as necessary, revised on an annual basis.

3.3 Women's Employment Plan Responsibilities

LIM and each of the main contractors will identify a senior member of their staff responsible for implementing the Women's Employment Plan. Project equity will be monitored and tracked by these representatives in accordance with the commitments of this Plan and requirements of the IBAs.

It is important that employment equity is a consideration of the Project employers from the outset. Experience with other projects has demonstrated the positive impact of early employer engagement in making equity a priority throughout the project. This Project will be greatly assisted by having this Women's Employment Plan in place in advance of the start of work. In addition, LIM will liaise with the Women in Resource Development Committee (WRDC) prior to and throughout the Project, including inviting the WRDC representatives to meet with them within 30 days of Project sanction and periodically thereafter. During this initial period, LIM will work with WRDC to identify the occupations in which women are under-represented and will, on an ongoing basis, update this information and re-evaluate goals accordingly.

3.4 Women's Employment Goals and Initiatives

LIM has established overall goals for women's employment during construction and operations of the Project, consistent with the approach adopted in the Province's Energy Plan. However, the most recent such report uses data from the 1990s, so the Project goals have been established based on more recent occupational and industry data, adjusted to reflect the nature of the Project. These goals will be communicated to all potential and selected contractors.

LIM and each of its main contractors will identify actions for achieving the goal levels of employment for women. When new main contractors are identified, they will be asked, as part of the tendering process, to provide information concerning their programs to promote employment equity for women.

3.4.1 Construction Phase

Construction occupations have long had small proportions of women workers. In 2001, only 1% of the membership of the Newfoundland and Labrador Construction Trades Council were women, and labour force survey estimates show that women held just 3.4% of construction trades occupations in 2006, somewhat lower than the national average.[1] There are currently a total of 214 females tradespersons registered with the Office to Advance Women Apprentices, including 21 journeypersons and 179 apprentices (G. Hickey, pers. comm.)[2]. Within the Province, participation by women in trades programs at the College of the North Atlantic (CNA) has been approximately 20% between 2006 and 2008. Participation has been greater in Labrador than on the island, and has increased from 24% female graduates in 2006 to 54% in 2008, with the largest numbers of female graduates from the Industrial Mechanic Millwright and Mining Technology programs. The CNA's Labrador campuses also offer the Career Exploration for Women and Orientation to Trades and Technology – Women programs, which are introductory programs designed to introduce women to trades careers (I. Pye, pers. comm.)[3]. However, the Project will require work at a remote location with a projected construction phase of only approximately eight weeks duration, resulting in limited opportunities to train workers.

Accordingly, LIM has established no overall goal for women's employment during the construction phase of the Project.

It is recognized that opportunities may be identified to hire female employees in some employment categories and hence LIM and its contractors will work with the WRDC in order to determine the employment categories where these improvements would be most appropriate.

---

[1] Statistics Canada. *Table 282-0008 Labour Force Survey Estimates (LFS), by North American Industry Classification System (NAICS), Sex and Age Group, Annual* (Table). CANSIM (database). Using CHASS (distributor). Version updated April 20, 2007. http://dc2.chass.utoronto.ca.qe2a-proxy.mun.ca/cansim2/ (accessed April 25, 2007).

[2] G. Hickey	Executive Director, Office to Advance Women Apprentices, St. John's, NL
[3] I. Pye	Policy, Planning and Research Analyst, College of the North Atlantic, St. John's, NL.

The participation of women in design and engineering positions is also traditionally low. In 2008, Memorial University reported that women comprised only 18% of graduates from the Bachelor of Engineering program[4]. Additionally, Professional Engineers and Geoscientists of Newfoundland and Labrador membership data show that as of December 2008 women comprise 9% of professional engineers and engineers-in-training, up from 7% in 2007. This is consistent with female participation in engineering nationally, which was 9% for professional engineers and 19% for engineers-in-training in 2007 (L. Pinsent Parsons, pers. comm.)[5].

Based on this information and the short term period of construction, LIM has established a goal of over 30% (3 women in a workers group total of 8) for women's employment in Project design and engineering during construction.

3.4.2 Operations Phase

It is estimated that the operations phase of the Project will last five years and it will only employ approximately 109 people for about seven months a year.

Mining has traditionally employed relatively small numbers of women, although this is less the case with open pit operations. The most recent employment data from Statistics Canada shows that although women represent approximately 47.5% of total employment across all industries in Newfoundland and Labrador in 2008, women comprised only 15.4% of the workforce in occupations unique to primary industry.[6] In Labrador, female graduates from the CNA's Mining Technology trades program has been 66% between 2006 and 2009 (I. Pye, pers. comm.)[3].

Accordingly, LIM has established an initial 15% goal for women's employment by the end of the second year of Project operations and will strive to increase this during the remaining years of the project.

Operations phase employees will be provided training through a post-employment on-the-job training program. This will provide LIM an opportunity to incorporate goals for women's employment into the initial intake of employees. This has the potential to both increase the opportunity for success in achieving overall goals for employment in the early phase of Project operations and to have a lasting impact on employment equity over its life.

3.4.3 Review of Goals

The above goals will be reviewed and, as necessary, revised after two years of operations, in consultation with the Women's Policy Office, Department of Natural Resources and WRDC. Any revisions will take into consideration women's participation in identified occupational groups as well as labour market conditions generally. It is expected that the employment equity initiatives established by

---

[4] Memorial University. 2008. Fact Book 2008. Memorial University, St. John's, NL.

[5] L. Pinsent Parsons Registrar and Director of Administration, Professional Engineers and Geoscientists Newfoundland and Labrador, St. John's, NL

[6] Statistics Canada. 2009. CANSIM Table 282-0010 Labour Force Survey Estimates by National Occupational Classification for Statistics (NOC-S) and Sex, Annual 1987-2008. CANSIM Database using CHASS (Distributor) http://dc2.chass.utoronto.ca.qe2a-proxy.mun.ca/cansim2/ (accessed April 25, 2007).

LIM and its major contractors will facilitate an increase in the number of women employed in these positions over the life of the Project.

3.5 Monitoring and Reporting

The performance of the Women's Employment Plan will be reviewed at least every six months. During this review LIM and its main contractors will each: review its employment equity initiatives; discuss its success in implementing them; report on the employment equity of its current Project workforce, by main employment types (e.g. numbers and percentage who are managers, administrative staff, professionals and technicians, and others); and discuss the progress that has been made towards the established goals. Outside resource people, with specialist information about employment equity issues, may be invited to present to the Committee.

Within one month of every second review period (i.e. on an annual basis), LIM and its main contractors will compile an up-to-date list of Project employment equity initiative commitments, together with a short summary report on the employment equity in its current Project workforce. LIM will maintain a file of these commitments and reports, which will be available to the Women's Policy Office, Department of Natural Resources and WRDC. LIM accepts responsibility for the Women's Employment Plan including the consistent application of the plan by any Project Contractors or Subcontractors.

4.0 ACTIONS

This part of the Women's Employment Plan identifies and describes required and optional actions that are designed to achieve employment equity for women. These are:

- Information and Communications;
- Employee Recruitment and Selection;
- Employee Development;
- Working Environments; and
- Community Outreach.

LIM and its main contractors will consider and report on these actions in their own employment equity planning. For each of them, this section of the Women's Employment Plan provides a description of appropriate actions, based on best practice experiences elsewhere.

The scope and scale of actions required of each Project contractor varies according to such things as its size, current labour force composition and activities, and the policies and practices it has already implemented. Other possible initiatives may be identified by companies.

4.1 Information and Communications

Information content and its communication have a major role to play in achieving employment equity. Appropriate actions LIM and its main Project contractors may take in addressing this topic include:

- Hold information sessions specifically targeted at women;

- Ensure women are equitably represented in text and illustrations the companies use for promotional, motivational and information purposes, including handbooks, newsletters, posters and websites; and
- Review all text they use internally and externally to see that it uses gender-inclusive language.

4.2 Employee Recruitment and Selection

The characteristics of the Project workforce will to some degree reflect those of the labour market as a whole and of prospective new entrants to it. However, the recruitment process can serve to either reinforce or counter any under-representation of women. There is, accordingly, a need to use recruitment procedures that actively encourage women to apply for all positions, including full-time, part-time, temporary and co-op student ones. To support an increase in female employment in all phases of the project, LIM will seek to consult with women in the area and/or in related work environments to determine beneficial policies and procedures.

Appropriate other actions LIM and its main Project Contractors might take in addressing this topic include:

- Establish guidelines for writing model job advertisements that aim to reach female candidates;
- Review job descriptions and collective agreements for the use of gender-inclusive titles and text;
- Establish relationships with training institutions and work with them to include female candidates in regular and co-op student positions;
- Implement a system to document outreach recruitment initiatives;
- Initiate and implement a gender-sensitivity and anti-harassment training program for all management, workers and contractors, to encourage equitable selection and treatment of women in the workplace;
- Encourage an environment of mutual respect;
- Implement programs targeted at eliminating violence in the workplace;
- Include an assessment of goal achievements as part of management performance reviews;
- Establish relationships with women’s groups and work with them to identify and encourage female candidates; and
- Implement a system to monitor the gender of persons with resumes on file.

4.3 Employee Development

It is important that women be encouraged to develop, and assisted in developing, their capabilities and achieving promotion within LIM and its main contractors. Appropriate actions LIM and its main contractors might take in addressing this topic include:

- Consider the participation of women in all training initiatives; and
- Develop a strategy to increase women’s representation in management through mentoring, special assignments, management training, creation of junior management bridging positions, and gender-sensitivity and anti-harassment training.

4.4 Working Environments

During both the construction and operations phases of the Project, LIM will work diligently to create a work environment that is conducive to employment equity. Gender sensitivity training will be required by all LIM and contract employees. LIM's goal is to create a culture that fosters equity and is encouraged by successful implementation of this Women's Employment Plan.

The work environment, and the presence of policies that address harassment and other concerns, can be critical to retaining women in the workforce. Appropriate actions LIM and its main contractors might take in addressing this topic at Project workplaces include:

- Establish respectful workplace guidelines and an anti-harassment and anti-violence in the workplace policies;
- Establish, distribute and publicize the anti-harassment policy and procedures; and
- Provide gender-sensitivity and anti-harassment training for managers and supervisors.

4.5 Community Outreach

The numbers of women in and interested in entering, construction and technical occupations will be a significant constraint to the employment of women on the Project. In the longer term, this is best addressed by initiatives that promote such occupations to girls and young women. Currently, LIM has an active outreach program in local area schools, providing information about the project and encouraging educational activities in schools, both near the Project area and its Toronto-based corporate office. Additional appropriate actions LIM and its main Project contractors may take in this area include:

- Participation in career days and facilitating workplace visits; and
- Support of, or mentoring, Techsploration and other WRDC programs.

5.0 LABRADOR IRON MINES INITIATIVES

In support of the above-noted process (Section 3.0), LIM has already adopted a number of initiatives aimed at delivering women's employment equity on the Project. These will serve, not least, as a demonstration of LIM's equity commitment to its contractors and other stakeholders. Specifically, LIM will:

- Review home community childcare services available to qualifying personnel in Labrador;
- Implement arrangements and policies at the worker accommodations that ensure a respectful living environment for all employees. This will include an anti-harassment program and community sensitivity program, endeavouring to accommodate women in a specific part of the camp, providing women-only access to exercise facilities at some times, and adopting a zero-tolerance policy with respect to harassment at both the workplace and accommodations facility;
- Provide a cultural and gender awareness orientation to all employees; and
- Include in Project-related job advertisements, and require all contractors advertising for positions largely or entirely related to the Project to include, statements encouraging applications from women.

APPENDIX E

Correspondence from DFO

From: Yetman, Dana [mailto:Dana.Yetman@dfo-mpo.gc.ca]

Sent: Thursday, September 25, 2008 1:22 PM

To: Linda Wrong

Cc: Grant, Carole

Subject: Labrador Iron Mines - Schefferville Project

Hi Linda,

This email is in reference to your letter dated September 9, 2008 in which you provided a summary of gill-netting activities for the Schefferville project. Based upon the results, Habitat Management has determined that the historic pits, specifically Redmond Pit 1, Redmond Pit 2, Wishart Pit, and Ruth Pit, do not constitute productive fish habitat that supports, or potentially supports, a commercial, recreational or aboriginal fishery. Therefore a Section 35(2) Fisheries Act Authorization will not be required. Please note that this determination only applies to the aforementioned pits; an official determination regarding all other water bodies within the project area will be forth coming once all requested habitat information has been received and assessed by Habitat Management.

Please do not hesitate to contact me if you require further clarification.

Thanks,

Dana Yetman

Senior Regional Habitat Biologist | Biologiste Principal Régional des Habitats

Fisheries and Oceans Canada | Pêches et Océans Canada

Marine Environment and Habitat Management Division | Division De l'Environnement Marin et de la Gestion de l'Habitat

Oceans and Habitat Management Branch | Direction de la Gestion des Océans et de l’Habitat

Northwest Atlantic Fisheries Centre | Centre des Pêches de l'Atlantique Nord-Ouest

80 East White Hills Road l 80, route White Hills est

PO Box 5667 | CP 5667

St. John's NL A1C 5X1

Telephone | Téléphone: (709) 772-6658

Fax | Télécopieur: (709) 772-5562

Dana.Yetman@dfo-mpo.gc.ca

PLEASE NOTE MY EMAIL ADDRESS HAS CHANGED

APPENDIX F

New Millennium News Release

NEWS RELEASE 08-05

NEW MILLENNIUM ANNOUNCES PRODUCTION DEVELOPMENT UPDATE OF ITS DIRECT SHIPPING ORE PROJECT

Not for Distribution to US newswire services or dissemination in the United States

CALGARY, Alberta, Canada – February 5, 2008 – New Millennium Capital Corp. (“NML” or “the Company”) (TSX-V: NML), announced today that it has completed the proposed development plans and schedule for its Direct Shipping Ore (“DSO”) Properties in the Schefferville region of Quebec and Newfoundland and Labrador.

Mr. Robert Martin, New Millennium CEO and President, said, “We are very pleased to start development of our DSO Project. With our current robust iron ore markets, there have been many inquiries from potential consumers concerning our intentions. Our plan is to establish a brownfield mining operation that can be developed sooner and with less capital than the KéMag deposit. The expedient and cost effective development of the DSO Project can potentially produce substantial cash flow for the Company while the larger KéMag Project is being developed. Successful development of the DSO Project is aided by management’s intimate familiarity with the properties and we are also fortunate in being able to assemble a strong project team with past experience in the Schefferville operations.”

NML’s DSO holdings are contained in 27 deposits that were previously owned by the Iron Ore Company of Canada (“IOC”). These deposits are outlined on the attached map. They consist of 145 mineral claims in Quebec covering 6,344 hectares and 155 mineral claims in Labrador covering 3,875 hectares. Based on historical estimates, these claims cover approximately 100 million tonnes of direct shipping quality iron ore. The grade of this ore, based on historical operations as published by the American Iron Ore Association in 1978, is in the order of 60% iron (dry analysis).

The historical estimates contained in this news release of quantities of direct shipping quality ore are not in accordance with the mineral resources or mineral reserves classifications contained in the CIM Definition Standards on Mineral Resources and Mineral Reserves, as required by National Instrument 43-101 (“NI 43-101”). Accordingly, NML is not treating these historical estimates as current mineral resources or mineral reserves as defined in NI 43-101 and such historical estimates should not be relied upon. A qualified person has not done sufficient work to date to classify the historical estimates as current mineral resources or mineral reserves. The term “ore” in this release is being used in a descriptive sense for historical accuracy, and is not to be misconstrued as representing current economic viability. A feasibility study has not been completed in respect of the DSO properties and there is no certainty the proposed operations will be economically viable.

The DSO holdings controlled by NML are sub-divided into four areas designated Area 1, Area 2, Area 3 and Area 4. The Company’s conceptual plan is to consider mining these areas in two phases.

The first phase, which represents about 20% of the Company’s DSO historical estimated resources, includes Area 2 and Area 3. This brownfield phase has semi-developed infrastructure which will permit rapid development. The conceptual plan is to transport the crude ore by haulage truck from the 10 open pit deposits in Area 2 (10 km north of Schefferville) and Area 3 (20 km north of Schefferville) to a wash plant to be built and installed in Area 3. The wash plant is expected to produce two products, a lump ore and a fines product. It is planned to transport these products by rail to a marshalling yard near Schefferville prior to shipment on the main line to Sept Iles.

One of the mines in area 3, Timmins 3, was partially mined and two others, Timmins 4 and Timmins 7 were partially stripped by IOC at the time of closure in 1982. All three would be expected to be reopened by NML.

The second phase, about 75% of NML's DSO historical estimated resources, will entail mining in Area 4. This area, which is about 50 km north of Schefferville is devoid of infrastructure and, as a consequence, will take longer to develop than Area 2 and Area 3. The conceptual mining plan is to transport the crude ore by haulage truck from the 9 open pit deposits in Area 4 to an overland conveyor for transport to the wash plant in Area 3, then via the phase 1 infrastructure to the Port of Sept-Iles.

NML anticipates the startup of its Phase 1 production (Areas 2 and Area 3) in 2010 and its Phase 4 production (Area 4) in 2013. There are nine Area 1 open pit deposits, about 5% of NML's DSO historical estimated resources. Seven of these are jointly owned with Labrador Iron Mines (TSX-V: LIR). Seven of these, the James, the Knob Lake 1, the Redmond 5, the Houston 1, the Houston 2S and the Houston 3 would most likely be mined in accordance with the LIR mining schedule which currently plans to commence production in area 1 in 2009. To date there has not been any agreement reached with LIR regarding NML's claims that partially cover seven of their deposits. As part of this year's program, NML will attempt to negotiate some mutually satisfactory agreement with LIR regarding the mining of NML's ore and the possible cost sharing of infrastructure.

NML's DSO development is being fast-tracked to take advantage of current shortages of iron ore in the world market place. The project is expected to be a relatively low cost capital venture owing to the existence of significant infrastructure in the form of air, rail and hydroelectric links with the Town of Schefferville and, in most cases, road links from Schefferville to the Company's deposits.

Phase 1 development is currently in progress with the commencement of planning related to geology, mining and resource, metallurgy, environmental and pre-feasibility studies. Negotiations with effected First Nations and the TRT railroad are also in progress.

The Company's 2008 DSO Project objectives are: 1) to initiate development drilling and trenching in Area 2, Area 3 and Area 4 in order to publish a NI 43-101 compliant resource estimate; 2) to complete metallurgical testing and finalize the wash plant flowsheet; 3) to complete phase 1 environmental assessment; 4) to finalize Impact and Benefit Agreements ("IBA") with the First Nations, tariff agreements with three railways, land and dock use agreements with the Sept-Iles Port Authority, infrastructure sharing at Pointe Noire with Wabush Mines and the leasing of rolling stock and mining equipment; and, 5) to complete a preliminary feasibility study and financial evaluation.

Approximately 4,000 metres of reverse circulation drilling and 2,000 metres of trenching are scheduled. The drilling and trenching program will be done for twinning purposes. This is expected to supplement and verify the use of the extensive drilling and trenching previously performed on these properties by IOC. It is also expected to upgrade the historical results to current NI 43-101 standards. Results are expected by the end of December 2008.

To complete metallurgical testing, several bulk samples will be taken for crushing and screening tests to determine the amount of lump ore in the run of mine materials along with their respective grades. Samples of both lump and fines will be sent to an outside testing lab for washing and iron recovery tests including product grades which may be expected. This work is expected to be completed by the end of September 2008.

The environmental impact assessment has started and the DSO Project description is currently being prepared. Contracts will be awarded to consultants by the end of March and the Environmental Impact Statement is expected to be sent to the appropriate governmental authorities by the end of October. Government review and approval is expected for Area 2 and Area 3 by the end of March 2009.

IBA meetings have recently started with some of the effected First Nations. Discussions with the Tshiuetin Railway, which requires a major upgrade to its track structure, the QNS&L Railway and the Arnaud Railway will be initiated to plan the railway transportation agreements required to move the ore from the mine sites near Schefferville to the Port of Sept-Iles. Initial discussions with The Port Authority of Sept-Iles have begun and discussions with Wabush regarding the joint use of their ship loading terminal will be scheduled as soon as the Wabush facilities are turned over to its new owner. All agreements are expected to be in place by the end of December 2008.

A Preliminary Feasibility Study will be initiated once the summer program is completed and the sample analysis results start to arrive. The final report and financial analysis is scheduled for completion by the end of December 2008 and the feasibility study is expected by the end of May 2009.

As previously announced, the Corporation, with the assistance of it's financial advisors Credit Suisse ("CS") and Miller Mathis ("MM:"), is actively seeking investment and offtake commitments from potential strategic partners that will permit the Corporation to develop one or more of its iron ore projects located in the provinces of Quebec and Newfoundland and Labrador, Canada. This process includes the DSO Properties. While this process continues, no agreements have been achieved in respect of such commitments. However, this process has elicited a number of expressions of interest, and now can be advanced to a further stage where firm offers are solicited.

Moulaye Melainine, Eng. and Bish Chanda, Eng. are the Qualified Persons as defined in NI 43-101 who have reviewed and verified the scientific and technical mining disclosure contained in this news release on behalf of NML.

About New Millennium

New Millennium holds a 100% interest in the KéMag Property (Quebec) and an 80% interest in the LabMag Property (Newfoundland and Labrador). Both properties are located within the Millennium Iron Range, the centre of which is located approximately 230 km north of Labrador City, NL and 40 km northwest of Schefferville, QC. The Company also has a 100% interest in 300 DSO claims in Quebec and Labrador that contain, based on historical estimates that are not in compliance with NI 43-101, in excess of 100 million tons of direct shipping quality ore. A qualified person has not done sufficient work to classify the historical estimate as current mineral resources. The Company is not treating the historical estimate as current mineral resources and the historical estimate should not be relied upon.

Subject to the completion of positive feasibility studies, project financing and project construction, the concentrate from the KéMag Project would be pumped from the property through a slurry pipeline, about 750 kilometres, to Pointe-Noire, near the Port of Sept-Iles, QC, where it would be both pelletized and sold as concentrate. The concentrate from the LabMag Project would be pumped from the property through a slurry pipeline, about 230 kilometres, to Emeril, NL where it would be pelletized prior to rail transportation via an existing railroad about 390 km to Pointe-Noire, near the Port of Sept-Iles. DSO products are envisioned to be transported by rail to a Port at Pointe-Noire.

These projects envision the construction and operation of ship loading facilities and related infrastructure at the Pointe-Noire terminus from where the various iron ore products would be shipped by ocean vessels to markets in Canada, the United States, Western Europe, North Africa, the Middle East and Asia.

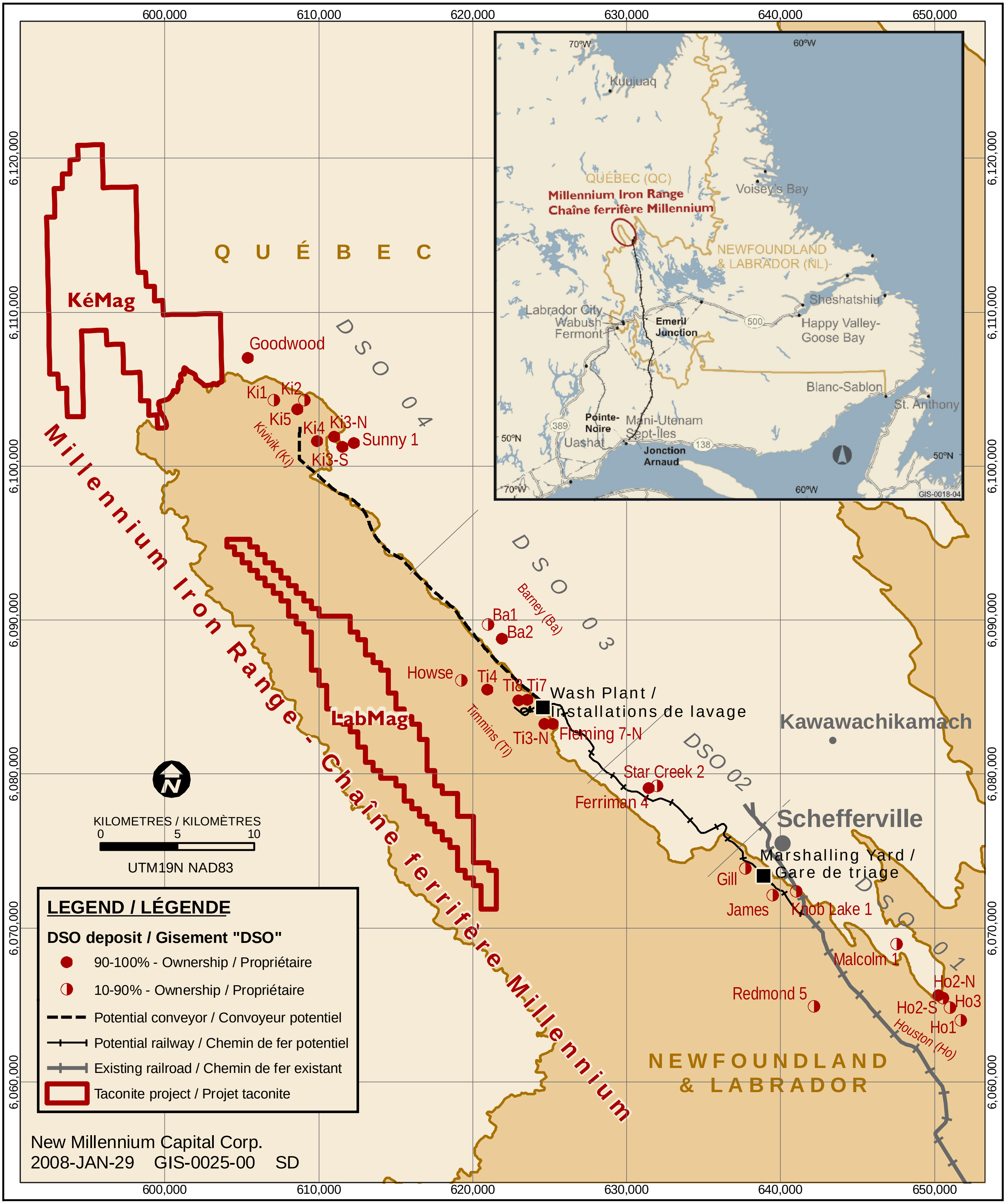
The Corporation's mission is to add shareholder value through the responsible and expeditious development of the Millennium Iron Range and other mineral projects to create a new large source of raw materials for the world's iron and steel industries. For further information, please visit www.nmlresources.com.

This release may contain forward looking statements within the meaning of the "safe harbor" provisions of US laws. These statements are based on management's current expectations and beliefs and are subject to a number of risks and uncertainties that could cause actual results to differ materially from those described in the forward looking statements. New Millennium does not assume any obligation to update any forward looking information contained in this news release.

For more information, please contact

New Millennium Capital Corp.
Robert Martin, President & CEO
Tel: (514) 935-3204 ext. 233
Email: rmartin@nmlresources.com

The Equicom Group Inc.
Martti Kangas
Tel: (416) 815-0700 ext.243
Email: mkangas@equicomgroup.com


600,000
610,000
620,000
630,000
640,000
650,000
6,120,000
6,110,000
6,100,000
6,090,000
6,080,000
6,070,000
6,060,000
Q U É B E C
KéMag
Goodwood
DSO 04
Ki1
Ki2
Ki5
Ki4
Ki3-N
Sunny 1
Ki3-S
Kivivik (Ki)
Millennium Iron Range - Chaîne ferrifère Millennium
DSO 03
Barney (Ba)
Ba1
Ba2
Howse
Ti4
Ti3
Ti7
Wash Plant / Installations de lavage
Timmins (Ti)
Ti3-N
Fleming 7-N
LabMag
Kawawachikamach
DSO 02
Star Creek 2
Ferriman 4
Schefferville
Marshalling Yard / Gare de triage
Gill
James
Knob Lake 1
DSO 01
Malcolm 1
Redmond 5
Ho2-N
Ho3
Ho2-S
Ho1
Houston (Ho)
NEWFOUNDLAND & LABRADOR
KILOMETRES / KILOMÈTRES
0
5
10
UTM19N NAD83
LEGEND / LÉGENDE
DSO deposit / Gisement "DSO"
● 90-100% - Ownership / Propriétaire
◐ 10-90% - Ownership / Propriétaire
Potential conveyor / Convoyeur potentiel
Potential railway / Chemin de fer potentiel
Existing railroad / Chemin de fer existant
Taconite project / Projet taconite
New Millennium Capital Corp.
2008-JAN-29 GIS-0025-00 SD
70°W
60°W
Kuujjuaq
QUÉBEC (QC)
Millennium Iron Range
Chaîne ferrifère Millennium
Voisey's Bay
NEWFOUNDLAND & LABRADOR (NL)
Sheshatshiu
Labrador City
Wabush
Fermont
Emeril Junction
500
Happy Valley-Goose Bay
Blanc-Sablon
St. Anthony
50°N
Pointe-Noire
389
Uashat
Mani-Utenam
Sept-Îles
138
Jonction Arnaud
GIS-0018-04

APPENDIX G

Beneficiation Process

APPENDIX G – BENEFICIATION PROCESS

Primary Crushing Circuit

The raw ore from the pits will be delivered via off-highway end dump trucks to the Primary Mobile Crushing Plant and either directly dumped into the feed hopper or stockpiled nearby for subsequent reclaiming into the feed hopper by a Front End Loader or a loader and truck.

The primary mobile crushing plant includes a hopper, vibrating grizzly feeder, jaw crusher, various chutes, bins, and conveyors, lubricating system and hydraulic power pack.

The ROM feed will have a top size of 600mm. It is expected that approximately 50% of the feed will bypass the primary crushing as it will already be minus 100mm.

The primary crushing plant will not be enclosed. There will be a dust collector system accompanying the Primary Crushing circuit. The specifications on the dust collector are not yet available; however the small unit will be designed to meet Newfoundland and Labrador Regulation 39/04.

Tumbling Scrubber Circuit

The discharge from the Primary Crushing will be conveyed to the Tumbling Scrubber circuit. The purpose of this step is to beneficiate the ore by incorporating water to wash the clay materials from the ore materials. It is anticipated that the scrubber will be mounted on a portable chassis.

Primary Screening Circuit

The discharge from the Tumbling Scrubber proceeds to the Primary Screening circuit. This is the first stage of classification.

The oversize material (> 50 mm) on the top deck is sent to the secondary crushing circuit, the undersize material (< 6 mm) from the bottom deck is sent to the Secondary Screening circuit, and the remaining material (> 6 mm, < 50 mm) is conveyed to the Lump Ore Stockpile.

Secondary Crushing Circuit

The oversize (> 50 mm) from the primary screening circuit is transferred to the secondary crushing circuit. The secondary crusher will be a standard cone crusher, GP300 or equivalent. The product from the cone crusher will be transferred back to the primary screening circuit.

Secondary Screening Circuit

The undersize (< 6 mm) from the Primary Screening circuit will be pumped to the Secondary Screening circuit.

The oversize material (> 0.325 mm) on the top deck is conveyed to the Sinter Fines Stockpile, the oversize material (> 0.150 mm, < 0.325 mm) on the bottom deck is pumped to the dewatering circuit equipment for dewatering. The undersize material (< 0.150 mm) from the bottom screen is pumped to the reject rock fines disposal area.

Dewatering Circuit

Material from the Secondary Screens that is less than 0.325 mm and greater than 0.150 mm in size will be transferred to the dewatering circuit via chutes. The purpose of this circuit is to dewater the sinter fine product to a maximum 8% moisture content. The overflow material from this circuit will be conveyed to the Sinter Fines Stockpile. The underflow will be pumped to the reject rock fines disposal area.

Product Storage

The iron ore products from the beneficiation process will be conveyed from the enclosure to the respective radial stackers. The lump ore product and the sinter fines product will be stockpiled separately. An area of approximately 4,300 m^2 is available for clean ore storage. Drainage from the ore stockpiles will be managed through site grading and ditching. The surface run-off will be directed to the Silver Yard Stormwater Management Pond (SWM-1) as shown on Figure 3-4 (site layout).

Reject Fines Handling

The undersize material from the Secondary Screening circuit (< 0.150 mm) and the filtration filtrate will be combined and pumped as a slurry to the reject rock fines disposal area. The reject fines slurry is estimated at 21% solids and will be pumped at an estimated flow rate of 520 m^3/h. The options for the reject fines disposal will include the following:

1) The reject fines slurry will be pumped approximately 3 km via an above ground, 300 mm diameter HDPE pipeline to the Ruth Pit. The Ruth Pit is an exhausted mine that is now flooded. The surface area of the Pit is 61.5 ha and the depth of the pit is 120 m.
2) An emergency disposal/storage area within the Silver Yards area is also designed to provide room in the case the reject fines pipeline or beneficiation process equipment needs to be purged. Its location is coincident with the Silver Yards Stormwater Management Pond (SWM-1).

Rail Loadout

The material from the Sinter Fines stockpile and the Lump Ore stockpile will be reclaimed with front end loaders.. Further details of the rail loadout process are presented under Section 3.1.5.

APPENDIX H

Air Quality Technical Report

Jacques Whitford

Environmental
Engineering
Scientific
Management
Consultants

7271 Warden Avenue
Markham ON
Canada L3R 5X5

Bus 905 474 7700
Fax 905 479 9326

www.jacqueswhitford.com

REPORT

AIR QUALITY TECHNICAL STUDY

LABRADOR IRON MINES LIMITED

PROJECT NO. 1046156

PROJECT NO. 1046156

REPORT TO **Labrador Iron Mines Limited**
220 Bay Street, Suite 700
Toronto, Ontario
M5J 2W4

FOR **Air Quality Technical Study**

ON **West Central Labrador Iron Ore Project**

January 29, 2009 Rev.3

Jacques Whitford Limited
7271 Warden Avenue
Markham, Ontario,
L3R 5X5

Phone: 905-474-7700
Fax: 905-479-9326

www.jacqueswhitford.com

EXECUTIVE SUMMARY

This document is the Air Quality Technical Study prepared in support of the environmental impact statement (EIS) for the West Central Labrador Iron Ore Project ("the Project"). The Project, proposed by Labrador Iron Mines Ltd, is to mine iron ore at the James and Redmond properties in Labrador, near Schefferville, Quebec. Mining will initially be at a combined rate of one to two million tonnes/year at the three main mine sites, James North, James South and Redmond with an estimated production rate no greater than 3,000 t/d at each mine location.

This Air Quality Technical Study was conducted to assess potential changes in air quality due to Project-related emissions,. The study was conducted following accepted methodologies to establish existing (baseline) conditions, estimate emissions and predict the maximum downwind ground-level concentrations of the pertinent air contaminants. The results of this Technical Study are intended to provide the data needed to assess potential environmental effects as described in the EIS.

The most substantive Project-related emissions during operation are due to fuel combustion and fugitive dust emissions from the beneficiation area (where extracted ore from mining is reduced to particles that can be separated into mineral and waste), the mine site locations, and from trucks hauling ore to the beneficiation area.

The results of the dispersion modelling (which consider all substantive emissions from the beneficiation area) show that although there may be potential exceedances of regulatory standards at locations near the property line during adverse meteorological conditions, these higher values are limited to within about 150 m of the property line. As this region is far from any of the sensitive receptor locations, it is unlikely that prolonged human exposure to air contaminant concentrations at these levels will occur. Therefore, as the predicted exceedances represent worst-case meteorological conditions, and are limited in spatial extent, and are short-term in duration, no substantive changes in air quality are expected.

Although fugitive dust emissions will occur due to truck traffic along the haul routes during operation, the majority of the fugitive dust will remain in the lowest 1-2 meters above ground level and settle within a few hundred meters of the road. The haul route is an existing dirt road, and although traffic along the route is expected to increase with Project activities, no more than five trucks are expected to pass in a given hour. As such, while some dusting of vegetation may occur due to vehicle traffic during certain meteorological conditions, as such emissions as they will be localized in extent and short-term in duration. Therefore, no substantive changes in air quality are expected.

Emissions due to blasting and on-site traffic at the mine site locations are not expected to cause substantive changes in air quality as they will be emitted inside a pit and the transport distances to the nearest sensitive receptors are relatively far (greater than 1.5 km). Emissions from the diesel locomotive used for transporting ore from the beneficiation area are not expected to cause substantive changes in air quality as such emissions will be intermittent (one trip per day) and short-term in duration. Emissions from the standby diesel generators installed at the worker's camp will be intermittent, short-term in duration, and negligible relative to other emissions during operation.

As emissions occurring during construction are expected to be small compared to those occurring during operation, the maximum model-predicted concentrations during operation provide a conservative envelope for potential changes in air quality due to emissions during this phase.

Therefore, on an overall basis, the modelling results show the changes in air quality due to Project-related emissions, including background, are not expected to be substantive.

Table of Contents

List of Tables

List of Figures

List of Appendices

1.0 INTRODUCTION

This document is the Air Quality Technical Study ("the Study") prepared in support of the environmental impact statement (EIS) for the West Central Labrador Iron Ore Project ("the Project"), the proposed iron mining operation west of Schefferville, Quebec.

The Project, proposed by Labrador Iron Mines Ltd, is to mine iron ore at the James and Redmond properties in Labrador, near Schefferville, Quebec. Mining will be conducted using open pit methods. Iron ore remaining at these previously mined locations will be mined, crushed and washed to produce lump ore and sinter fine ores, prior to being transported by rail to Sept-Iles and then shipped to customers. The project will also include the re-establishment of a spur line, approximately 3.5 kilometres in length, between an area known as the Silver Yards, north of the James property, and the existing railway in Schefferville, Quebec. Mining will initially be at a combined rate of one to two million tonnes/year at the three main mine sites, James North, James South and Redmond. The estimated daily production rate will be less than 3,000 t/d at each mine location. Ore will be crushed and washed at the Silver Yards beneficiation area (the area where extracted ore from mining is reduced to particles that can be separated into mineral and waste). Mining will be conducted approximately eight months per year with a winter shutdown.

The primary sources of potential air contaminant emissions during construction will be due to combustion emissions from on-site vehicles and temporary power sources, as well as fugitive dust emissions. During operation, emissions may be emitted from many sources, including the beneficiation area, the locomotives used to transport ore and materials, the open pit mines, a standby diesel generator installed at the worker's camp, and hauling ore along existing dirt roads between the mine sites and the Silver Yards.

1.1 Purpose of this Technical Study

The purpose of this study is to provide the necessary data to support the EIS and meet the requirements set out by the Newfoundland and Labrador Department of Environment & Conservation (NL DEC) in the Draft Guidelines (NL DEC 2008). In this document, the detailed methodology, assumptions, and results of the analysis done to assess potential changes in air quality are presented.

To support the assessment of a potential impact in air quality through this Technical Study, existing ambient air quality baseline conditions were characterized, air contaminant emissions from potential Project sources during construction and operation were estimated, and air quality modelling was conducted to predict the resulting fate and transport of the estimated emissions. A detailed description of the methodology for this Technical Study is presented in Section 2.

1.2 Overview of Report Contents

This Technical Study has been developed in support of the EIS for the West Central Labrador Iron Ore Project, and is presented in ten major sections, as follows.

- In Section 1, a general introduction and background information about the Project and this study is provided.
- In Section 2, an overview of the study methodology is provided.
- In Section 3, the regulatory framework considered for the study is presented.
- In Section 4, the baseline ambient air quality conditions are summarized.
- In Section 5, the emissions inventories are provided.
- In Section 6, the dispersion modelling methodology is outlined.
- In Section 7, the results of the dispersion and deposition modelling are presented.
- In Section 8, the conclusions of this study are summarized.
- In Section 9, a closure statement is provided.
- In Section 10, references consulted as part of the work and personal communications are provided.

2.0 STUDY METHODOLOGY

Several Project activities may cause air contaminants to be emitted to the atmosphere during construction and operation. This detailed Air Quality Technical Study was conducted to assess the potential for a Project-related change in air quality. The study was conducted following generally accepted methodologies to establish existing (baseline) conditions, estimate substantive emissions from Project activities, and predict the maximum downwind concentrations of the pertinent air contaminants.

2.1 Study Components

The Study consists of three key components which are considered together to characterize existing conditions and assess the potential environmental effects of Project-related emissions to the atmosphere.

- Ambient Air Quality Assessment: Existing (baseline) ambient air quality in and around the Project was characterized based on federal monitoring data from other remote locations in Labrador, as well as on-site ambient particulate matter monitoring conducted in support of the EIS. A summary of the existing baseline conditions, based on this analysis, is provided in Section 4 of this study.
- Emissions Inventory Development: Air contaminant emission rates from the Project were estimated based on conceptual engineering design information and published sources of emission factors. Details regarding Project-related emissions, including assumptions and calculations techniques, are provided in Section 5 of this study.
- Dispersion Modelling: The plume dispersion of the substantive air contaminant emissions from the Project was modelled to predict maximum ground-level concentrations (GLC). Details regarding the models used, model input data processing, as well as the model options selected are provided in Section 6. The results of the modelling are presented in Section 7.

Based on this analysis, the potential environmental effects due to air contaminant emissions from the Project are considered and assessed with a high degree of confidence in the EIA/EA.

2.2 Emission Source Screening

As previously mentioned, emissions estimates and dispersion modelling were used to quantitatively assess the potential change in air quality for substantive Project-related emissions which might result in adverse environmental effects. Project-related emissions expected to be negligible in the context of other emissions were not quantified, but are identified and described qualitatively in this section and in Section 5.

2.2.1 Construction

The emissions occurring during construction are expected to be relatively small compared to those occurring during operation. As there are very few buildings/units to be installed in the primary beneficiation area during construction, very few vehicles will be required on-site. Intermittent visits may cause releases of fugitive dust and combustion emissions. Up to two temporary diesel generators installed at the worker's camp may also contribute to emissions during construction. On the other hand, during operation, as substantive amounts of material will be handled/processed and much larger continuous power sources (diesel generators) are necessary, emissions will be much larger in magnitude than during construction. Therefore, the potential changes in air quality during construction were considered indirectly by considering the predicted concentrations during operation as a worst-case scenario.

2.2.2 Operation

The emission sources quantified and considered in the dispersion modelling included all substantive sources in the beneficiation area during operation such as:

- Combustion emissions from fuel oil boilers and diesel generators (continuous power);
- Particulate matter emissions due to crushing, loading/dumping, wind erosion, and dust from conveyors.

These emissions will only occur seasonally with LIM's operation. No attributable emissions are expected to occur during the winter months when LIM is not operating. The emissions estimates for these sources are provided in Section 5, while the results of the dispersion modelling are provided in Section 7.

Potential emissions due to standing losses from storage tanks at the beneficiation area are not expected to be substantive as the contents will have relatively low vapour pressures (diesel and heavy oil). Similarly, emissions due to on-site vehicle traffic are not expected to be substantive relative to the other combustion and fugitive dust sources in the primary beneficiation area. As these sources are expected to represent only a small fraction of the total emissions from the primary processing facility, emissions from these sources are not expected to cause substantive changes in air quality and were not quantified.

Emissions due to fuel combustion and fugitive dust from trucks hauling ore from the deposits to the beneficiation area during operation were quantified (see Section 5), but not modelled. Although fugitive dust emissions will occur due to vehicle traffic along the road, the majority of the fugitive dust will remain in lowest 1-2 meters above ground level and settle within a few hundred meters of the road (DRI 1999). The haul route is an existing dirt road, and although traffic along the route is expected to increase with Project activities, no more than five trucks are expected to pass in a given hour. As such, while changes in air quality may occur due to fugitive dust emissions during certain meteorological conditions when trucks pass, these events will be localized and short in duration.

Emissions due to blasting and on-site traffic at the mine site locations during operation are not expected to cause substantive changes in air quality as they will be emitted inside a pit and the distances from the site to the nearest sensitive receptors are relatively far (more than 1.5 km). LIM will follow an explosive management program to ensure that environmental concerns are considered during the periodic blasting that may be required at the site. Furthermore, the blasting and associated emissions will be short-term in duration. Therefore, these emissions were not quantified.

Emissions from the diesel locomotive used for transporting ore from the beneficiation area are not expected to cause substantive changes in air quality. The railway is already operating in the area and LIM does not expect to add significantly to the current operation. Any emissions from the locomotive are expected to be intermittent (one trip per day) and short-term in duration. Therefore, these emissions were not quantified.

Similarly, emissions during from the standby diesel generators installed at the worker's camp will be intermittent, short-term in duration, and negligible relative to other emissions during operation. Therefore, these emissions were not quantified.

2.3 Dispersion Modelling

Air quality dispersion modelling was performed to predict maximum ground-level concentration (GLC) from substantive Project emissions and quantitatively assess potential environmental effects. Based on the site-specific conditions in the region, and after consultation with the NL DEC beginning November 11, 2008 (Lawrence 2008), the CALPUFF modelling system (TRC Companies, Inc. 2007) was selected to perform the dispersion and modelling for this assessment. CALPUFF was selected primarily because of its superior ability to characterize atmospheric dispersion in areas with complex, non-steady state meteorological conditions (NL DEC 2006). Atmospheric conditions in the region fit this criterion: areas with complex terrain in the study area create high variability in winds and turbulence. The model has specialized algorithms to deal with calm wind speed conditions and characterize dispersion in regions of complex terrain. Refer to Section 6 for a more detailed description of the CALPUFF modelling system and its algorithms.

To consider a variety of worst-case meteorological events in the dispersion modelling, a five-year simulation period spanning 2002-2006 was selected. As Project operations are expected to cease during the winter months, emissions were not modelled from November to March. The study area considered in the modelling assessment covers a 30 x 30 km area centered over the beneficiation area and is shown in Figure 2-1.

Model results were used to quantitatively assess potential changes in air quality due to Project emissions of NO_X, SO_2, CO, PM, PM_{10}, and $PM_{2.5}$. For each source modelled, emissions and other source characteristics were estimated based on preliminary design information and available literature. The model-predicted maximum GLC were added to estimated background concentrations and compared to the relevant air quality standards. The baseline ambient concentrations considered in the modelling were provided by the NL DEC and are expected to conservatively estimate existing conditions in the region. For more details on the existing ambient air quality in the region, refer to Section 4.

For more details concerning the CALPUFF modelling methodology and results refer to Sections 6 and 7, respectively.

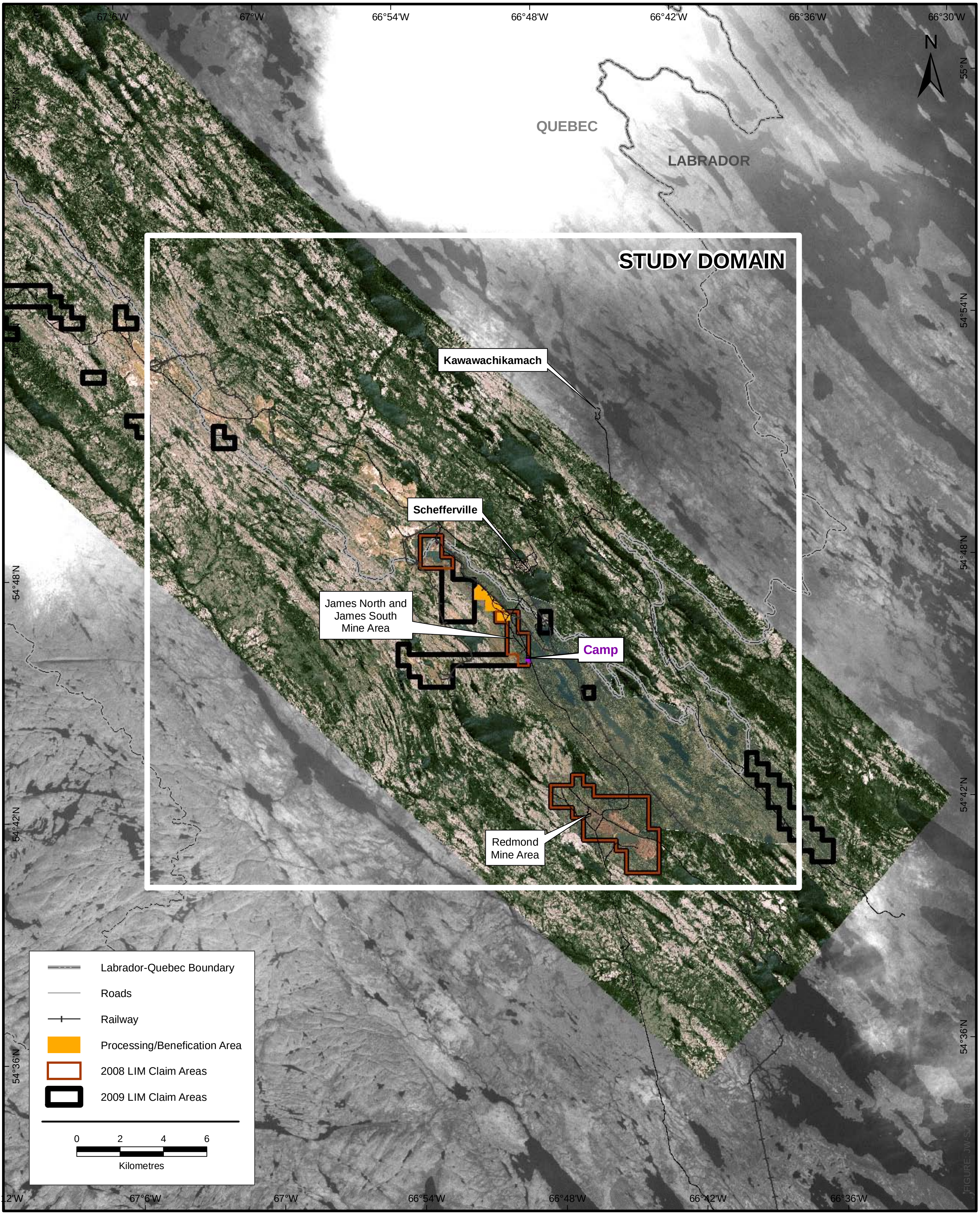


FIGURE NO:

2-1

Study Domain

DRAFT DATE:

19/12/2008

REVISION DATE:

12/8/2009

3.0 REGULATORY FRAMEWORK

Ambient air quality is regulated both federally and provincially for several air contaminants. Ambient air quality objectives and standards are routinely used as a basis of comparison for air quality assessments and are generally chosen by regulators to be protective of human and environmental health. As such, published objectives and standards where available, were used in this study for comparison with measured or predicted values and in characterizing environmental effects.

Provincial standards are in place for all air contaminants considered in this study. Additionally, National Ambient Air Quality Objectives (NAAQO) or Canada Wide Standards (CWS) are available for all but particulate matter less than 10 microns (PM_{10}). A brief summary and description of the air quality standards in Newfoundland and Labrador (NL), and the NAAQO and CWS are presented in the following subsections.

3.1 Newfoundland and Labrador Air Quality Regulation

In NL, ambient air quality standards are published in Schedule A of the *Air Pollution Control Regulation* 39/04 under the *Environmental Protection Act.* A summary of the standards for ambient air quality concentrations in NL are presented below in Table 3.1.

Table 3-1 Summary of Newfoundland and Labrador Ambient Air Quality Standards

Air Contaminant	Averaging Period	Regulatory Standard (μg/m^3)
Nitrogen dioxide (NO_2)	1 hr	400
	24 hr	200
	Annual	100
Sulphur dioxide (SO_2)	1 hr	900
	3 hr	600
	24 hr	300
	Annual	60
Total suspended particulate matter (TSP)	1 hr	-
	24 hr	120
	Annual	60
Particulate matter less than 10 microns (PM_{10})	1 hr	-
	24 hr	50
Particulate matter less than 2.5 microns ($PM_{2.5}$)	1 hr	-
	24 hr	25
Carbon monoxide (CO)	1 hr	35,000
	8 hr	15,000

For the purposes of assessing changes in air quality in this study, the relevant NL regulatory standards were considered preferentially where applicable.

3.2 Federal Air Quality Objectives and Standards

The pertinent federal air quality standards for the assessment are the NAAQO and CWS. The NAAQO were established by the federal government in the early 1970s to protect human health and the environment by setting objectives for the following common air pollutants: carbon monoxide, nitrogen dioxide, ozone, sulphur dioxide and total suspended particulates. The objectives are denoted as “Desirable”, “Acceptable” and “Tolerable”. The Federal Objectives are defined as follows:

- The Maximum Desirable Level is the long-term goal for air quality and provides a basis for anti-degradation policy for unpolluted parts of the country, and for the continuing development of control technology;
- The Maximum Acceptable Level is intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, visibility, personal comfort and well-being; and
- The Maximum Tolerable Level denotes time-based concentrations of air contaminants beyond which, due to a diminishing margin of safety, appropriate action is required to protect the health of the general population.

The CWS are based on intergovernmental agreements developed under the Canadian Council of Ministers of the Environment (CCME) Canada-wide Environmental Standards Sub-Agreement, which operates under the broader CCME Canada-wide Accord on Environmental Harmonization. The CWS flow from the federal, provincial and territorial Ministers desire to address key environmental protection and health risk issues that require concerted action across Canada. They represent cooperation toward a common goal, but involve no delegation of authority by any federal, provincial or territorial government. The standards may include qualitative or quantitative standards, guidelines or objectives for protecting the environment and human health. A number of these exist to protect air quality, including ambient air quality objectives for $PM_{2.5}$.

Overall, the NAAQO “Acceptable” Levels and the NL ambient air quality standards are very similar. There is no NAAQO for $PM_{2.5.}$ However, the CWS for $PM_{2.5}$ is similar to the NL ambient air quality standard. There is no NAAQO or CWS standard for PM_{10}. The National Ambient Air Quality Objectives and CCME Canada Wide Standards are presented below in Table 3-2.

Table 3-2 National Ambient Air Quality Objectives and Canada Wide Standards

Air Contaminant	Averaging Period	National Ambient Air Quality Objectives: Max Desirable/Acceptable/Tolerable Levels[1] ($\mu g/m^3$)	CCME Canada Wide Standards[2] ($\mu g/m^3$)
Sulphur dioxide (SO_2)	1 hr	450/900/--	--
	24 hr	150/300/800	--
	Annual	30/60/--	--
Nitrogen oxides as Nitrogen dioxide (NO_2)	1 hr	--/400/1,000	--
	24 hr	--/200/300	--
	Annual	60/100/--	--
Carbon monoxide (CO)	1 hr	15,000/35,000/--	--
	8 hr	5,730/15,000/20,000	--
Total suspended particulate matter (TSP)	24 hr	--/120/400	--
	Annual	60/70/--	--
Particulate matter less than 2.5 microns ($PM_{2.5}$)	24 hr	--	30
Particulate matter less than 10 microns (PM_{10})	--	--	--

Notes:

1 Government of Canada (1999), National Ambient Air Quality Objectives, Maximum Acceptable Levels

2 CCME (2000), Canada Wide Standards for Particulate Matter (Based on 98th percentile of 3 year rolling average)

-- No standard or objective available

4.0 EXISTING BASELINE CONDITIONS

4.1 Climate

The existing physical environment in the area of the LIM operations is presented in the following paragraph. Although all of LIM's properties are located in the Province of Newfoundland and Labrador (NL), the properties are bordered by the Province of Québec (QC), and the nearest town is Schefferville, QC to the north. Hence, the assessment boundary was extended beyond the provincial boundary in order to assess potential impacts in the airshed.

The Schefferville area and vicinity have a sub-arctic continental climate with severe winters. The terrain is comprised of parallel ridges and valleys trending northwest to southeast. The area is thinly forested, with bare rock exposure, and has some low wetland areas including bogs. Surface disturbance is present in the area as a result of previous mining. The climatology described in the following sections is based on 30-year Canadian Climate Normal data obtained from Environment Canada for the Schefferville Airport (1971 to 2000).

4.1.1 Climate Normals

The description of the climate for the region is based on climate normals from 1971-2000 for the Schefferville Airport weather station. These data are presented in Table 4-1 (Environment Canada 2008b). The Schefferville Airport weather data are considered to be an accurate representation of average weather conditions at the Labrador Iron Mines properties.

The daily average temperature for the Schefferville area varies from -24.1ºC in January to 12.4ºC in July with an annual average temperature of -5.3ºC. The extreme maximum and minimum temperatures recorded are 34.3ºC and -50.6ºC recorded during June and February, respectively.

The annual average total precipitation for the area is 822.9 mm of which 408.1 mm is in the form of rain.

The annual average wind speed reported at the Schefferville airport is approximately 17 km/h (kilometres per hour) and the most frequent wind direction, on an annual basis, is winds blowing from the north-west. The maximum wind speeds occur in October with average speeds of 17.8 km/h and the minimum speeds occur in July at an average of 15.1 km/h. The average monthly wind speeds are higher in the winter than in the summer. Maximum gusts, averaged from 1971 to 2000 for each month range from 101 km/h to 153 km/h. Occurrences of extreme winds are uncommon at Schefferville, as over the last three decades there has been an average of 13.9 and 3.3 days per year with winds ≥ 52 km/h and 63 km/h respectively (Environment Canada 2008b).

Table 4-1 Canadian Climate Normals for Schefferville, QC (1971-2000)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Temperature (°C)													
Daily Average	-24.1	-22.6	-16	-7.3	1.2	8.5	12.4	11.2	5.4	-1.7	-9.8	-20.6	-5.3
Daily Maximum	-19	-16.9	-9.8	-1.5	6	13.7	17.2	15.8	8.9	1.3	-6.1	-15.9	-0.5
Daily Minimum	-29.2	-28.1	-22.2	-13.1	-3.6	3.3	7.6	6.5	1.7	-4.6	-13.5	-25.2	-10
Extreme Maximum	5.1	5.1	9.4	13.1	28.3	**34.3**	31.7	28.7	26.7	20.6	9.8	5	
Date of Occurrence (yyyy/dd)	1986/28	1981/24	1953/25	1984/28	1950/31	**1989/24**	1970/25	1990/05	1959/10	1970/10	1977/11	1951/04+	
Extreme Minimum	-48.3	**-50.6**	-45	-36.1	-23.3	-7.8	0	-3.3	-9.4	-19.4	-35.6	-47.2	
Date of Occurrence (yyyy/dd)	1957/15	**1950/07**	1964/10	1950/08	1972/01	1956/08+	1951/14+	1948/30	1948/29	1974/22	1949/23	1989/27	
Precipitation													
Rainfall (mm)	0.2	0.2	1.6	8.4	27.7	65.4	106.8	82.8	85.3	24.4	4.5	0.9	408.1
Snowfall (cm)	57.4	42.6	56.6	54.8	22.9	8	0.5	1.7	12.7	57.2	70.7	55.4	440.5
Precipitation (mm)	53.2	38.7	53.3	61.4	52.1	73.7	107.2	84.5	98.4	80.5	69.4	50.7	822.9
Extreme Daily Precipitation (mm)	29	29	36.8	32.8	33.8	51.3	**54.4**	48.5	49	41.2	35.8	24.6	
Date of Occurrence(yyyy/dd)	1982/18	1976/02	1982/27	1975/19	1992/23	1958/14	**1989/19**	1970/01	1990/15	1990/19	1966/03	1962/10	
Days with:													
Max. Temp. > 0 °C	0.41	0.65	3.4	12.5	27.2	29.9	31	31	29.5	18.9	4	0.55	188.9
Rainfall >= 0.2 mm	0.3	0.3	1	2.9	8.6	14.7	19	18.4	17.2	7.3	1.8	0.64	92.2
Snowfall >= 0.2 cm	17.4	14.3	16.6	14.6	10.3	3.4	0.17	0.33	6.4	19	21.3	19.2	142.9
Precipitation >= 0.2 mm	17.1	14.3	16.4	16.2	15.8	16.1	19	18.4	20.4	21.8	21.3	19	215.9
Wind													
Mean Wind speed (km/h)	16.4	16.8	17.4	16.5	16	16.2	15.1	15.6	16.9	17.8	17.3	16	16.5
Most Frequent Direction	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW	NW
Maximum Gust Speed (km/hr)	134	148	148	130	101	126	103	117	137	137	142	153	

Source: Environment Canada (2008b)

4.1.2 Ambient Air Quality

There is currently no heavy industry in the vicinity of the Project. Therefore, on an overall basis, background concentrations of air contaminants are very low for the purposes of the study in the development area. Fugitive dust levels in the region may be elevated occasionally due to the use of predominantly unpaved roads for transportation in the area wind-blown dust from loose cover material.

4.1.2.1 Supplementary On-Site Ambient Monitoring

A search of the National Air Pollution Surveillance (NAPS) Network data records indicated that there is limited data available to determine background air quality for air contaminants in the vicinity of the proposed operations. The nearest available sources of ambient air quality monitoring data are Goose Bay and Labrador City, both of which are greater than 200 km from the site location. Goose Bay and Labrador City have both more industry and population than the LIM area. Additionally, LIM wanted to estimate what contribution, if any, the mobile crusher had to particulate matter levels.

To address the above issues, an ambient air quality monitoring program was conducted between September and November 2008, specifically monitoring total particulate levels in the beneficiation area known as the Silver Yards on Labrador Iron Mine Ltd. properties, where the highest levels of particulate would be expected. This area was chosen for ambient monitoring since it is nearest to Schefferville which is the nearest residential area.

Samples were obtained near the James Mine property on a six day schedule on days when ore was being crushed as well as on days when operations were not occurring. Results from the program indicated half of the samples had particulate levels that were equal to or below the laboratory detection limit of 0.3 mg (21 $\mu g/m^3$), suggesting that particulate levels in the area were generally low. The highest particulate level sampled was 0.6 mg (42 $\mu g/m^3$), while the average of all samples was 0.3 mg (21 $\mu g/m^3$), which is low compared to the NL standard of 120 $\mu g/m^3$. For more details on the ambient monitoring conducted in support of this assessment, refer to the On-site Ambient Monitoring Report which is included as Attachment A.

4.1.2.2 Ambient Background Values Used for Dispersion Modelling

For the purposes of assessing cumulative environmental effects, conservative estimates for ambient background concentrations were provided by the NL DEC (Lawrence 2008).

To estimate background levels for SO_2, TSP, PM_{10}, and $PM_{2.5}$ in the region, the NL DEC provided the lowest annual ambient levels measured at Labrador City/Wabush. This is considered to be a conservative approach since the Labrador City/Wabush ambient air is influenced by two nearby iron ore pelletizing operations. The value of 15 $\mu g/m^3$ given for TSP is consistent with, and on the same order of magnitude of the results from the on-site ambient monitoring as described in the preceding section and Attachment A.

For the remaining contaminants, CO and NO_2, the lowest annual values for all stations in the NAPS 2005/2006 report (Environment Canada 2008a) were provided by the NL DEC to approximate ambient background values of these contaminants. This approach was considered conservative since NAPS is a community based network (i.e. monitoring is done in populated areas), unlike LIM's project area in a historically developed area. The ambient background concentrations provided for the modelling assessment are located in Table 4-2 below.

Table 4-2 Ambient Background Concentrations Used in Dispersion Modelling

Air Contaminant	Estimated Background Concentration (μg/m^3)
NO_2	3.8
SO_2	5
TSP	15
PM_{10}	10
$PM_{2.5}$	5
CO	114

Source: (Lawrence 2008)

5.0 EMISSIONS INVENTORY

5.1 Overview

A summary of the processes and activities which are expected to have substantive emissions, and the sources of these emissions, are provided in the following sub-sections. Substantive emissions are those that may be emitted in quantities that could result in ambient concentrations of concern to the regulatory agencies or the public.

Two main source groups were considered for the purposes of this assessment: combustion sources and fugitive dust sources. These sources were considered to operate over an 8-month period, with a winter shut-down consistent with LIM's mining operation.

Combustion sources at the facility include the following:

- Two (2) fuel-oil fired boilers (note that based on updated design, these units are no longer required);
- Three (3) diesel fired generators;
- On-site vehicles (tail pipe emissions);
- Locomotive engines; and,
- Up to two diesel generators at the worker's camp.

Fugitive dust sources at the facility include the following:

- Ore loading/unloading;
- Ore crushing;
- Ore stockpile erosion;
- Conveyor systems; and,
- On-site traffic.

Fugitive dust emissions from blasting as well as fugitive volatile organic compound (VOC) emissions from tank storage were also considered. These sources of emissions will be present at the facility during both construction and operation activities. Heavy construction activities at the site are expected to be minimal due to the few buildings being erected and since the area is already relatively cleared of brush and debris. Construction activities include erecting the main crushing building, the placement of the required generators, boilers, and tanks, and the installation of conveying systems and rail lines. Emissions during construction are expected to occur intermittently over the duration of the construction period as opposed to emissions during operation, which will occur continuously. Also, the amount of fugitive dust emitted due to operational activities (crushing, ore loading/unloading, conveying, and stockpile erosion) will be greater than those observed during construction activities due to the nature of the ore beneficiation process. Therefore, the maximum emissions during operation provide a conservative envelope for those occurring during construction.

An operating scenario with production at 1,500,000 tonnes of ore per year at the LIM facility was used to estimate emissions from the main sources of potential concern. Manufacturer's specifications, where applicable were used for the on-site equipment and engineering estimates were used where required. Maximum short-term emission rates for each contaminant of concern were calculated and are expected to provide conservative predictions for longer averaging times (greater than 1-hour) when used in the dispersion modelling. Emission rates were calculated using emission factor (EF) approaches and engineering assumptions. The emission calculation methodology for each significant source is described in this section.

An overview of the project boundaries, including the beneficiation area, the James and Redmond claims, and the hauling routes are included in Figure 5-1. A close-up view of the beneficiation area, including major sources of concern is included in Figures 5-2 and 5-3. The following sub-sections detail the combustion and fugitive dust sources considered in this assessment.

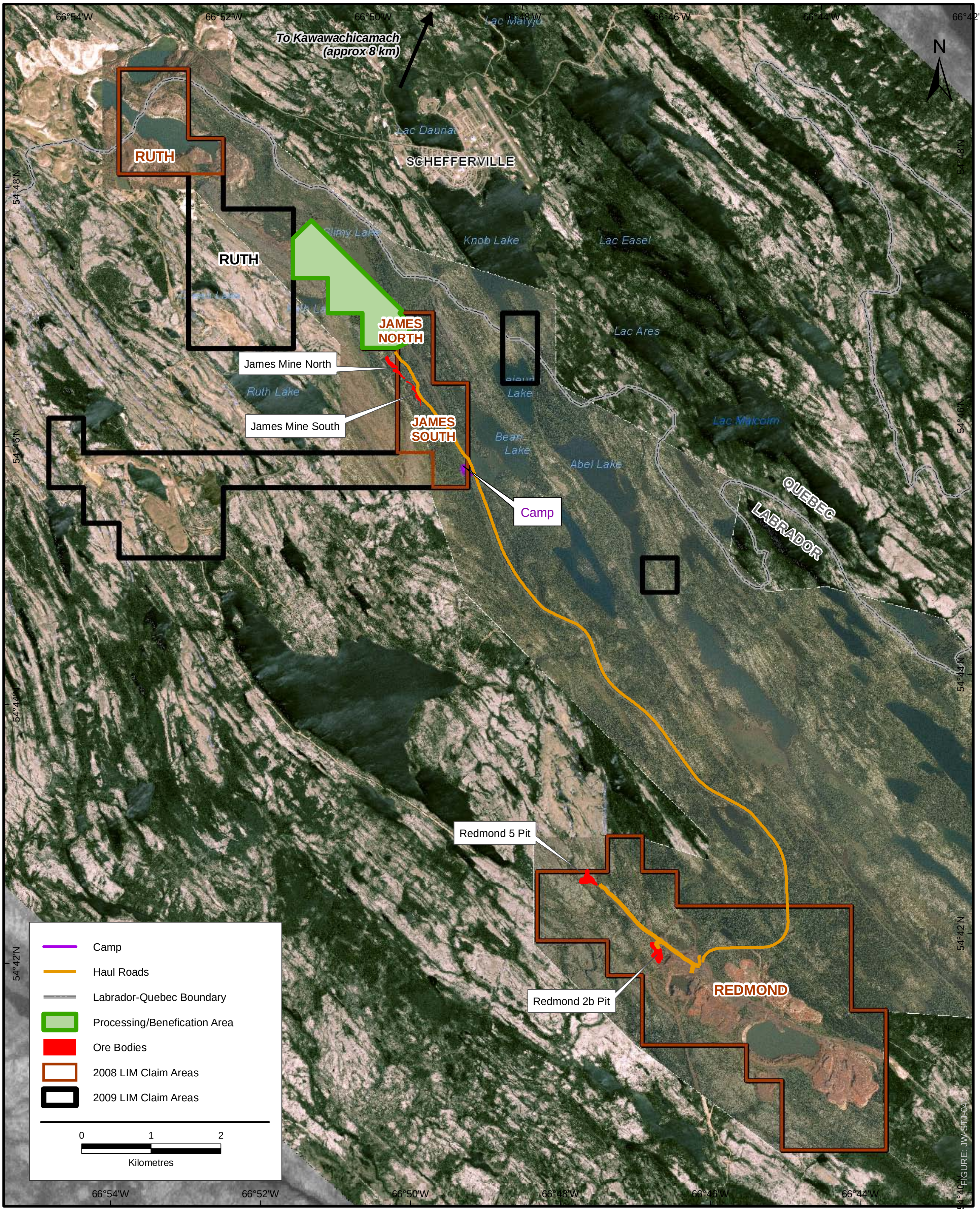


FIGURE NO:

5-1

Overview of Project Emission Sources

DRAFT DATE:
08/12/2008

REVISION DATE:
12/8/2009

Figure 5-2 Emission Sources in Primary Beneficiation Area – Including Site Plan

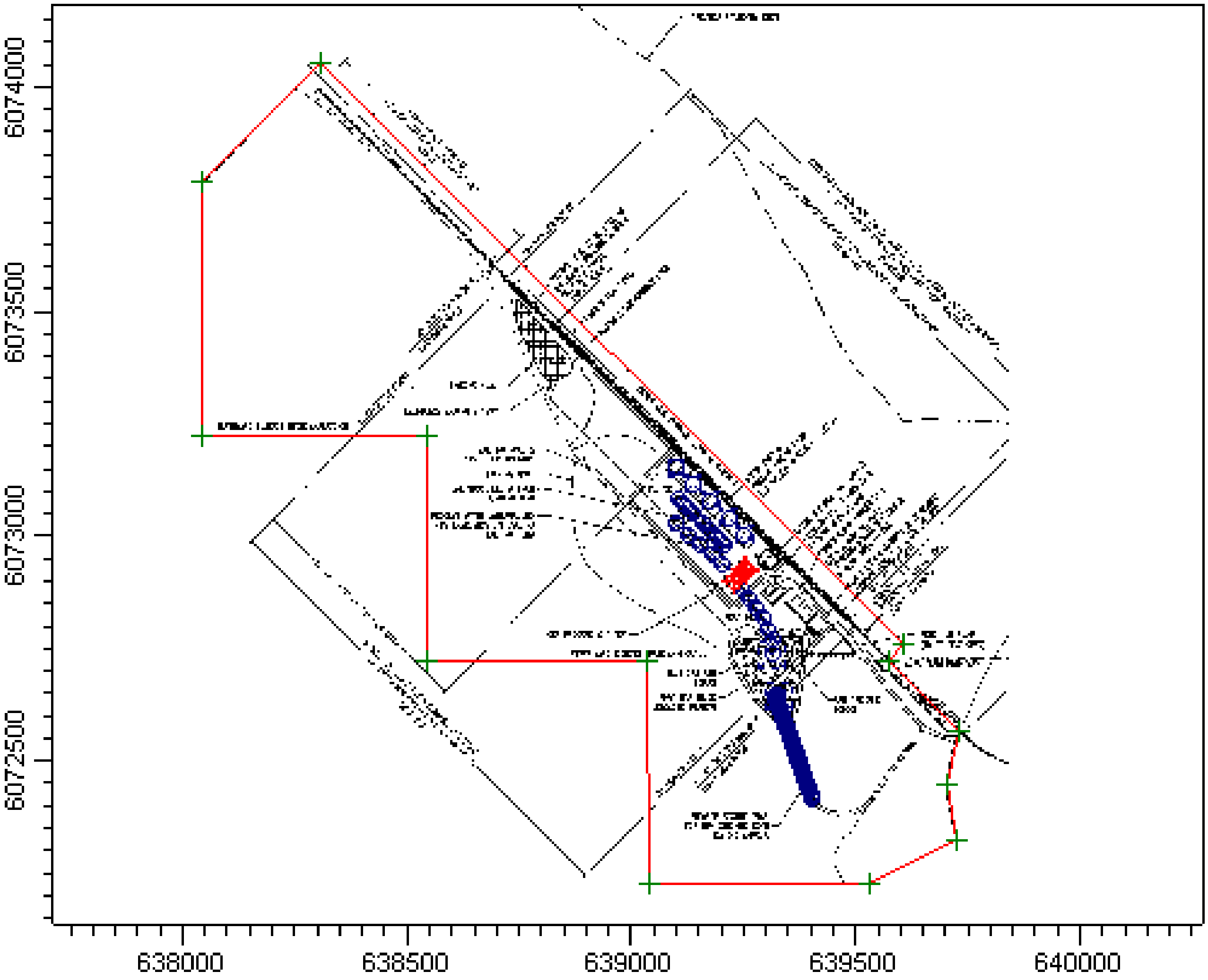
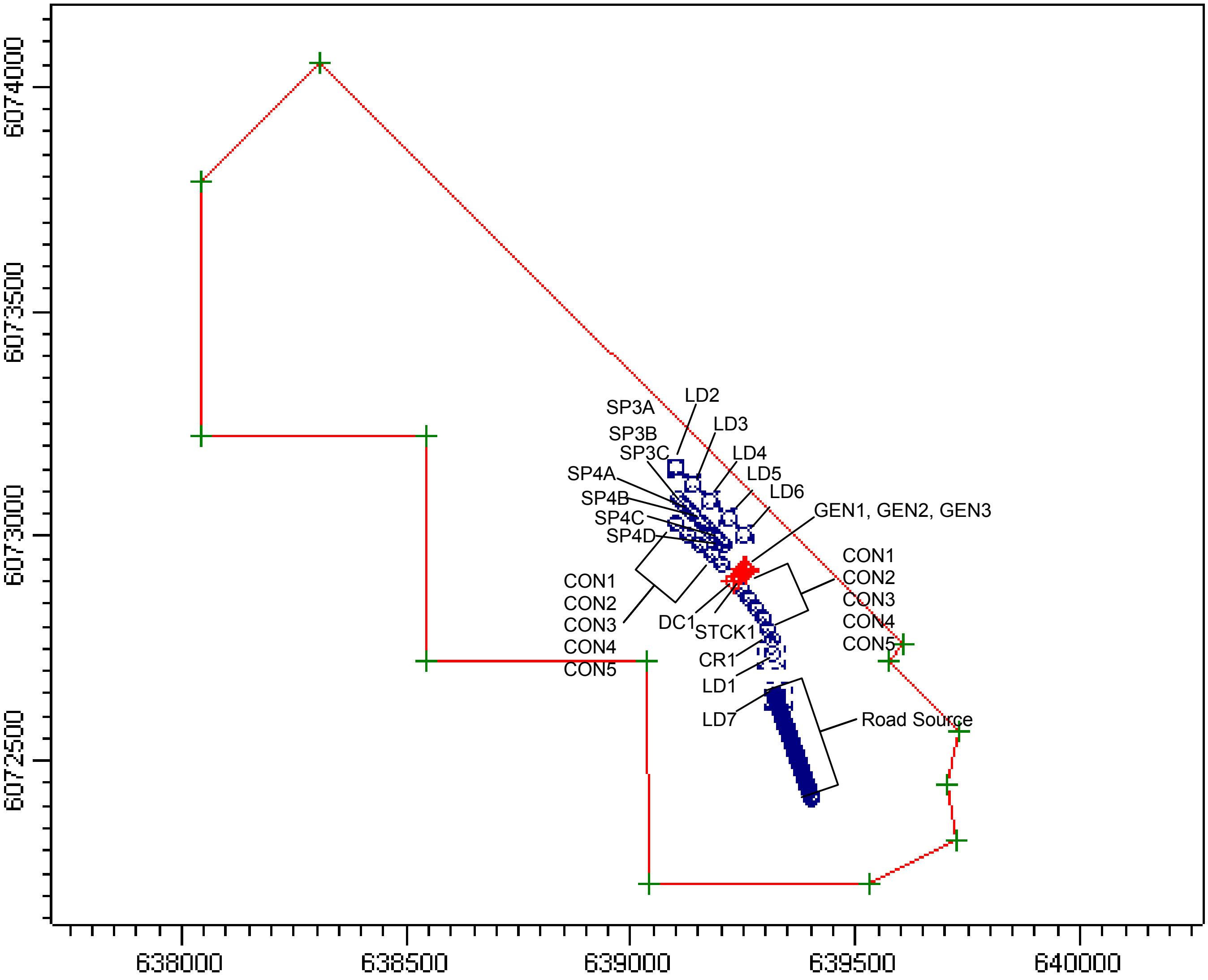


Figure 5-3 Emission Sources in Primary Beneficiation Area – Labeled Sources



5.2 Combustion Emissions

Combustion emissions will occur at the facility during both construction and operation activities. Emissions due to fossil fuel combustion are expected to occur during construction in the beneficiation area and worker's camp from diesel generators as well as tail pipe emissions from on-site traffic. Emissions due to fossil fuel combustion are also expected to occur during operation in the beneficiation area and worker's camp from diesel generators, boilers (note that based on updated design information, these units are no longer required), and tail pipe emissions from on-site traffic and locomotives.

5.2.1 Diesel-Powered Generators

Three (3) mobile diesel generators will be used in the beneficiation area to provide power to the equipment. These are referred to as GEN1, GEN2, and GEN3. The specifications for the set of generators are: continuous duty, 750 kW, 60Hz, and 600V. Each generator will be enclosed and placed on concrete pads. Each generator will emit contaminants to the atmosphere through a stack having an assumed diameter of 0.2 m and a height of 0.7 m above the enclosure, approximately 5 m above grade.

In addition, up to two (2) diesel generators (125 and 175 kw) will be used as a temporary power source for the camp until electricity can be connected from the nearby grid (during the construction phase). Grid access is nearby and no significant construction is anticipated to facilitate the grid connection. During operation, these units will be used for emergency power losses only. Since these emissions will be intermittent, short-term in duration, and negligible compared to other emissions occurring during operation, emissions from these potential sources were not quantified or modelled.

The main contaminants of concern considered from diesel-fired generators are NO_x, CO, SO_2, PM, PM_{10} and $PM_{2.5}$. Emissions for all contaminants from the diesel generators in the beneficiation area were calculated based on emission factors in U.S. EPA AP-42 Chapter 3.4 „Gasoline and Diesel Industrial Engines' (>600-hp), and the power rating of the unit. The NO_X emission factor for controlled generators was used to account for the use of Best Available Control Technology (BACT) at the site. Although no emission factors were provided in Table 3.4-1 of AP-42 for PM_{10} and $PM_{2.5}$, the ratio of each fraction of particulate matter (PM_{10} or $PM_{2.5}$) to PM from table 3.4-2 of the same document was used to estimate emissions.

Sample Calculation – NO_x Emissions for GEN1:

NO_X Generator Emission (g/s) = EF (lb/hp-hr) x Power Rating (kW) x Conversion (hp/kW) x Conversion (g/lb) / 3600 (s/hr)

= 0.013 (lb/hp-hr) x 750 (kW) x 1.34 (hp/kW) x 454 (g/lb) / 3600 (s/hr)

= 1.65 g/s

Emissions from the other expected contaminants were calculated in a similar fashion and are provided in Table 5-1.

Table 5-1 Estimated Emission Rates from Combustion Equipment - Generators

Source	Power Rating (kW)	Contaminant	Emission Factor	EF Units	Emission Rate (g/s)
Generators	750.0	NO_x	0.013	lb/hp-hr	1.65E+00
		CO	0.0055	lb/hp-hr	6.98E-01
		PM	0.0007	lb/hp-hr	8.88E-02
		SO_2	0.0032	lb/hp-hr	4.10E-01
		PM_{10}	0.0006	lb/hp-hr	7.28E-02
		$PM_{2.5}$	0.0006	lb/hp-hr	7.10E-02

Reference: US EPA AP-42 Table 3.4-1 and 3.4-2

5.2.2 Fuel Oil Boilers

Based on the preliminary design information, two (2) 224 kW fuel oil boilers were to be located in the main processing building and will be used for required process water in the tumbling scrubber during the beneficiation process. The boilers would have been powered by No. 2 fuel oil and emitted to the atmosphere through a common stack (STCK1), having a diameter of 0.9 m and an assumed height of 1 m above the roof of the processing building. Based on updated design information, the boilers are no longer required as part of the proposed Project. However, to be conservative, the potential contributions of these sources were still considered quantitatively in the air quality assessment (emissions estimated and dispersion modelling conducted).

The main potential contaminants of concern considered from the fuel-oil fired boilers would be NO_X, CO, SO_2, PM, PM_{10} and $PM_{2.5}$. Emissions for all contaminants from the boilers were calculated based on emission factors in U.S. EPA AP-42 Chapter 1.3 „Fuel Oil Combustion', and the fuel volume requirement of the unit. Emissions estimates for SO_2, NO_X, CO and PM were based on Low-NO_X burners, to account for the required Best Available Control Technology (BACT) used at the site.

Sample Calculation – NO_x Emissions for STCK1:

NO_X Boiler Emission (g/s) = EF (lb/10^3 gal) x Fuel Volume (gal/h) / 1000 (gal/10^3 gal) x Conversion (g/lb) / 3600 (s/hr) x 2 boilers

= 10 (lb/10^3 gal) x 85 (gal/hr) / 1000 (gal/10^3 gal) x 454 (g/lb) / 3600 (s/hr) x 2

= 0.21 g/s

Other emissions were calculated in a similar fashion and are provided in Table 5-2.

Table 5-2 Estimated Emission Rates from Combustion Equipment - Boilers

Source	Max Fuel Flow (gal/hr)	Contaminant	Emission Factor	EF Units	Emission Rate (g/s)
Boilers	85	NO_x	10	lb/10^3 gal	2.14E-01
		CO	5	lb/10^3 gal	1.07E-01
		PM	2	lb/10^3 gal	4.29E-02
		SO_2	7.85	lb/10^3 gal	1.68E-01
		PM_{10}	1	lb/10^3 gal	2.14E-02
		$PM_{2.5}$	0.25	lb/10^3 gal	5.36E-03

Reference: US EPA AP-42 Table 1.3-1 and 1.3-6

5.2.3 On-site traffic

Potential emissions from on-site traffic sources include tail-pipe emissions due to fossil fuel combustion. Emissions from combustion arise from the burning of fuel and are dependent on fuel flow rate, fuel type, and the type of combustion equipment. The primary products from combustion include nitrogen oxides (NO_X), sulphur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM). Both diesel and gasoline powered vehicles are expected to be operating at the site during both construction and operation activities. Construction vehicles will include dozers, graders, dump trucks, boom trucks and pick-up trucks. Vehicles expected during operation will include pick-up trucks, hauling trucks, tractors and trailers. These emissions will be localized in extent, limited in duration, and occur over the entire property as the vehicles travel.

On-site traffic will be very light and not a substantive contributor to overall emissions at a facility and were therefore not estimated for the purposes of this assessment.

5.2.4 Locomotive emissions

Combustion emissions are expected from the diesel locomotive used for transporting ore from the beneficiation area to Schefferville and beyond. Similar to on-site traffic emissions, emissions from combustion arise from the burning of fuel and are dependent on fuel flow rate, fuel type, and the type of combustion equipment. The primary products from combustion include nitrogen oxides (NO_X), sulphur dioxide (SO_2), carbon monoxide (CO), and particulate matter (PM).

Emission estimation methods for locomotives are available, although published emission rates vary greatly. Due to the infrequent nature of the source at the site (one trip is expected per day), the environmental effect is expected to be minimal therefore emissions estimates for locomotive transport were not estimated.

5.3 Fugitive Dust Emissions

Fugitive dust emissions at the site will occur from several different sources during construction and operation. Potential sources of fugitive dust during construction activities will include railway track installation, the clearing/grubbing for site services area, any necessary excavation and the erection of temporary buildings. Potential sources of fugitive dust during operation may include ore loading/unloading, ore crushing, stockpile erosion and dust from conveyor systems around the site. Fugitive dust emissions during construction are expected to be localized in extent, limited in duration, and smaller in magnitude than those occurring during operation and as such, only potential fugitive dust emissions during operation were quantified. Long term fugitive dust emissions at the site were developed from available data and relevant emission factors.

5.3.1 Ore loading and unloading

Ore will be loaded and unloaded at different locations on the site throughout the operating period. These are referred to as LD1, LD2, LD3, LD4, LD5, LD6, and LD7. Hauling trucks will unload the raw ore from the mine sites at the southern end of the property and processed ore will be loaded onto rail cars at the northern end of the property.

Particulate matter (including PM, PM_{10} and $PM_{2.5}$) is the main air contaminant of concern during ore loading and unloading. Emissions due to ore loading and unloading were calculated using the material transfer equation in the U.S. EPA AP-42 document Chapter 13.2.4 „Aggregate Handling and Storage Piles'. The equation is:

EF = K (0.0016) (U/2.2) 1.3 / (M/2) 1.4

Where: EF = emission factor (kg/megagram);

K = particle size multiplier (1.0 for PM, 0.35 for PM$_{10}$ and 0.11 for PM$_{2.5}$)

U = mean wind speed (4.4 m/s –average from processed meteorological data from Schefferville airport)

M = material moisture content (%).

The corresponding material emission rate was determined by:

Emission Rate (g/s) = EF x MR x (100 – CE) /100

Where: EF = Emission factor, kg/megagram of material handled

MR = Material transfer rate (megagram/s).

CE = Control efficiency %. These operations were conservatively assumed to be uncontrolled.

The material transfer rate was based on the loading and unloading operations occurring for eight months of the year (the operating period). The emission factor calculation methodology has a US EPA data rating of "B" as described in the AP-42 chapter. The emission rate calculation for this source was based on the equipment operating continuously at its maximum production rate. Emissions estimates for all the loading and unloading operations are provided in Table 5-3.

Table 5-3 Estimated Emission Rates from Fugitive Dust Sources – Ore Loading and Unloading

Source ID	Source Description	Contaminant	Emission Rate
LD1	Ore loading - from raw stockpiles to mobile crusher	PM	4.08E-02
		PM$_{10}$	1.43E-02
		PM$_{2.5}$	2.16E-03
LD2	Ore loading - from crushed stockpiles to rail 1 of 5	PM	8.16E-03
		PM$_{10}$	2.86E-03
		PM$_{2.5}$	4.33E-04
LD3	Ore loading - from crushed stockpiles to rail 2 of 5	PM	8.16E-03
		PM$_{10}$	2.86E-03
		PM$_{2.5}$	4.33E-04
LD4	Ore loading - from crushed stockpiles to rail 3 of 5	PM	8.16E-03
		PM$_{10}$	2.86E-03
		PM$_{2.5}$	4.33E-04
LD5	Ore loading - from crushed stockpiles to rail 4 of 5	PM	8.16E-03
		PM$_{10}$	2.86E-03
		PM$_{2.5}$	4.33E-04
LD6	Ore loading - from crushed stockpiles to rail 5 of 5	PM	8.16E-03
		PM$_{10}$	2.86E-03
		PM$_{2.5}$	4.33E-04

Table 5-3 Estimated Emission Rates from Fugitive Dust Sources – Ore Loading and Unloading

Source ID	Source Description	Contaminant	Emission Rate
LD7	Ore loading - from trucks to raw stockpiles	PM	4.08E-02
		PM_{10}	1.43E-02
		$PM_{2.5}$	2.16E-03

5.3.2 Stockpile Wind Erosion

Particulate (including PM, PM_{10} and $PM_{2.5}$) emissions may be generated by wind erosion of uncovered storage piles and exposed areas within the site boundaries. These sources typically are characterized by nonhomogeneous surfaces interspersed with nonerodible elements (particles larger than approximately 1 centimetre in diameter) and are referred to as SP3A, SP3B, SP3C, SP4A, SP4B, SP4C, and SP4D. These material surfaces are characterized by finite availability of erodible material (mass/area) referred to as the erosion potential. Any natural crusting of the surface can bind the erodible material outer layer, which would reduce the erosion potential.

Fugitive dust emissions due to wind erosion on the different ore stockpiles at the site were estimated based on emission estimation methodology and related emission factors in Chapter 13.2.5 of U.S. EPA AP-42 entitled „Industrial Wind Erosion'. At both James and Redmond properties, there are existing stockpiles that were left behind by previous mining operations. As crusting of the existing stockpile surfaces will occur over time, they were not considered significant sources for the purposes of this assessment.

The emission rate calculations for these sources are based on the maximum size of the stockpiles and the calculated emission rate should be conservative.

The emission factor for wind erosion is expressed as:

$$\mathbf{EF = k \times N \times [58(u - u_t)^2 + 25(u-u_t)]}$$

Where: EF = Emission factor, g/m2

k = Particle size multiplier

N = Number of times the surface material is disturbed in a given time period

u = Friction velocity, m/s

u_t = Threshold friction velocity, m/s

The corresponding erosion emission rate for a given unit of time is determined by:

Emission Rate = EF x Surface area of exposed material

The following parameters were used for this equation:

- Particle Size Coefficients (k):

PM = 1.0

PM_{10} = 0.5

$PM_{2.5}$ = 0.075

- N = 360 (conservatively assumed a pile active area is available is available at least 1.5 times each day during the annual operating period).
- u_t = the threshold friction velocity stipulates the minimum wind speed required to scavenge particulate matter into the air, and can be estimated from the dry aggregate structure of the surface material. A threshold friction velocity of 1.33 m/s for the raw ore piles and 1.12 m/s for the processed ore piles was used.
- u = the friction velocity was calculated from the maximum gust wind speed observed at the Schefferville airport during 2006. A value of 1.22 m/s was used.
- Surface area of exposed material – conservatively estimated the actual area of the piles using length and width as opposed to length and height.

Emissions estimates for these sources are provided in Table 5-4.

Table 5-4 Estimated Emission Rates from Fugitive Dust Sources – Stockpile Wind Erosion

Source ID	Source	Dimension of Pile[1]		Assumed Surface Area (m^2)	Threshold Friction Velocity[2] – U_t* (m/s)	Estimated Emission Rate (g/s)		
		Length (m)	Width (m)			PM	PM_{10}	$PM_{2.5}$
SP1	Blue Ore Pile	65	35	2275	1.33	0	0	0
SP2	Red Ore Pile	65	35	2275	1.33	0	0	0
SP3	Lump Ore Stockpile	75	25	1875	1.12	1.04E-01	5.20E-02	7.80E-03
SP4	Sinter Fines Stockpile	50	25	1250	1.12	6.93E-02	3.47E-02	5.20E-03

Notes:

1. The stockpile dimensions were estimated based on the site plans provided by LIM.
2. Data from Section 13.2.5 of US EPA AP-42 (scoria and uncrusted coal pile data was used).

5.3.3 Primary and Secondary Crushing

Dust emissions from the primary mobile crusher and from the secondary crushing (CR1 and DC1) occurring in the beneficiation area will occur whenever the equipment is operating at the facility. Dust levels from both crushers will be minimized through the use of control equipment (dust collectors). The emission rate calculations for these sources are based on the total annual ore production at the facility (1,500,000 tonnes) and the calculated emission rate is therefore conservative.

Fugitive dust emissions due to primary and secondary crushing at the site were estimated based on emission estimation methodology and related emission factors in Chapter 11.24 of U.S. EPA AP-42 entitled „Metallic Minerals Processing. PM and PM_{10} emissions from the mobile crusher (CR1) were estimated using the emission factors for „Primary Crushing of High-moisture Ore'. The PM and PM_{10} emissions from the processing building crusher (DC1) were estimated using the emission factors for „Secondary Crushing of High-moisture Ore'. The $PM_{2.5}$ emissions for both sources were estimated on a $PM_{2.5}$ to PM_{10} multiplier for „Construction Operations' from the U.S. EPA document „Examination of the Multiplier Used to Estimate $PM_{2.5}$ Fugitive Dust Emissions from PM_{10}" (U.S. EPA, 2005). Dust control efficiency data for the emissions from the secondary crushing area was assumed to be 90%, which is conservative. No information was available in regards to the type of control that will be used in conjunction with the primary crusher. Emissions were conservatively estimated assuming no controls in place.

Emissions estimates for these sources are provided in Table 5-5.

Table 5-5 Estimated Emission Rates from Fugitive Dust Sources – Primary and Secondary Crusher

Source ID	Process Description	Control Efficiency	PM Emission Factor	PM Emission Rate	PM_{10} Emission Factor	PM_{10} Emission Rate	$PM_{2.5}$ Emission Factor	$PM_{2.5}$ Emission Rate
			kg/Mg	g/s	kg/Mg	g/s	kg/Mg	g/s
CR1	Mobile Crushing/Screening	0	1.00E-02	7.23E-01	4.00E-03	2.89E-01	8.00E-04	5.79E-02
DC1	Enclosed Crushing/Screening	90	3.00E-02	2.17E-01	1.20E-02	8.68E-02	2.40E-03	1.74E-02

Notes:
The control efficiency for DC 1 was assumed.
Emission Factors for high-moisture content ore (greater than 4%) were used from Sec 11.24 of U.S. EPA AP-42 (Table 11.24-1)

5.3.4 Conveying Systems

Dust emissions from the conveying systems in use at the site will occur whenever the equipment is operating at the facility. These are referred to as CON1, CON2, CON3, CON4, CON5, CON6, CON7, CON8, CON9, and CON10. Dust levels from the conveyors will be minimized through the use of control equipment (coverings and water suppression). The emission rate calculations for these sources are based on the total annual ore production at the facility (1,500,000 tonnes) and the calculated emission rate are therefore expected to be conservative.

Fugitive dust emissions due to the sue of conveyors at the site were estimated based on emission estimation methodology and related emission factors in Chapter 11.24 of U.S. EPA AP-42 entitled „Metallic Minerals Processing. PM and PM_{10} emissions from the conveyors were estimated using the emission factors for „Material Handling and Transfer – all minerals except bauxite'. The $PM_{2.5}$ emissions for the conveyors were estimated on a $PM_{2.5}$ to PM_{10} multiplier for „Construction Operations' from the U.S. EPA document „Examination of the Multiplier Used to Estimate $PM_{2.5}$ Fugitive Dust Emissions from PM_{10}" (U.S. EPA, 2005). Although water suppression will be used for the conveyors between the mobile crusher and the processing building and coverings may be used for the other conveyors on site, fugitive dust emissions from all conveying systems were conservatively estimated assuming no control systems.

Emissions estimates for these sources are provided in Table 5-6.

Table 5-6 Estimated Emission Rates from Fugitive Dust Sources – Conveying Systems

Source ID	Process Description	PM Emission Factor	PM Emission Rate	PM_{10} Emission Factor	PM_{10} Emission Rate	$PM_{2.5}$ Emission Factor	$PM_{2.5}$ Emission Rate
		kg/Mg	g/s	kg/Mg	g/s	kg/Mg	g/s
CON1/ CON2/ CON3/ CON4/ CON5/	Conveyor - Sinter fines conveyor	5.00E-03	2.17E-01	2.00E-03	8.68E-02	4.00E-04	1.74E-02
	Conveyor - Lump ore conveyor	5.00E-03	5.43E-02	2.00E-03	2.17E-02	4.00E-04	4.34E-03
CON6/ CON7/ CON8/ CON9/ CON10/	Conveyor - Mobile Crusher to Crushing Building	5.00E-03	3.62E-01	2.00E-03	1.45E-01	4.00E-04	2.89E-02

Notes:
The source IDs for the conveyor systems between the processing building and the ore stockpiles were combined for use in the CALPUFF model. The emissions presented for each process were divided into the separate sources for modelling.
Emission Factors for high-moisture content ore (greater than 4%) were used from Sec 11.24 of U.S. EPA AP-42 (Table 11.24-1)

5.3.5 On-Site Traffic other than Ore Hauling

Fugitive dust emissions due to on-site traffic would be proportional to the amount of property disturbed and the frequency of disturbance. The fugitive dust emissions from on-site traffic are not considered to be substantive compared to the other activities occurring at the facility during operation.

5.3.6 Ore Hauling from Mine Site to Beneficiation Area

Emissions from the ore hauling activities are similar to the potential emissions due to on-site traffic as discussed above.

Dust emissions would occur along the haul routes between the James or Redmond mine areas and the beneficiation area. These are all existing dirt roads and would be prone to dust emissions from any type of vehicle traffic. When a vehicle travels along an unpaved road, the vehicle's wheels travelling on the road generate dust which is then lifted and exposed to passing winds.

Emissions due to ore hauling were estimated using standard techniques including equations found in the US EPA's AP-42 guidance documents. Fugitive dust emission estimates varied from 221 – 325 kg/day for the one kilometre hauling route between the James deposit and the beneficiation area and 2869 – 4225 kg/day for the thirteen kilometre hauling route between the Redmond deposit and the beneficiation area.

A small on-property section was used for modelling purposes. Emissions from a road, approximately 250 m in length, were developed to include in the model.

Particulate matter (including PM_{10} and $PM_{2.5}$) is the main contaminant of concern for this on-site travel. Emission factors for this source were calculated using equation (1) in U.S. EPA AP-42, Chapter 13.2 „Unpaved Roads'. The equation is:

$$\mathbf{EF = k\ (s/12)^a\ (W/3)^b}$$

Where:

k, a, b, c and d are empirical constants;

EF = size-specific emission factor (lb/VMT) (1 lb/VMT = 281.9 g/VKT) ;

s = surface material silt content (%) ;

W = mean vehicle weight (tons).

The corresponding material emission rate was determined by:

Emission Rate (g/s) = EF x TD x (100 – CE) /100 x # trips/day

Where: EF = general emission factor, kg/vehicle km travelled

TD = Travel distance (km). A one-way travel distance of 250 m was estimated from the site plan.

CE = control efficiency %. No control was assumed to be conservative in the emissions estimates.

Emissions estimates for this road source are included in Table 5-7.

Table 5-7 Estimated Emission Rates from Fugitive Dust Sources – Road Dust

Contaminant	Assumed Road Length - One Way Trip	Total Emissions	Short-Term Emission Rate
	(km)	(kg/day)	(g/s)
PM	0.25	81	9.40E-01
PM_{10}	0.25	20	2.34E-01
$PM_{2.5}$	0.25	2	2.34E-02

5.3.7 Ore Mining

Potential fugitive dust emissions due to the mining operations at the James and Redmond deposits include emissions from loading and blasting operations.

Fugitive dust emissions from loading operations depend on the condition of the storage piles being disturbed. When freshly processed material is loaded onto a pile, there is a greater potential of fine particulate emissions. Over time, as the pile is weathered, or if the material has a high moisture content, potential emissions will be greatly reduced. Other factors influencing fugitive dust emissions during loading and unloading include the frequency of the operation and the local meteorological conditions, including wind speed, humidity, precipitation, and temperature.

The removal of ore and surrounding waste rock involves drilling and blasting. A dust cloud is produced during blasting. Due to the nature of open pit mining, the dust cloud will partially be retained in the pit, although some portion of it will rise out into the local surroundings. However, it should be noted that the elevated levels of particulate matter will be limited in spatial extent and short lived, as the majority of the fugitive dust will settle within a short distance (contained within the pit). Also, based on field investigations to-date, only periodic blasting is expected to be required at the sites. LIM will be following an explosive management program which will consider both safety and environmental factors prior to blasting. Emission estimation methods for blasting operations are available, but not specifically for iron ore mining. As blasting activities at James and Redmond will be infrequent due to the nature of the deposits and the seasonal nature of the operation, estimates were not developed for either deposit.

5.4 Miscellaneous Emissions

5.4.1 Storage Tanks

Volatile organic compounds (VOCs) can be emitted to the atmosphere from storage tanks as a result of both standing and working losses. Standing (breathing) losses are mainly due to evaporation in the tanks and depend on physical tank properties as well as local meteorological conditions. Working losses can occur during filling and drawing of tank products. Emissions due to standing losses and working losses from storage tanks at the primary beneficiation area are not expected to be substantive as the contents will have relatively low vapour pressures (diesel and heavy oil) and were therefore not estimated for the purposes of this assessment.

5.5 Summary of Emissions Considered in Dispersion Modelling

Based on the emissions estimated developed for the sources at the LIM site, some sources were combined and included as volume sources in the CALPUFF model, while others were modelled as point sources. A list of the point sources modelled in this assessment is included in Table 5-8 and a list of volume sources is included in Table 5-9.

Table 5-8 Point Sources used in the CALPUFF Model

Stack ID	Stack Description	Contaminant	Emission Rate (g/s)	Stack Height above building (m)[1]	Release Height Above Ground (m)[1]	Stack Exit Temperature (K)[1]	Stack Exit Velocity (m/s)[1]	Stack Diameter (m)[1]
STCK1	Boiler stack	NO$_X$	2.1E-01	1	33.4	423	25	0.9
		CO	1.1E-01					
		PM	4.3E-02					
		SO$_2$	1.7E-01					
		PM$_{10}$	2.1E-02					
		PM$_{2.5}$	5.4E-03					
GEN1	Generator 1	NO$_X$	1.6E+00	1	6	423	25	0.2
		CO	7.0E-01					
		PM	8.9E-02					
		SO$_2$	4.1E-01					
		VOC	8.9E-02					
		PM$_{10}$	7.3E-02					
		PM$_{2.5}$	7.1E-02					

Table 5-8 Point Sources used in the CALPUFF Model

Stack ID	Stack Description	Contaminant	Emission Rate (g/s)	Stack Height above building (m)[1]	Release Height Above Ground (m)[1]	Stack Exit Temperature (K)[1]	Stack Exit Velocity (m/s)[1]	Stack Diameter (m)[1]
GEN2	Generator 2	NO$_X$	1.6E+00	1	6	423	25	0.2
		CO	7.0E-01					
		PM	8.9E-02					
		SO$_2$	4.1E-01					
		VOC	8.9E-02					
		PM$_{10}$	7.3E-02					
		PM$_{2.5}$	7.1E-02					
GEN3	Generator 3	NO$_X$	1.6E+00	1	6	423	25	0.2
		CO	7.0E-01					
		PM	8.9E-02					
		SO$_2$	4.1E-01					
		VOC	8.9E-02					
		PM$_{10}$	7.3E-02					
		PM$_{2.5}$	7.1E-02					
DC1	Dust Collector	PM	2.2E-01	1	33.4	AMB	10	0.5
		PM$_{10}$	8.7E-02					
		PM$_{2.5}$	1.7E-02					

Table 5-9 Volume Sources used in the CALPUFF Model

Source ID	Source Description	Contaminant	Emission Rate
SP4A	Sinter fine stockpile 1 of 4	PM	1.73E-02
		PM$_{10}$	8.67E-03
		PM$_{2.5}$	1.30E-03
SP4B	Sinter fine stockpile 2 of 4	PM	1.73E-02
		PM$_{10}$	8.67E-03
		PM$_{2.5}$	1.30E-03
SP4C	Sinter fine stockpile 3 of 4	PM	1.73E-02
		PM$_{10}$	8.67E-03
		PM$_{2.5}$	1.30E-03
SP4D	Sinter fine stockpile 4 of 4	PM	1.73E-02
		PM$_{10}$	8.67E-03
		PM$_{2.5}$	1.30E-03
SP3A	Lump ore stockpile 1 of 3	PM	3.47E-02
		PM$_{10}$	1.73E-02
		PM$_{2.5}$	2.60E-03
SP3B	Lump ore stockpile 2 of 3	PM	3.47E-02
		PM$_{10}$	1.73E-02
		PM$_{2.5}$	2.60E-03
SP3C	Lump ore stockpile 3 of 3	PM	3.47E-02
		PM$_{10}$	1.73E-02
		PM$_{2.5}$	2.60E-03

Table 5-9 Volume Sources used in the CALPUFF Model

Source ID	Source Description	Contaminant	Emission Rate
LD1	Ore loading - from raw stockpiles to mobile crusher	PM	4.08E-02
		PM_{10}	1.43E-02
		$PM_{2.5}$	2.16E-03
CR1	Mobile crusher	PM	7.23E-01
		PM_{10}	2.89E-01
		$PM_{2.5}$	5.79E-02
LD2	Ore loading - from crushed stockpiles to rail 1 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD3	Ore loading - from crushed stockpiles to rail 2 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD4	Ore loading - from crushed stockpiles to rail 3 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD5	Ore loading - from crushed stockpiles to rail 4 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
LD6	Ore loading - from crushed stockpiles to rail 5 of 5	PM	8.16E-03
		PM_{10}	2.86E-03
		$PM_{2.5}$	4.33E-04
CON1	Conveyor from crushing building to crushed stockpiles 1 of 5	PM	5.43E-02
		PM_{10}	2.17E-02
		$PM_{2.5}$	4.34E-03
CON2	Conveyor from crushing building to crushed stockpiles 2 of 5	PM	5.43E-02
		PM_{10}	2.17E-02
		$PM_{2.5}$	4.34E-03
CON3	Conveyor from crushing building to crushed stockpiles 3 of 5	PM	5.43E-02
		PM_{10}	2.17E-02
		$PM_{2.5}$	4.34E-03
CON4	Conveyor from crushing building to crushed stockpiles 4 of 5	PM	5.43E-02
		PM_{10}	2.17E-02
		$PM_{2.5}$	4.34E-03
CON5	Conveyor from crushing building to crushed stockpiles 5 of 5	PM	5.43E-02
		PM_{10}	2.17E-02
		$PM_{2.5}$	4.34E-03
CON6	Conveyor from mobile crusher to crushing building 1 of 5	PM	7.23E-02
		PM_{10}	2.89E-02
		$PM_{2.5}$	5.79E-03
CON7	Conveyor from mobile crusher to crushing building 2 of 5	PM	7.23E-02
		PM_{10}	2.89E-02
		$PM_{2.5}$	5.79E-03

Table 5-9 Volume Sources used in the CALPUFF Model

Source ID	Source Description	Contaminant	Emission Rate
CON8	Conveyor from mobile crusher to crushing building 3 of 5	PM	7.23E-02
		PM_{10}	2.89E-02
		$PM_{2.5}$	5.79E-03
CON9	Conveyor from mobile crusher to crushing building 4 of 5	PM	7.23E-02
		PM_{10}	2.89E-02
		$PM_{2.5}$	5.79E-03
CON10	Conveyor from mobile crusher to crushing building 5 of 5	PM	7.23E-02
		PM_{10}	2.89E-02
		$PM_{2.5}$	5.79E-03
LD7	Ore loading - from trucks to raw stockpiles	PM	4.08E-02
		PM_{10}	1.43E-02
		$PM_{2.5}$	2.16E-03
N/A	Road source - 64 volume sources	PM	1.47E-02
		PM_{10}	3.66E-03
		$PM_{2.5}$	3.66E-04

6.0 DISPERSION MODELLING METHODOLOGY

6.1 Introduction

The US EPA CALPUFF modelling system was used to predict maximum ground-level concentrations due to Project-related emissions. The core of this system consists of a meteorological model CALMET, and a transport and dispersion model CALPUFF.

The CALMET meteorological model is used to provide the meteorological data necessary to initialize the CALPUFF dispersion model. This model is initialized with terrain and land use data describing the region of interest, as well as meteorological input from potentially numerous sources. Various user-defined parameters control both how the input meteorological data is interpolated to the grid, as well as which internal algorithms are applied to these input fields. Output from the CALMET model includes hourly temperature and wind fields on a user-specified three-dimensional domain as well as additional two-dimensional variables used by the CALPUFF dispersion model.

CALPUFF is a non-steady-state Gaussian puff dispersion model capable of simulating the effects of time and space-varying meteorological conditions on pollutant transport, transformation, and removal. This model requires time-variant two- and three-dimensional meteorological data output from a model such as CALMET, as well as information regarding the relative location and nature of the sources to be modelled for the application. Output from the CALPUFF model includes ground-level concentrations of the species considered.

The following sections describe in detail the methodology used to conduct the dispersion modeling, including a summary of input data sources and data selected.

6.2 CALMET Meteorological Modelling

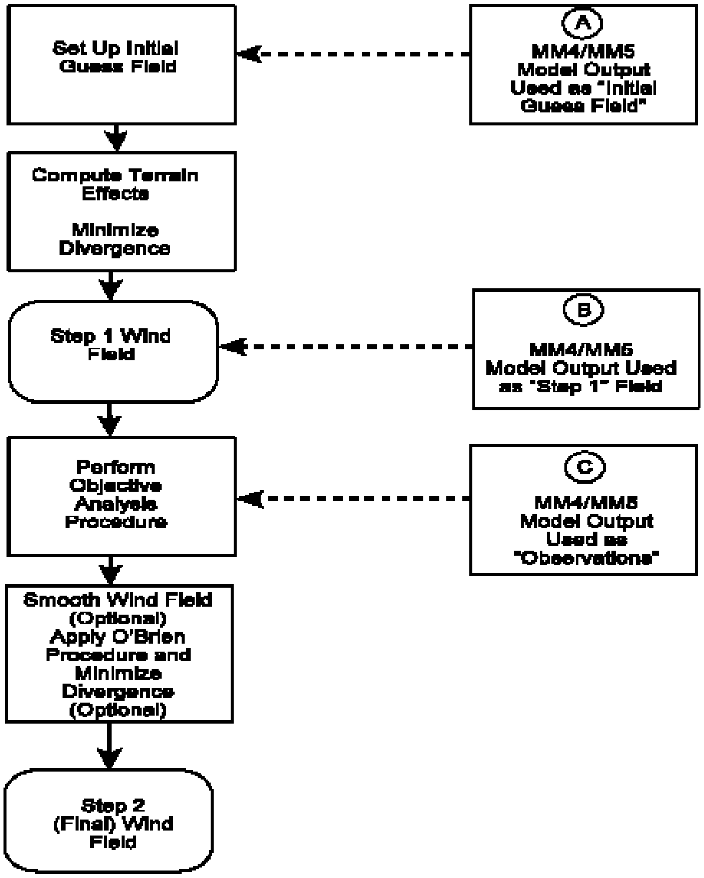
6.2.1 Model Description

The following description of the CALMET model's major model algorithms and options are all excerpts from the CALMET model's user manual (Scire et al. 2000a).

The CALMET meteorological model consists of a diagnostic wind field module and micrometeorological modules for overwater and overland boundary layers. The diagnostic wind field module uses a two-step approach to the computation of the wind fields (Douglas and Kessler 1988), as illustrated in Figure 6-1.

In the first step, an initial guess wind field is adjusted for kinematic effects of terrain, slope flows, and terrain blocking effects to produce a Step 1 wind field. The initial guess field is either a uniform field based on available observational data or the output from the NCAR/PSU Mesoscale Modelling System (MM4/MM5). The second step consists of an objective analysis procedure to introduce observational data into the Step 1 wind field to produce a final wind field. An option is provided to allow gridded prognostic wind fields to be used by CALMET, which may better represent regional flows and certain aspects of slope/valley circulations. Wind fields generated by the prognostic wind field module can be input to CALMET as either the initial guess field or the Step 1 wind field.

Figure 6-1 Flow Diagram of Diagnostic Wind Module in CALMET



Source: Scire et al. 2000a

6.2.1.1 Diagnostic Wind Field Module

Initial Guess Field

Options existing with CALMET to create an initial guess field either by interpolating observation data or by using output from a prognostic meteorological model, such as the NCAR/PSU Mesoscale Modelling System (MM4/MM5). The prognostic model data is usually run over a very large domain with much coarser resolution than that applied with CALMET. The advantage of using CALMET is that it can be used to interpolate the prognostic data to develop a 3-D fine scale first guess field of wind speeds and directions.

Step 1 Wind Field

The step one wind field is adjusted for kinematic effects of terrain, slope flows, and blocking effects as follows:

Kinematic Effects of Terrain: The approach of Liu and Yocke (1980) is used to evaluate kinematic terrain effects. The domain scale winds are used to compute a terrain forced vertical velocity, subject to an exponential, stability dependent decay function. The kinematic effects of terrain on the horizontal wind components are evaluated by applying a divergence minimisation scheme to the initial guess wind field. The divergence minimisation scheme is applied iteratively until the three dimensional divergence is less than a threshold value.

Slope Flows: An empirical scheme based on Allwine and Whiteman (1985) is used to estimate the magnitude of slope flows in complex terrain. The slope flow is parameterised in terms of the terrain slope, terrain height, domain scale lapse rate, and time of day. The slope flow wind components are added to the wind field adjusted for kinematic effects.

Blocking Effects: The thermodynamic blocking effects of terrain on the wind flow are parameterised in terms of the local Froude number (Allwine and Whiteman 1985). If the Froude number at a particular grid point is less than a critical value and the wind has an uphill component, the wind direction is adjusted to be tangent to the terrain.

Step 2 Wind Field

The wind field resulting from the adjustments of the initial guess wind described above is the Step 1 wind field. The second step of the procedure involves the introduction of observational data into the Step 1 wind field through an objective analysis procedure. An inverse distance squared interpolation scheme is used which weighs observational data heavily in the vicinity of the observational station, while the Step 1 wind field dominates the interpolated wind field in regions with no observational data. The resulting wind field is subject to smoothing, an optional adjustment of vertical velocities based on the O'Brien (1970) method, and divergence minimisation to produce a final Step 2 wind field.

6.2.1.2 Micrometeorology Modules

The CALMET model contains two boundary layer models for application to overland and overwater grid cells:

Overland Boundary Layer Model: Over land surfaces, the energy balance method of Holtslag and van Ulden (1983) is used to compute hourly gridded fields of the sensible heat flux, surface friction velocity, Monin Obukhov length, and convective velocity scale. Mixing heights are determined from the computed hourly surface heat fluxes and observed temperature soundings using a modified Carson (1973) method based on Maul (1980). The model also determines gridded fields of PGT stability class and optional hourly precipitation rates.

Overwater Boundary Layer Model: The aerodynamic and thermal properties of water surfaces suggest that a different method is best suited for calculating the boundary layer parameters in the marine environment. A profile technique (Garratt 1977; Hanna et al. 1985), using air sea temperature differences, is used in CALMET to compute the micrometeorological parameters in the marine boundary layer.

6.2.2 Meteorological Modelling Domain

The CALMET meteorological domain adopted for this project is summarized below in Table 6-1. A map of the approximate area covered by the modelling domain is presented in Figure 2-1.

Table 6-1 Map Projections and Horizontal Grid Parameters

Parameter	Value
Map Projection	UTM
UTM Zone	19N
Datum	WGS-84
Number of Grid Cells (nx,ny)	60, 60
SW Corner (x,y)	623 km, 6,060 km
Grid Spacing	0.5 km

As discussed in Section 2, the meteorological domain was selected to cover the region surrounding the proposed beneficiation area and ore mines as well as nearby sensitive receptor locations. To adequately resolve the terrain and land use features of the region, a 0.5 km grid was chosen for the CALMET modelling.

Eight vertical levels were used to model the atmosphere up to a maximum cell face height of 3300 m above ground level. Cell mid-points were chosen at heights of 20, 50,100, 200, 500,1000, 2000, 3300 m above ground to allow for higher resolution in the layers nearest to the earth's surface than in the levels aloft.

6.2.3 Study Period

The Newfoundland and Labrador Guidance for Plume Dispersion Modelling (NL DEC 2006) requires a minimum period of three years to be considered when conducting dispersion modelling and no reliable source of on-site data is available. For this application, the CALMET meteorological model was run from January 1, 2002 to December 31, 2006. Five years of meteorological data were considered to depict a wide range of meteorological conditions and associated dispersive conditions.

6.2.4 Geophysical Input Data

To initialize the CALMET model, terrain elevation and land use data depicting the geophysical conditions in the selected modelling domain are required. Terrain elevation data is used in CALMET in various model algorithms to characterize meteorological phenomena such as up- and down-slope flows and the terrain-steering of winds. In addition to the terrain elevation data, the CALMET model utilizes surface parameters such as surface roughness length, albedo, Bowen ratio, leaf area index, soil heat flux, and anthropogenic heat flux to estimate meteorological parameters such as surface heat flux and mechanical turbulence. In the model's geophysical pre-processor MAKEGEO, values for each of these surface parameters are specified based on input land use categories.

6.2.4.1 Terrain Data

For the CALMET model grid considered in this study, terrain elevations were initialized with data from the Shuttle Radar Topography Mission (SRTM). This data, a preliminary product from a joint project between the US National Aeronautics and Space Administration (NASA) and the US National Geospatial-Intelligence Agency (NGA), is available at 3 arc-second (approximately 90 m) resolution for the continent of North America (USGS 2007). The SRTM data was processed by the CALPUFF pre-processor TERREL over the domain of interest to approximate terrain elevations at 0.5 km resolution over the modeling domain.

After processing, the prepared terrain data was compared with local topography maps and satellite imagery to assure quality. The agreement between these data sets was found to be reasonable.

The terrain elevations used as input for CALMET (gridded at 500 m resolution) are shown in Figure 6-2. The proposed Labrador Iron Mines plant is located about 2.3 km southeast of Schefferville. The terrain in the immediate vicinity of the site location can be considered complex, with elevation in the CALMET domain range from approximately 500 to 620 meters above sea level (masl).

6.2.4.2 Land Use Data

Natural Resources Canada's Earth Observation for Sustainable Development of Forests (EOSD) dataset (NRC 2008), with a resolution of approximately 50 m, was used to estimate the dominant land use categories in the CALMET modelling. This high resolution dataset contains detailed information on forest crown closure and is an appropriate input for conducting dispersion modelling in rural/pristine environments. The land use data was rasterized (gridded) at 500 m resolution, exported to a text format, then mapped to the CALMET land use categories and converted into a fraction land use format accepted by the model. The final CALMET land use categories used as input to the model are shown at 500 m resolution in Figure 6-3.

A summary of the mapping from the EOSD land use categories to the CALMET (USGS) land use categories is provided in Table 2-3. All available EOSD land use categories were mapped to existing CALMET categories except for the „Coniferous Open' category (212), which was mapped to a mixed forest/tundra category based on consultation with the NL DOE (Lawrence 2008). The surface parameters defined for this user-specified land-use category as well as the default parameters specified for the CALMET land use categories are provided in Table 2-4.

As no Project operations are planned during the winter time (November – March), a winter land use scenario was not required for this application.

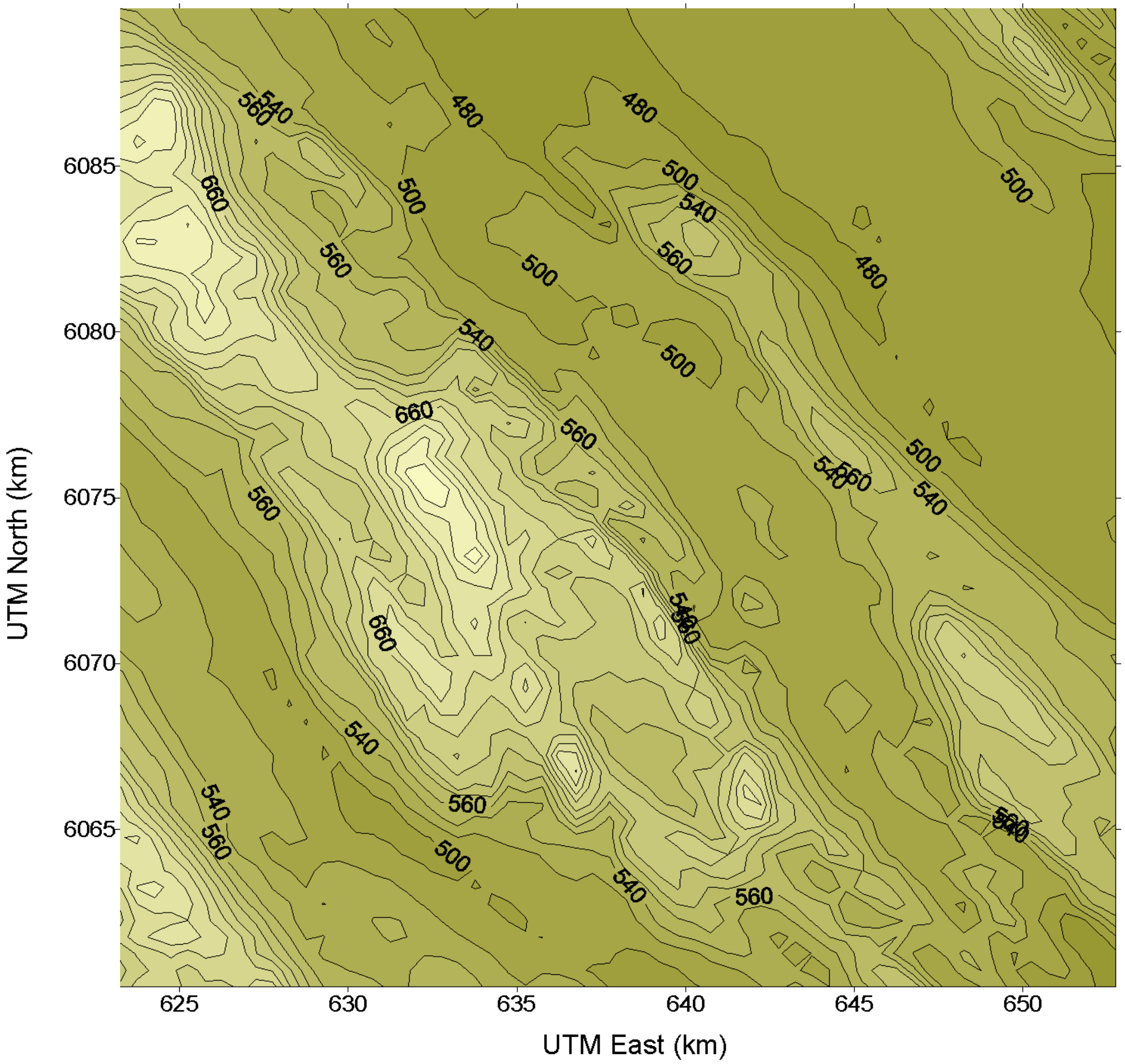


FIGURE 6-2

Terrain Elevations Over the Modeling Domain

Map Parameters
Projection: UTM
Datum: NAD 83
Zone: 19
Map Units: km
Date: 8/14/2009
Project: 1046156

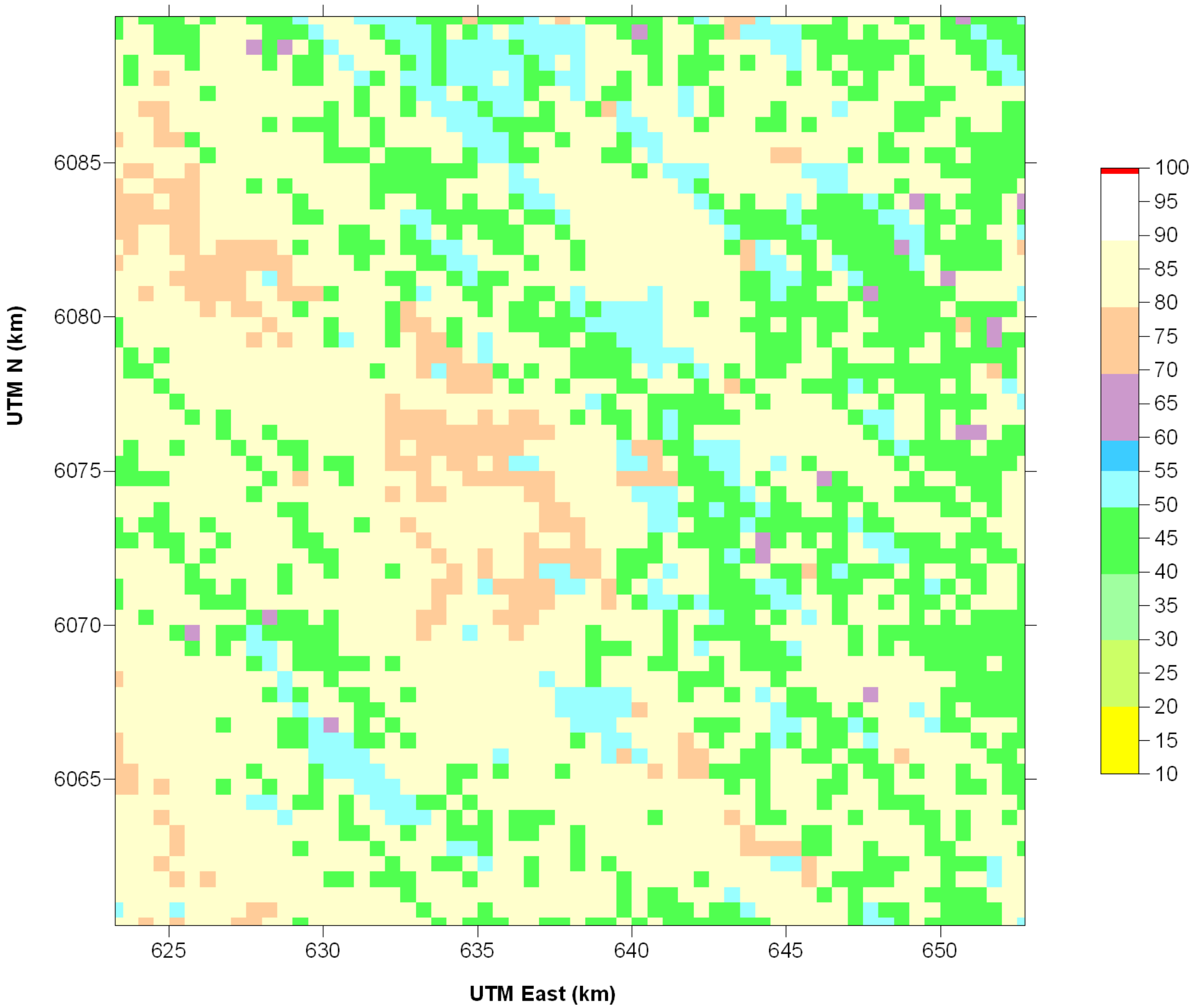


FIGURE 6-3

Dominant CALMET Land Use Categories over the Modeling Domain

Map Parameters
Projection: UTM
Datum: NAD 83
Zone: 19
Map Units: km
Date: 8/14/2009
Project: 1046156

Table 6-2 EOSD to CALMET Land Use Mapping

EOSD Land Cover Classification		CALMET (USGS) Land Use Classification	
Code	**Description**	**Code**	**Description**
20	Water: Lakes, reservoirs, rivers, streams, or salt water.	52	Lakes, streams
32	Rock/Rubble: Bedrock, rubble, talus, blockfield, rubbley mine spoils, or lava beds	77	Mixed barren land
33	Exposed Land: River sediments, exposed soils, pond or lake sediments, reservoir margins, beaches, landings, buildings and parking or other non-vegetated surfaces, burned areas, road surfaces, mudflat sediments, cutbanks, moraines, gravel pits, tailings, railway surfaces,	77	Mixed barren land
40	Bryoids: Bryophytes (mosses, liverworts, and hornworts) and lichen (foliose or fruticose; not crustose); minimum of 20% ground cover or one-third of total vegetation must be a bryophyte or lichen.	85	Mixed tundra
52	Shrub Low: At least 20% ground cover which is at least one-third shrub; average shrub height less than 2 m.	81	Shrub and brush tundra
82	Wetland-Shrub: Land with a water table near/at/above soil surface for enough time to promote wetland or aquatic processes; the majority of vegetation is tall, low, or a mixture of tall and low shrub.	61	Forested wetland
211	Coniferous Dense: Greater than 60% crown closure; coniferous trees are 75% or more of total basal area.	42	Evergreen forest land
212	Coniferous Open: 26-60% crown closure; coniferous trees are 75% or more of total basal area.	43	User Defined (redefined surface parameters to be 1/2 tundra and 1/2 forest)
213	Coniferous Sparse: 10-25% crown closure; coniferous trees are 75% or more of total basal area.	81	Shrub and brush tundra

Table 6-3 Surface Characteristics for CALMET Land Use Categories

Land Use Category	Input Category ID	z_0 (m)	Albedo	Bowen Ratio	Soil Heat Flux (W/m2)	Anthropogenic Heat Flux (W/m2)	Leaf Area Index	Category
Residential	11	0.5	0.18	1	0.2	0	1	10
Other Urban	12	1	0.18	1.5	0.25	0	0.2	10
	13	1	0.18	1.5	0.25	0	0.2	10
	14	1	0.18	1.5	0.25	0	0.2	10
	15	1	0.18	1.5	0.25	0	0.2	10
	16	1	0.18	1.5	0.25	0	0.2	10
	17	1	0.18	1.5	0.25	0	0.2	10
Agricultural	21	0.25	0.15	1	0.15	0	3	20
	22	0.25	0.15	1	0.15	0	3	20
	23	0.25	0.15	1	0.15	0	3	20
	24	0.25	0.15	1	0.15	0	3	20
Rangeland	31	0.05	0.25	1	0.15	0	0.5	30
	32	0.05	0.25	1	0.15	0	0.5	30
	33	0.05	0.25	1	0.15	0	0.5	30
Forestland – Deciduous	41	1	0.1	1	0.15	0	7	40
Forestland – Coniferous	42	1	0.1	1	0.15	0	7	40
User Defined: Mixed forest land (0.5 tundra, 0.5 forest)	43	0.6	0.2	0.75	0.15	0	7	40
Freshwater	51	0.001	0.1	0	1	0	0	51
	52	0.001	0.1	0	1	0	0	51
	53	0.001	0.1	0	1	0	0	51
Bays and Estuaries	54	0.001	0.1	0	1	0	0	54
Ocean and Sea	55	0.001	0.1	0	1	0	0	55
Wetland - Forested	61	1	0.1	0.5	0.25	0	2	61
Wetland - Non-forested	62	0.2	0.1	0.1	0.25	0	1	62
Barren land	71	0.05	0.3	1	0.15	0	0.05	70
	72	0.05	0.3	1	0.15	0	0.05	70
	73	0.05	0.3	1	0.15	0	0.05	70
	74	0.05	0.3	1	0.15	0	0.05	70
	75	0.05	0.3	1	0.15	0	0.05	70
	76	0.05	0.3	1	0.15	0	0.05	70
	77	0.05	0.3	1	0.15	0	0.05	70
Tundra	81	0.2	0.3	0.5	0.15	0	0	80
	82	0.2	0.3	0.5	0.15	0	0	80
	83	0.2	0.3	0.5	0.15	0	0	80
	84	0.2	0.3	0.5	0.15	0	0	80
	85	0.2	0.3	0.5	0.15	0	0	80
Perennial Snow/Ice	91	0.05	0.7	0.5	0.15	0	0	90
	92	0.05	0.7	0.5	0.15	0	0	90

6.2.5 Meteorological Input Data

The CALMET model requires the input of surface and upper air meteorological fields. For this application, CALMET was initialized with surface station information from two surface weather stations one upper-air station over the five year period (2002-2006).

6.2.5.1 Surface Station Input

Hourly observed surface meteorological data were obtained from Environment Canada (EC) and used to initialize CALMET. As shown in Table 6-4, two EC weather stations (Schefferville Airport and Wabush Airport) were used to initialize CALMET. As the Schefferville Airport is relatively close (approximately 3 km) from the primary beneficiation area, and as the dataset over the period is relatively complete, CALMET was initialized by the surface meteorological information the majority of the time. During periods with missing (or calm) data, wind information from Wabush Airport (more than 200 km away) was considered as input. Figure 6-4 below shows the location of the Shefferville Airport relative to Project activities.

Table 6-4 Input Surface Meteorological Stations

Station Name	Type	Easting (km)	Northing (km)	Elevation (masl)	Surface Input Data Used
Schefferville Airport	EC	640.284	6074.848	521.8	Temperature, Wind Speed & Direction, Cloud Cover & Ceiling Height, Station Pressure, Relative Humidity
Wabush Airport	EC	643.38	5866.985	551.1	Temperature, Wind Speed & Direction, Cloud Cover & Ceiling Height, Station Pressure, Relative Humidity

For all input surface station data, quality analysis of the data was performed. For periods with calm winds or missing data, the following protocols were followed:

1) For periods with winds below the threshold of the anemometer, wind directions and speeds were marked as missing. Wind speeds and directions during such periods were thus calculated within CALMET using data from other nearby surface stations.
2) No data fills were required for periods with missing hourly data or missing fields for non-missing records. This is because CALMET requires only one non-missing value for each mandatory input surface meteorological field. In other words, the required surface input data was available from at least one station for each hour of period of interest.

Wind direction and wind speed play an important role in determining the overall transport of airborne pollutants. The hourly surface winds (from 2002 to 2006) from the two weather stations used as input in the CALMET modelling are summarized in the wind rose plots shown in Figure 6-5 below. Wind roses are an efficient and convenient means of presenting wind data. The length of the radial barbs gives the total percent frequency of winds from the indicated direction, while portions of the barbs of different widths indicate the frequency of associated wind speed categories. Note that periods with calm winds cannot be included in these diagrams as such periods often do not have valid measurement for wind direction.

As can be seen in Figure 6-5, wind patterns in the study region can vary considerably due to differences in factors such as synoptic meteorology (large-scale weather trends), terrain, and local surface characteristics. The Schefferville Airport meteorological station, which is the surface station nearest to Project activities, shows a higher proportion of winds from the west, north west, and south. For the other surface meteorological station considered (Wabush Airport), the dominant wind directions are from the west and from the south.

The „Radius of Influence' parameters in CALMET allow the user to specify weightings which control the influence of the input surface winds when the observations are merged with the „Step 1 Wind Field' (see Section 6.1). If the radii of influence are set to higher numbers, winds will be more spatially homogeneous near input stations and more directly reflect the observed surface stations values. If the radii of influence are set to lower numbers, more weighting is given to the „Step 1 Wind Field' which has been treated in CALMET to consider terrain effects, smoothing, and divergence minimization. For this study, the radius of influence parameters were set to allow for the observational winds to have a stronger influence than the „Step 1 Wind Field' within a 2 km radius of the input station locations, and have no influence beyond a distance of 20 km.

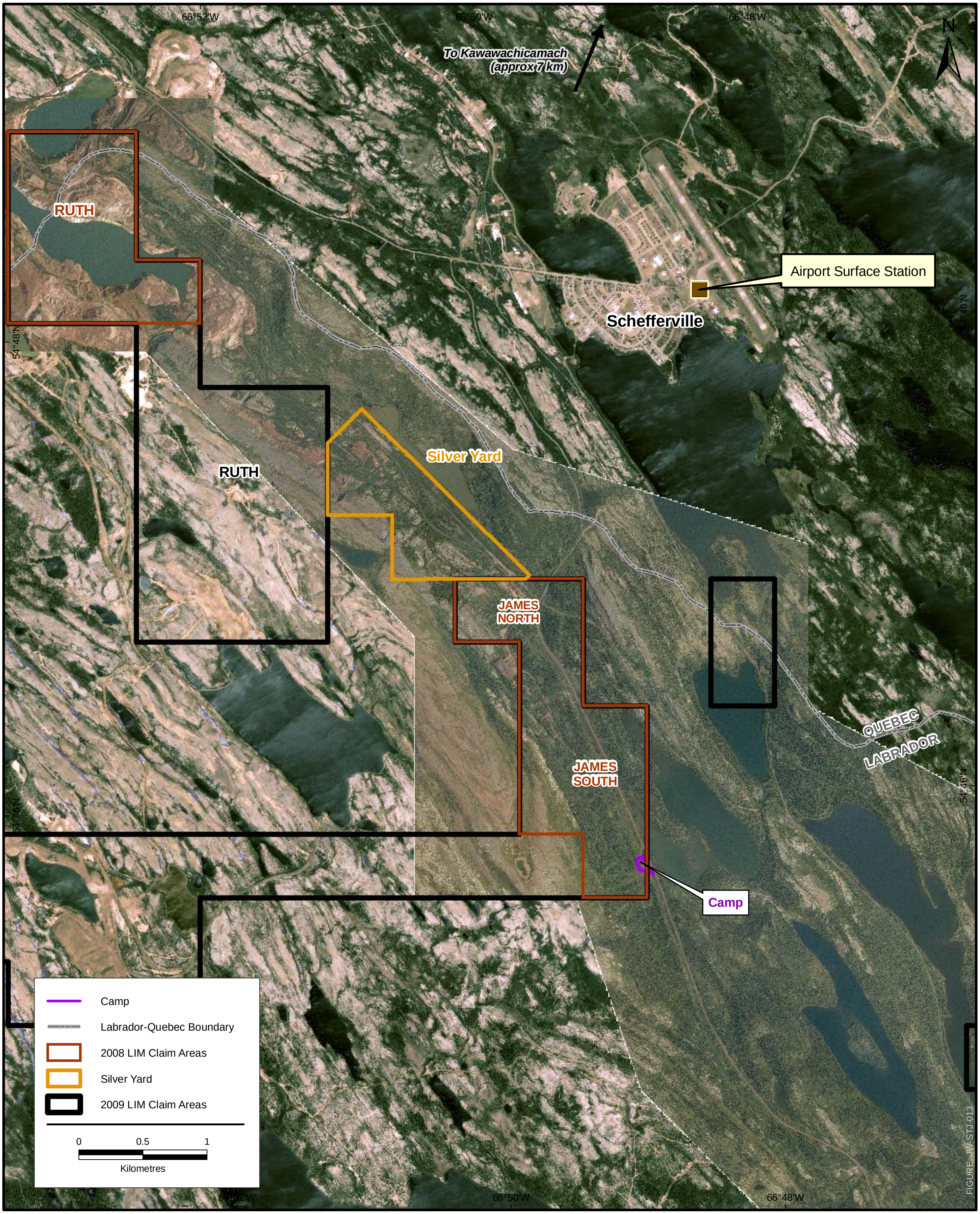


FIGURE NO:

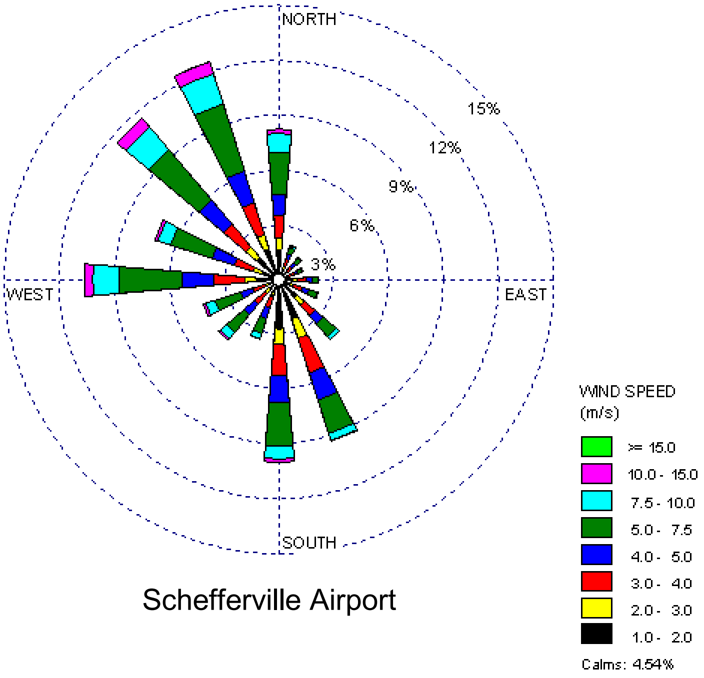
6-4

Airport Location

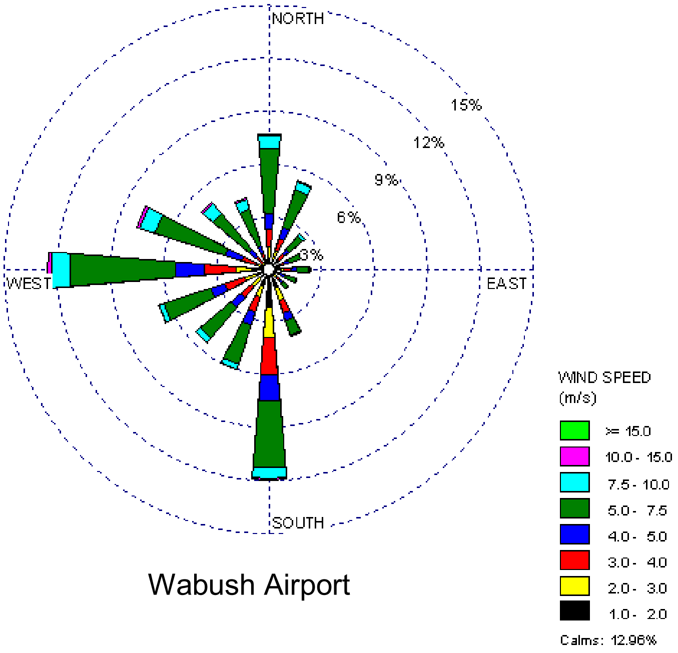
DRAFT DATE:
18/12/2008

REVISION DATE:
12/8/2009

Figure 6-5 Observed Winds at Input Surface Weather Stations (2002-2006)



Schefferville Airport



Wabush Airport

6.2.5.2 Upper Air Input

Twice-daily upper air sounding data from La Grande IV, located Western Labrador approximately 460 km west of the Project was used to initialize the upper air fields in CALMET. This station was selected based on guidance given in the NL DEC's Guidance for Plume Dispersion Modelling (NL DEC 2006). The model uses the upper level temperature and wind data to parameterize boundary layer parameters and determine upper level air flow. This data was downloaded from the NOAA ROAB Database and was prepared for use in CALMET with the model's READ62 pre-processor.

There were 78 missing soundings found in the period of interest (2002 to 2006) dataset and these were replaced by the sounding from the previous day for the same period (i.e., morning or evening). This was done as CALMET requires a complete upper air dataset to run. There were no extensive periods of missing data in the dataset with a maximum of three consecutive soundings found to be missing.

Sixteen missing surface-level data records in the sounding (i.e., FSL level „9') were replaced by data from the previous day for the same period.

The extrapolation of surface winds within CALMET allows for input surface station winds to also have influence in determining the flow patterns in the levels aloft. Along with choices concerning the method of computation for this extrapolation, the CALMET user is provided with an option to control, for each vertical level, the relative weighting of the extrapolated surface and upper-air values in the final interpolation. This model option is called the „BIAS' parameter.

For this application, the model-default method of extrapolation, using similarity theory and ignoring the influence of upper-air stations in the Level-1 wind field, was applied. A BIAS configuration was chosen to allow for surface wind input data to be more heavily weighted in the three lowest levels of the atmosphere (i.e., with no sounding station influence below 100 meters), but for upper air input wind data to be more heavily weighted in the levels further aloft (i.e., with no surface station influence above 500 meters). A CALMET input file with all parameterization options used for the modelling is proved in Attachment B.

6.2.6 Model Options

The most recent version of the CALMET model (Version 6.326, Level 080709) was used to predict the meteorological parameters required by the CALPUFF model. Model Options were selected based on the NL DEC's Guidance for Plume Dispersion Modelling (NL DEC 2006), consultation with the NL DEC, and guidance published by the U.S. Environmental Protection Agency (US EPA 1998). For model options with no NL DEC or U.S. EPA-recommended values, CALMET model default parameters were selected.

The CALMET input file, showing the values selected for this application, is provided in Attachment B.

6.2.7 CALMET Output

6.2.7.1 Wind Vector Diagrams

Surface wind vector plots provide an overview of how the wind fields predicted by CALMET vary across the modeling domain. The vector plots presented in this section were not selected to illustrate representative conditions, but rather to demonstrate how the CALMET-predicted winds can vary substantially across the domain for a given hour. In these diagrams, an arrow is shown to represent the direction and velocity of the wind for each meteorological grid cell. The direction of the arrow indicates the direction that the wind is blowing towards and the relative length of the arrow indicates the magnitude of the wind speed.

In Figure 6-6, surface winds for a calm night-time hour on January 6th 2004 at 12:00 Eastern Standard Time (EST) are presented. Atmospheric conditions were relatively stable during this time with a maximum wind speed of about 6 m/s predicted within the modelling domain. The action of CALMET's Diagnostic Wind Module and the influences of terrain, as well as the influence of the Schefferville Airport station data are both apparent during this period. For example, uniform calm winds (smaller in magnitude) from the Schefferville Airport surface station can be distinguished from model-predicted winds at other locations in the study domain (more influenced by the CALMET terrain algorithms).

In Figure 6-7, a wind vector diagram of the surface layer over the CALMET domain for July 16th at 00:00 EST is presented. Atmospheric conditions in the boundary layer were relatively stable during this period and the maximum wind speeds is approximately 5 m/s across the modeling domain. Wind directions are more uniform during this hour than in Figure 6-6.

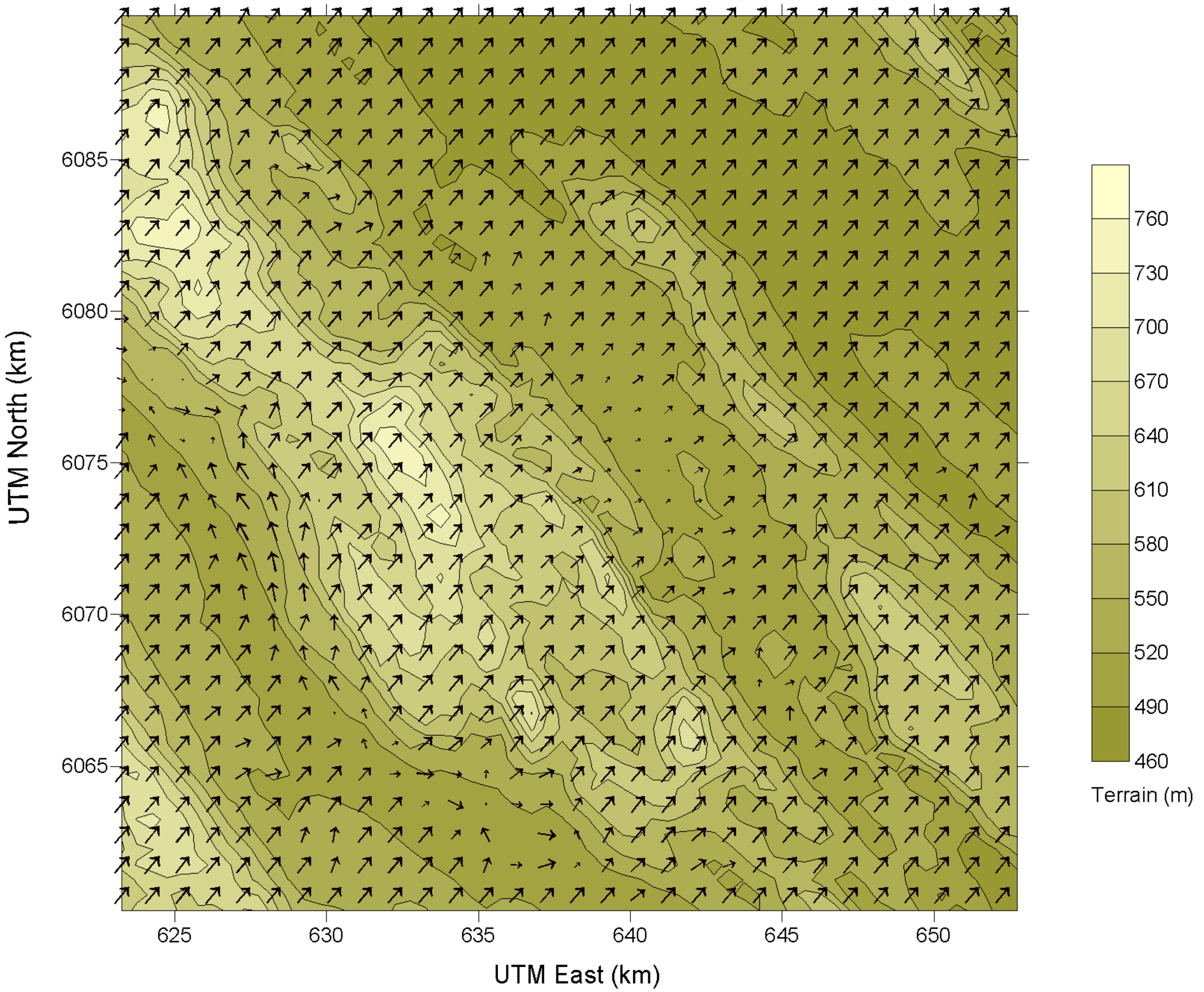


FIGURE 6-6

CALMET Level 1 (10 m) Winds: January 6th at 12:00 EST

Map Parameters
Projection: UTM
Datum: NAD 83
Zone: 19
Map Units: km
Date: 8/14/2009
Project: 1046156

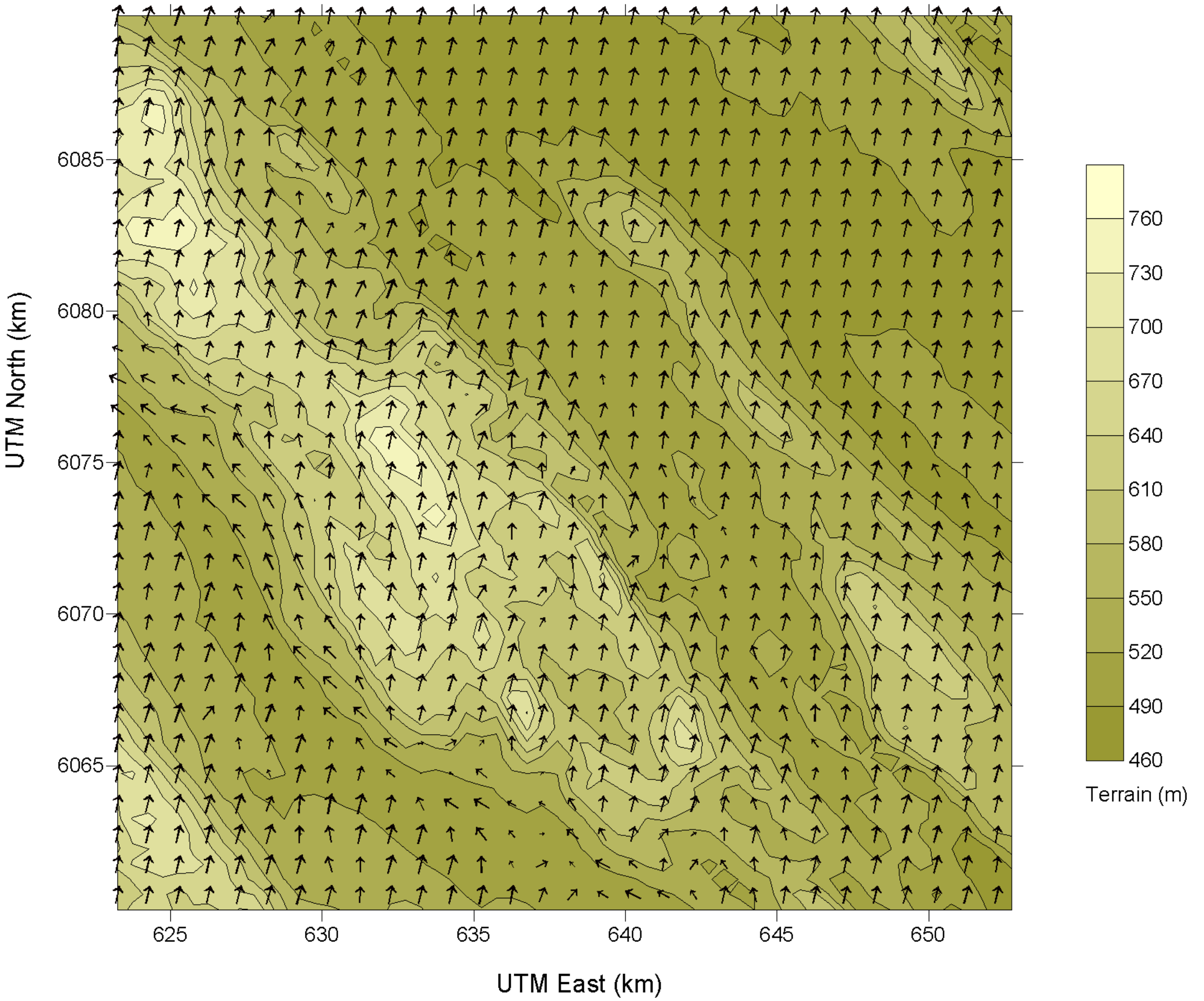


FIGURE 6-7

CALMET Level 1 (10 m) Winds: July 16th at 00:00 EST

Map Parameters
Projection: UTM
Datum: NAD 83
Zone: 19
Map Units: km
Date: 8/14/2009
Project: 1046156

6.2.7.2 Stability and Mixing Heights

Atmospheric turbulence near the earth's surface is often described in terms of atmospheric stability, which is governed by both thermal and mechanical factors. Atmospheric stability can be broadly classified as stable, neutral, or unstable.

Stable atmospheric conditions occur when vertical motion in the atmosphere is suppressed. With respect to air quality, this means pollutants emitted near ground-level are not well-dispersed and are believed to have a larger incremental effect on local ambient levels. This type of situation frequently occurs at night, when the earth's surface emits thermal radiation and cools. Air in contact with the ground thus becomes cooler and denser than the air aloft. This phenomenon is referred to as a ground-based temperature inversion and is often associated with poor air quality conditions.

Unstable atmospheric conditions are also highly dependent on radiation at the earth's surface, and most frequently occur during day-time hours. During such times, as short-wave energy from the sun heats the ground, air in contact with the ground becomes warmer and less dense than the air aloft. Subsequently, vertical motion in the atmosphere is enhanced and the atmosphere is said to be unstable.

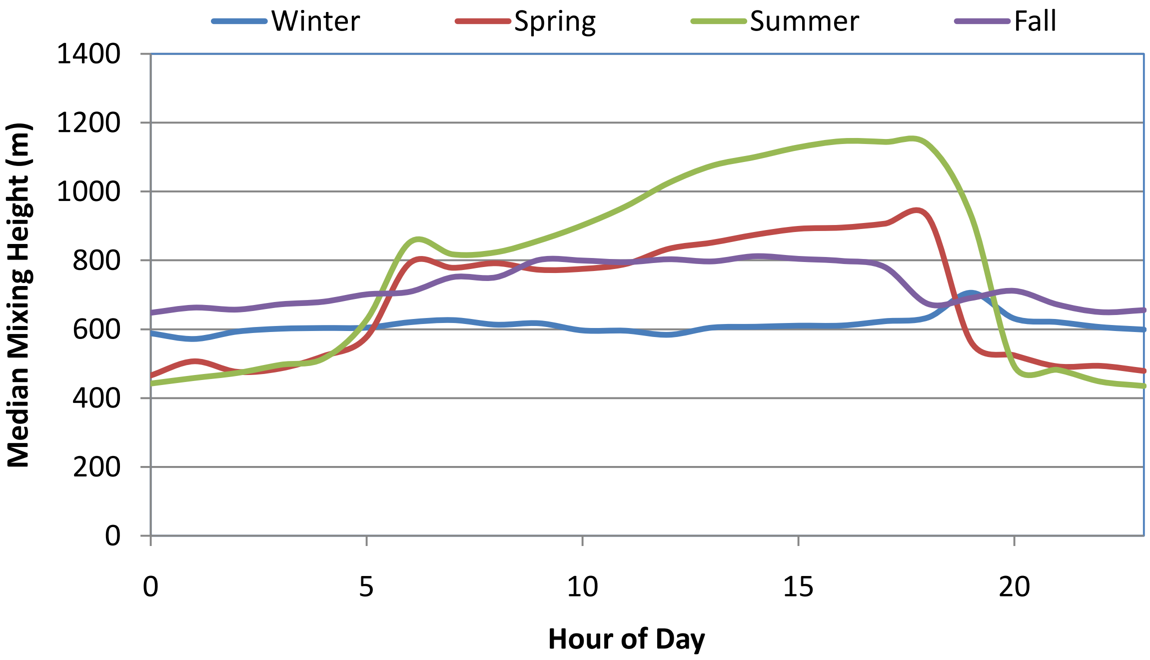
When a balance exists between incoming and outgoing radiation, there is no net heating or cooling of the air in contact with the ground, and vertical motions of the atmosphere are neither enhanced nor suppressed. Such an atmosphere is described as neutral and exists during overcast skies or during transition from unstable to stable conditions.

Mechanical mixing, which is mostly a function of lower level wind speeds (and surface roughness), can also influence atmospheric stability. Higher wind speeds (and a greater surface roughness) promote higher levels of turbulence in the region of discussion. This, in turn, leads to more mechanical mixing, which means that the atmosphere becomes more unstable. Mechanical mixing plays a more important role in determining stability when wind speeds are very high and at night, when convective vertical motion is suppressed.

The CALMET model calculates a maximum mixing height, as determined by either convective or mechanical forces. The convective mixing height is the height to which an air package will rise under the buoyant forces created by the heating of the earth's surface. The convective mixing height is dependent on solar radiation amount, wind speed, as well as the vertical temperature structure of the atmosphere. Mechanical mixing heights are, similarly, the height to which an air package will rise under the influence of mechanical-invoked turbulence. The mechanical mixing height is proportional to low-level wind speeds and surface roughness.

Diurnal variations of median mixing height, as estimated by the CALMET model at the grid cell nearest to the primary processing (beneficiation) area are shown for each season in Figure 6-8. Model mixing heights can vary from several meters to several thousand meters, depending on the intensity of solar radiation and wind speed. Daytime mixing heights are generally greater during the summer than during the winter due to different surface radiation budgets.

Figure 6-8 Median Diurnal Mixing Heights by Season near Beneficiation Area (2002-2006)



As shown in Figure 6-8, night time mixing heights are predicted to be slightly higher in winter under the influence of stronger winds associated with winter weather systems, which increase mechanical mixing heights in the model. In addition, due to the limited daylight and snow cover during the winter period, convective mixing is extremely limited and thus, mixing heights are primarily determined mechanically. On the other hand, during summer daytime hours when the effects of solar heating are greatest due to longer days, higher mixing heights are predicted due to convective motion. Conversely, the lowest mixing heights are predicted during summer nights due to losses of long-wave radiation.

6.3 CALPUFF Dispersion Modelling Methodology

As previously mentioned, the CALPUFF dispersion model was used to evaluate the potential changes in air quality due to the Project for all substantive emission sources.

The primary species considered in the dispersion modelling were NO_X (nitrogen oxides), SO_2 (sulphur dioxide), $PM_{2.5}$ (particulate matter less than 2.5 microns in diameter), PM_{10} (particulate matter less than 10 microns in diameter), TSP (total suspended particulate matter) and CO (carbon monoxide). For all modelled species, maximum ground-level concentrations (GLC) were calculated, then added to estimated ambient background concentrations to predict the cumulative changes in air quality due to Project-related emissions.

6.3.1 CALPUFF Model Description

The following description of the CALPUFF model's major model algorithms and options are all excerpts from the CALPUFF model's user manual (Scire et al. 2000b).

The CALPUFF model is a non-steady-state Gaussian puff dispersion model which incorporates simple chemical transformation mechanisms, wet and dry deposition, complex terrain algorithms and building downwash. The CALPUFF model is suitable for estimating ground level air quality concentrations on both local and regional scales, from tens of meters to hundreds of kilometres. It can accommodate arbitrarily varying point sources and gridded area source emissions. Most of the algorithms contain options to treat the physical processes at different levels of detail depending on the model application.

The major features and options of the CALPUFF model are summarized are briefly described below:

- Chemical Transformation: CALPUFF includes options for parameterizing chemical transformation effects using the five species scheme (SO_2, SO, NO_x, HNO_3, and NO) employed in the MESOPUFF II model, the six species RIVAD/ARM3 scheme, or a set of user-specified, diurnally-varying transformation rates.
- Subgrid Scale Complex Terrain: The complex terrain module in CALPUFF is based on the approach used in the Complex Terrain Dispersion Model (CTDMPLUS) (Perry et al. 1989). Plume impingement on subgrid scale hills is evaluated using a dividing streamline (H_d) to determine which pollutant material is deflected around the sides of a hill (below H_d) and which material is advected over the hill (above H_d). Individual puffs are split into up to three sections for these calculations.
- Puff Sampling Functions: A set of accurate and computationally efficient puff sampling routines are included in CALPUFF which solve many of the computational difficulties with applying a puff model to near-field releases. For near-field applications during rapidly varying meteorological conditions, an elongated puff (slug) sampling function can be used. An integrated puff approached is used during less demanding conditions. Both techniques reproduce continuous plume results exactly under the appropriate steady state conditions.
- Wind Shear Effects: CALPUFF contains an optional puff splitting algorithm that allows vertical wind shear effects across individual puffs to be simulated. Differential rates of dispersion and transport occur on the puffs generated from the original puff, which under some conditions can substantially increase the effective rate of horizontal growth of the plume.
- Building Downwash: The Huber-Snyder and Schulman-Scire downwash models are both incorporated into CALPUFF. An option is provided to use either model for all stacks, or make the choice on a stack-by-stack and wind sector-by-wind sector basis. Both algorithms have been implemented in such a way as to allow the use of wind direction specific building dimensions.
- Overwater and Coastal Interaction Effects: Because the CALMET meteorological model contains overwater and overland boundary layer algorithms, the effects of water bodies on plume transport, dispersion, and deposition can be simulated with CALPUFF. The puff formulation of CALPUFF is designed to handle spatial changes in meteorological and dispersion conditions, including the abrupt changes that occur at the coastline of a major body of water.
- Dispersion Coefficients: Several options are provided in CALPUFF for the computation of dispersion coefficients, including the use of turbulence measurements (σv and σw), the use of similarity theory to estimate σv and σw from modelled surface heat and momentum fluxes, or the use of Pasquill-Gifford (PG) or McElroy-Pooler (MP) dispersion coefficients, or dispersion equations based on the Complex Terrain Dispersion Model (CTDM). Options are provided to apply an averaging time correction or surface roughness length adjustment to the PG coefficients.

- Dry Deposition: A full resistance model is provided in CALPUFF for the computation of dry deposition rates of gases and particulate matter as a function of geophysical parameters, meteorological conditions, and pollutant species. Options are provided to allow user-specified, diurnally varying deposition velocities to be used for one or more pollutants instead of the resistance model (e.g., for sensitivity testing) or to by-pass the dry deposition model completely.
- Wet Deposition: An empirical scavenging coefficient approach is used in CALPUFF to compute the depletion and wet deposition fluxes due to precipitation scavenging. The scavenging coefficients are specified as a function of the pollutant and precipitation type (i.e., frozen vs. liquid precipitation).

6.3.2 Model Initialization

6.3.2.1 Computational Domain

The CALPUFF computational domain is the area in which the transport and dispersion of puffs are considered for the calculation of ground level concentrations. For this application, dispersion modelling was conducted using CALPUFF over a computational domain equal to the CALMET meteorological grid as defined in Section 6.2 of this report. A graphical representation of the modelling domain relative to the beneficiation and mine locations is shown in Figure 2-1.

6.3.2.2 Meteorological Data

Meteorological data such as mixing heights, stability and winds determine the transport and dispersion of pollutants within the CALPUFF model. To account for puff behaviour (plume dispersion) under a variety of meteorological conditions, five years of meteorological data (2002 to 2006) was considered in this application. Hourly three-dimensional meteorological data were prepared using the CALMET model (as described in Section 6.2) and used to drive the dispersion in CALPUFF.

6.3.2.3 Emission Rates and Stack Parameters

As previously mentioned, the CALPUFF model was used to predict maximum GLC due to all substantive Project-related emission sources. A summary of Project-related emissions, including the source characteristics and emission rates used as input to CALPUFF is provided in Section 5 of this report.

6.3.2.4 Building Downwash Effects

For stacks located in the wake region of buildings, enhanced plume dispersion due to turbulent wake and reduced plume rise caused by a combination of descending streamlines in the lee of the building and increased entrainment in the wake may occur. Building wake effects are generally expected to affect a stack if:

1) The stack is located a distance less than 5 times the greater of the building height or width from the building; and,
2) The height of the stack is less than 1.5 times the building height

The point sources in the beneficiation area range from about 5 m (diesel generators) to 33 boiler and dust collection system stacks on top of the primary crusher building). As the primary crusher building is approximately 32 m tall, and as the diesel generators are located within 10 m of the building, during certain meteorological conditions emissions from all of sources may be mixed rapidly down to ground level due to the influence of building downwash.

The U.S. EPA Building Profile Input Program (BPIP) Model (US EPA 1995) was used to estimate downwash effects based on the stack/building configuration presented in Section 5. CALPUFF uses the output from the BPIP model to account for the potential influence of building downwash in determining plume dispersion during certain meteorological conditions. The BPIP input and output files for this application are provided in Attachment C.

CALPUFF has two model options for downwash calculations (Scire et al. 2000b): the ISC downwash method, and the newer PRIME algorithm. The PRIME method was chosen because it is more up-to-date and recommended for most regulatory applications.

6.3.2.5 Receptor Grids

A series of nested Cartesian receptor grids surrounding the beneficiation area were selected following the NL DEC's Guidance for Plume Dispersion Modelling (NL DEC 2006). Terrain heights were calculated at each receptor point based on the previously-mentioned SRTM data (USGS 2007) to predict maximum concentrations at various points within the study domain. The primary purpose of these receptor grids are to predict maximum off-site GLC and depict the variance in predicted concentrations in the study area (isocontour plots). As shown in Figure 6-9, the density of the receptor grid decreases with distance from the Beneficiation Area as fewer receptor points are required to capture the local maxima.

In addition, maximum GLC were predicted at discrete sensitive receptors representing nearby cabins (including the worker's camp), residences, and recreational areas. Figure 6-10 shows the locations of the sensitive receptors relative to the area where Project activities will occur.

6.3.2.6 Terrain Effects

During the dispersion of a plume emitted from a given source, the impingement of the plume on nearby regions with elevated terrain can cause higher concentrations in dispersion models than would occur in regions of simple terrain.

In CALPUFF the effects of terrain between the source and receptor are accounted for in the dispersing plume (*i.e.*, the plume has a "memory" of the terrain that affected it between the source and receptor). To account for the possible distortion of the plume trajectory over elevated terrain, the CALPUFF model's Partial Plume Path Adjustment Method (PPPAM) was used to modify the height of the plume.

The PPPAM employs a plume path coefficient (PPC) to adjust the height of the plume above the ground. Default PPC values of 0.5, 0.5, 0.5, 0.5, 0.35, and 0.35 for Pasquill-Gifford (PG) stability classes A, B, C, D, E, and F, respectively are recommended by the CALPUFF authors and were used in this study.

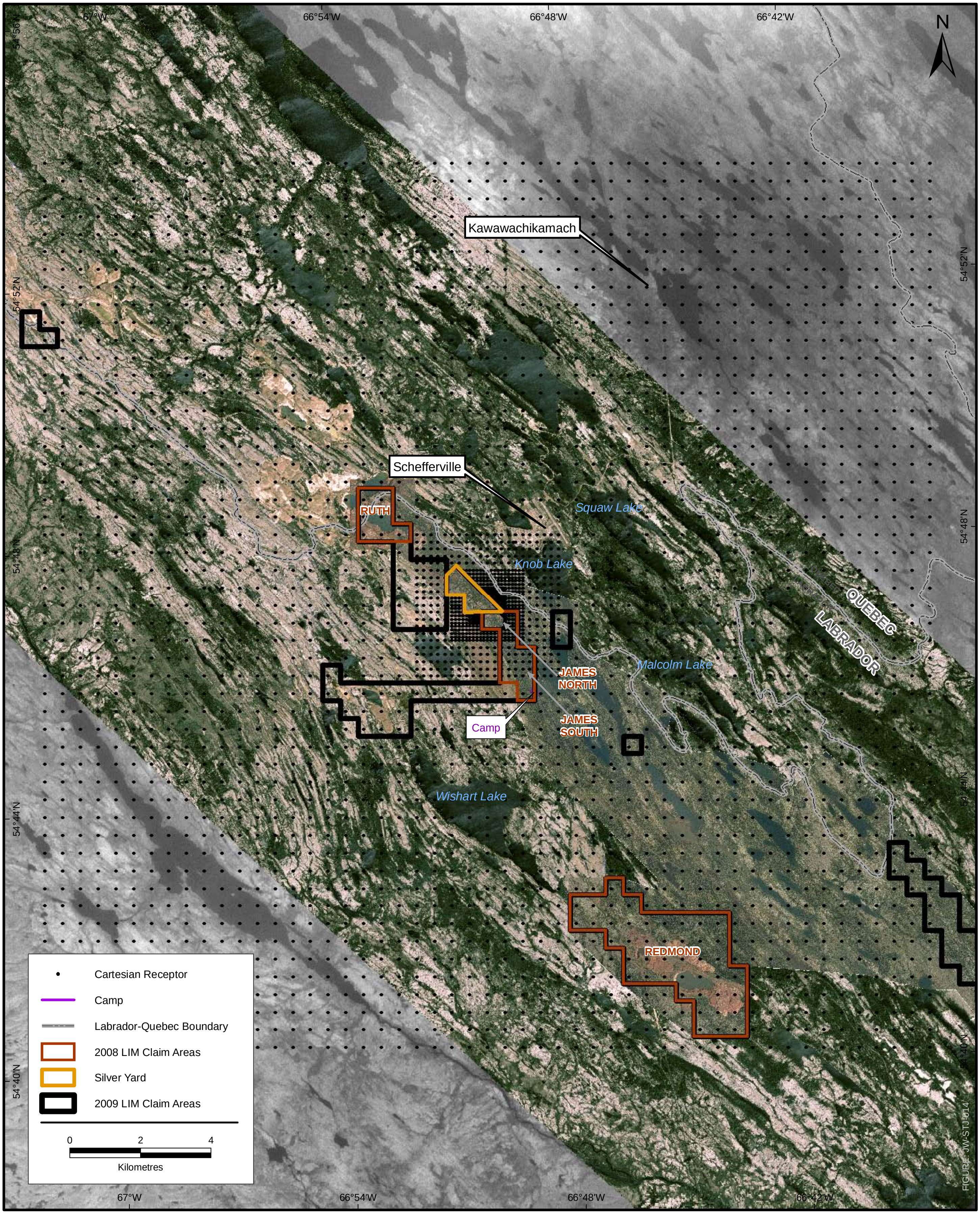


FIGURE NO:

6-9

Air Quality
Nested Cartesian Receptor Grids

DRAFT DATE:
18/12/2008

REVISION DATE:
12/8/2009

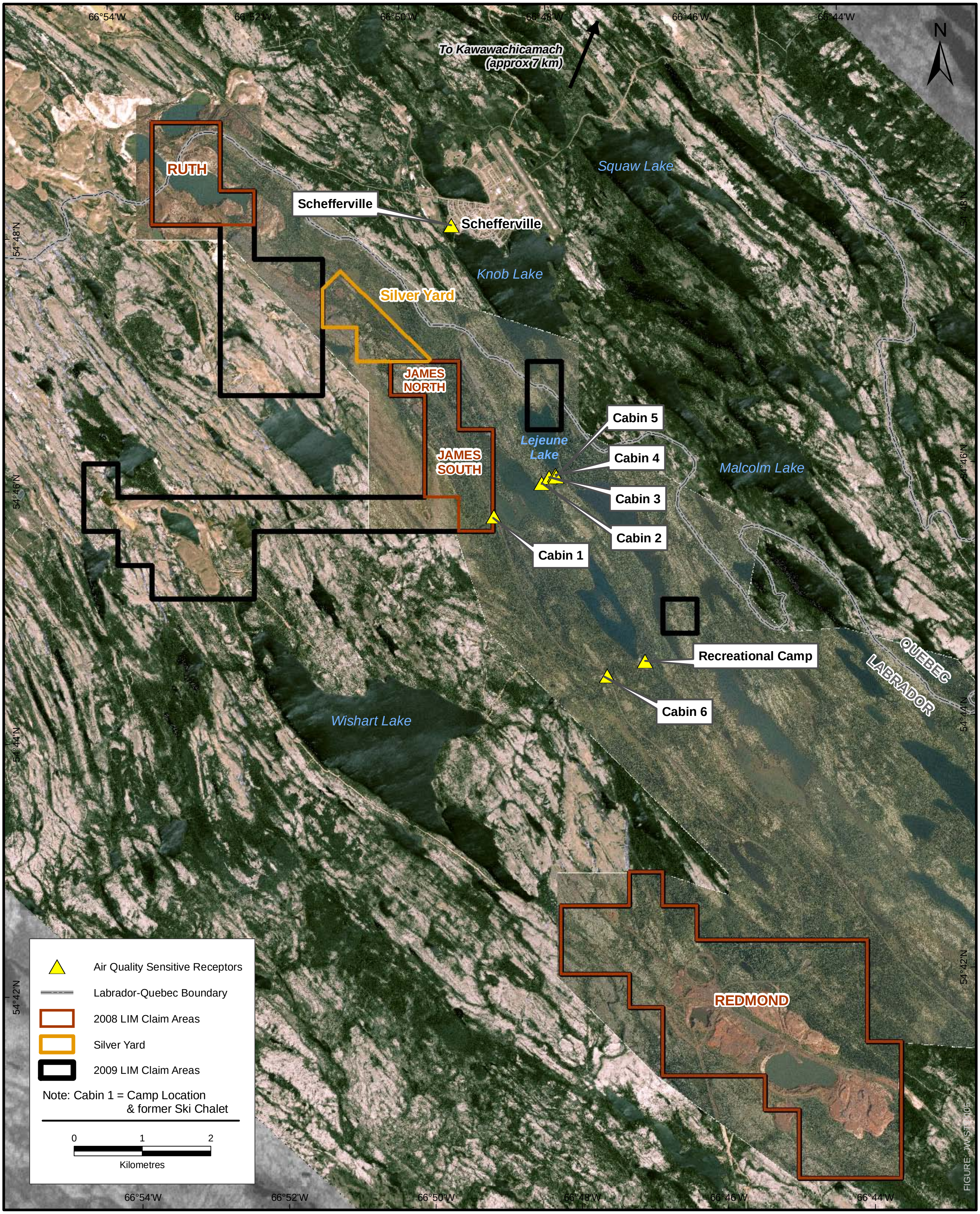


FIGURE NO:

6-10

Sensitive Receptors

DRAFT DATE:
18/12/2008

REVISION DATE:
12/8/2009

6.3.2.7 Dispersion Coefficients

A fundamental parameter controlling plume dispersion in a Gaussian model such as CALPUFF are the dispersion coefficients. These values, which must be specified for both the horizontal as well as the vertical directions in the model, can be computed using several different methods in CALPUFF. The two U.S. EPA-approved methods are:

- From internally calculated turbulence values using micrometeorological variables (MDISP=2; MPDF=1)
- By using the PG dispersion coefficients for RURAL areas and the MP coefficients for urban areas (MDISP=1,MPDF=0)

The first method is similar to that used in the AERMOD regulatory dispersion model, while the second is similar to that used in the now-outdated ISC dispersion model. The first method was chosen for this assessment. This is consistent with the guidance provided in the NL DEC's Guidance for Plume Dispersion Modelling (NL DEC 2006).

6.3.2.8 Particulate Deposition Parameters

The consideration of deposition in dispersion models such as CALPUFF allows for contaminant mass to be depleted from the transporting plume. For emissions of particulate matter from low-lying fugitive sources (*i.e.* roads, loading/unloading), a substantive portion of the resultant plume will remain in lowest 1-2 meters above ground level and settle within a few hundred meters of the source (see for example, DRI 1999).

To account for plume depletion due to settling/deposition of particulate matter (TSP, PM_{10}, $PM_{2.5}$), emitted particles were divided into three size classes, as defined in Table 6-5 below. The deposition parameters shown in Table 6-5 were chosen based on guidance from the NL DOE (Lawrence 2008).

Table 6-5 Particle Size Class Definitions and Deposition Parameters

Particle Size Class ID	Definition	Geometric Mass Mean Diameter (μ)	Geometric Standard Deviation (μ)	Number of Particle Intervals ((μ)
P1	P1 < 2.5(μ)	1.**25**	1.24	5
P2	2.5□ < P2 < 10(μ)	5	1.24	5
P3	P3 > 10(μ)	20	1.24	5

Emission rates were calculated for each particle size class in Table 6-5 based on the estimates for TSP, PM_{10}, and $PM_{2.5}$ provided in Section 5. Each size class was then modelled with dry deposition/plume depletion to predict maximum GLC of P1, P2, and P3. The maximum predicted $TSP/PM_{10}/PM_{2.5}$ ground-level concentrations could then calculated from the intermediate species by summing the relevant size fractions as follows:

- $PM_{2.5}$ = P1;
- PM_{10} = P1 + P2; and,
- TSP = P1 + P2 + P3.

6.3.3 Model Options Selected

The CALPUFF dispersion model (Version 6.262 - Level 080725) was used for all dispersion modelling conducted in this study. Model Options were selected based on the NL DEC's Guidance for Plume Dispersion Modelling (NL DEC 2006), consultation with the NL DEC, and guidance published by the U.S. Environmental Protection Agency (US EPA 1998). For model options with no NL DEC or U.S. EPA-recommended values, CALPUFF model default parameters were selected.

A sample CALPUFF input file, showing the model options selected for this study, is provided in Attachment D. Note that the parameterization provided in this sample file represents a specific emissions scenario used to model specific air contaminants over a particular receptor grid (point source emissions; NO_X, SO_2, CO; nested Cartesian receptor grid). Therefore, case-specific model parameters (*i.e.*, the number of sources modelled, numbers of receptors, species considered, deposition options) would have different values for different model runs.

6.3.4 CALPUFF Post-processing

6.3.4.1 NOx to NO2 Conversion

When initially released from a combustion source into the atmosphere, NO_X is typically comprised of about 5 to 10% $NO_{2,}$ with the remaining 90 to 95% in the form of NO. However, as a plume travels downwind, the majority of the released NO will convert to NO_2. Different methods are provided by regulatory authorities to account for the fraction of NO_X which will be present as NO_2 for the purposes of modelling assessments. The most conservative assumption to address the NO to NO_2 conversion is to assume that 100% of the NO emitted is immediately converted to NO_2. Another very widely used assumption to account for this conversion is the ozone limiting method (OLM).

Based on consultation with the NL DOE (Lawrence 2008), the OLM was selected to estimate ground-level concentrations of NO_2 from the maximum predicted NO_X in this study. The equations used to predict the maximum NO_2 GLC were the ones provided by the NL DEC for emissions from diesel generators (this is the most significant Project-related source of NO_X):

$$[NO2]_{hourly} = \{0.2 \times [NO_X]_{(predicted)}\} + \text{Minimum of } \{0.8 \times (NO_X]_{(predicted)}, [O_3]\}$$

$$[NO2]_{daily} = \{0.2 \times [NO_X]_{(predicted)}\} + \text{Minimum of } \{0.8 \times [NO_X]_{(predicted)}, [O_3]\}$$

$$[NO2]_{annual} = \{0.2 \times [NO_X]_{(predicted)}\} + \text{Minimum of } \{0.8 \times [NO_X]_{(predicted)}, [O_3]\}$$

where:

$[NO_X]_{(predicted)}$ is the model predicted concentration value in $\mu g/m^3$ for the given time frame

$[NO_2]_{(hourly)}$ is the predicted NO_2 concentration on an hourly basis in $\mu g/m^3$

$[NO_2]_{(daily)}$ is the predicted NO_2 concentration on an daily basis in $\mu g/m^3$

$[NO_2]_{(annual)}$ is the predicted NO_2 concentration on an annual basis in $\mu g/m^3$

and $[O_3]$ is the estimated background O_3 concentration in $\mu g/m^3$ as follows:

Hourly = 65 $\mu g/m^3$, Daily = 60 $\mu g/m^3$, Annual = 35 $\mu g/m^3$

The ozone concentrations used in the equations above are based on ambient monitored values at Goose Bay and were recommended by the NL DEC (Lawrence 2008).

7.0 DISPERSION MODELLING RESULTS

The CALPUFF dispersion model was used to predict maximum ground-level concentrations due to substantive Project-related emission sources during operation. As previously mentioned, emissions occurring during the construction phase are expected to be substantially less than those occurring during operation and were not modelled.

A summary of the dispersion modelling results is presented in Table 7.1. Modelling was conducted over all pertinent averaging periods for CO, SO_2, NO_2, $PM_{2.5}$, PM_{10}, and TSP. Estimated background concentrations, provided by the NL DEC (Lawrence, 2008), were added to the model-predicted values and compared to the NL regulatory standards. Refer to Section 4 for more information concerning the estimated background concentrations used in this assessment.

Overall, ground-level concentrations (GLC) were predicted to be below the regulatory standards most of the time for most averaging periods. However, 1-hour NO_2 and the 24-hour PM, PM_{10}, $PM_{2.5}$ concentrations are predicted to exceed the regulatory standard at locations near the beneficiation area property line during certain meteorological conditions. In general, the highest concentrations were predicted to occur along the northeast property boundary. A detailed description of the dispersion modelling predictions is provided for each contaminant in the following sub-sections.

Table 7-1 Summary of Maximum Predicted Ground-Level Concentrations

Air Contaminant	Averaging Period	Regulatory Standard (µg/m3)	Estimated Background Concentration (µg/m3)	Maximum Predicted Concentration (µg/m3)	Maximum Predicted Concentration with Background (µg/m3)	Percent of Standard (%)
NO_2	1 hr	400	3.8	**405**	**409**	**102%**
	24 hr	200	3.8	185	189	95%
	Annual	100	3.8	38	42	42%
SO_2	1 hr	900	5	436	441	49%
	3 hr	600	5	338	343	57%
	24 hr	300	5	161	166	55%
	Annual	60	5	10	15	25%
TSP	1 hr	-	15	705	720	n/a
	24 hr	120	15	**204**	**219**	**182%**
	Annual	60	15	15	30	49%
PM_{10}	1 hr	-	10	348	358	n/a
	24 hr	50	10	**93**	**103**	**207%**
$PM_{2.5}$	1 hr	-	5	112	117	n/a
	24 hr	25	5	**32**	**37**	**149%**
CO	1 hr	35,000	114	745	859	2%
	8 hr	15,000	114	392	506	3%

Bold Indicates an exceedance of a regulatory standard

7.1 Sulphur Dioxide (SO_2)

A summary of the maximum predicted ground-level SO_2 concentrations, including background, is presented for the 1-hour, 3-hour, 24-hour and annual averaging periods in Table 7.1. There are no predicted exceedances of the NL regulatory standard for any of the averaging periods considered.

Plots of the maximum predicted ground-level SO_2 concentrations, including background, are presented for the 1-hour, 3-hour, 24-hour and annual averaging periods in Figures D-1 to D-4 (Attachment E). The highest predicted SO_2 concentrations generally occur in the immediate vicinity of the beneficiation area, along the northeast property boundary.

7.2 Nitrogen Dioxide (NO_2)

A summary of the maximum predicted ground-level NO_2 concentrations, including background, is presented for the 1-hour, 24-hour and annual averaging periods in Table 7.1. The maximum NO_2 ground-level concentrations are predicted to be below the regulatory standards, with the exception of 1-hour NO_2 which has a maximum predicted value of 409 occurring on the northeast side of property line. However, as shown in Figure D-5 (Attachment E), the maximum predicted concentrations of NO_2 decrease to 380 $\mu g/m^3$ within 130 meters of the property line and there are no sensitive receptors within 2.5 km of the beneficiation area.

A summary of the maximum predicted ground-level NO_2 concentrations at sensitive receptor locations is provided in Attachment F. The results show the maximum predicted GLC are well below the regulatory standards at these locations.

7.3 Carbon Monoxide (CO)

A summary of the maximum predicted ground-level CO concentrations, including background, is presented for the 1-hour, and 8-hour averaging periods in Table 7.1. There are no predicted exceedances of the NL regulatory standard for any of the averaging periods considered.

Plots of the maximum predicted ground-level CO concentrations, including background, are presented for the 1-hour, and 8-hour averaging periods in Figures D-8 to D-9 (Attachment E). The highest predicted CO concentrations generally occur in the immediate vicinity of the beneficiation area, along the northeast property boundary.

7.4 Total Suspended Particulate (TSP)

A summary of the maximum predicted ground-level TSP concentrations, including background, is presented for the 1-hour, and 24-hour, and annual averaging periods in Table 7.1. The maximum TSP ground-level concentrations are predicted to be below the regulatory standards, with the exception of 24-hour TSP which has a maximum predicted value of 219 $\mu g/m^3$ occurring on the northeast side of property line. However, as shown in Figure D-11 (Attachment E), the maximum predicted concentrations of TSP decrease to 110 $\mu g/m^3$ within 135 meters of the property line and there are no sensitive receptors within 2.5 km of the beneficiation area.

A summary of the maximum predicted ground-level TSP concentrations at sensitive receptor locations is provided in Attachment F. The results show the maximum predicted GLC are well below the regulatory standards at these locations.

7.5 Particulate Matter Less than 10 Microns in Diameter (PM_{10})

A summary of the maximum predicted ground-level PM_{10} concentrations, including background, is presented for the 1-hour, and 24-hour, and annual averaging periods in Table 7.1. The maximum PM_{10} ground-level concentrations are predicted to be below the regulatory standards, with the exception of 24-hour PM_{10} which has a maximum predicted value of 103 $\mu g/m^3$ occurring on the northeast side of property line. However, as shown in Figure D-12 (Attachment E), the maximum predicted concentrations of PM_{10} decrease to 50 $\mu g/m^3$ within 153 meters of the property line and there are no sensitive receptors within 2.5 km of the beneficiation area.

A summary of the maximum predicted ground-level PM_{10} concentrations at sensitive receptor locations is provided in Attachment F. The results show the maximum predicted GLC are well below the regulatory standards at these locations.

7.6 Particulate Matter Less than 2.5 microns in Diameter ($PM_{2.5}$)

A summary of the maximum predicted ground-level $PM_{2.5}$ concentrations, including background, is presented for the 1-hour, and 24-hour, and annual averaging periods in Table 7.1. The maximum $PM_{2.5}$ ground-level concentrations are predicted to be below the regulatory standards, with the exception of 24-hour $PM_{2.5}$ which has a maximum predicted value of 37 $\mu g/m^3$ occurring on the northeast side of property line. However, as shown in Figure D-13 (Attachment E), the maximum predicted concentrations of PM_{10} decrease to 24 $\mu g/m^3$ within 58 meters of the property line and there are no sensitive receptors within 2.5 km of the beneficiation area.

A summary of the maximum predicted ground-level $PM_{2.5}$ concentrations at sensitive receptor locations is provided in Attachment F. The results show the maximum predicted GLC are well below the regulatory standards at these locations.

8.0 CONCLUSIONS

To assess the potential for a change in air quality due to Project-related emissions, a detailed Air Quality Technical Study was conducted. The study was conducted following generally accepted methodologies to establish existing (baseline) conditions, estimate emissions from potential Project activities, and predict the maximum downwind concentrations of the pertinent air contaminants. The results of this study provide the necessary data to assess potential environmental effects due to air contaminant emissions from the Project in the EIS this study supports.

The most substantive Project-related emissions during operation are due to fuel combustion and fugitive dust emissions. The emission sources can be categorized into three groups:

- Emissions from the beneficiation area;
- Emissions due to trucks hauling ore from the mines to the beneficiation area; and,
- Emissions due to blasting and on-site traffic at the mine site locations.

The results of the dispersion modelling (which consider all substantive emissions from the beneficiation area) show that although there may be potential exceedances of regulatory standards at locations near the property line during adverse meteorological conditions, these higher values are limited to within about 150 m of the property line. As this region is far from any of the sensitive receptor locations, it is unlikely that prolonged human exposure to air contaminant concentrations at these levels will occur. Therefore, as the predicted exceedances represent worst-case meteorological conditions, are limited in spatial extent, seasonal, and are short-term in duration, no substantive changes in air quality are expected on the local or regional scales due to emissions from the primary processing facility.

Although fugitive dust emissions will occur due to vehicle traffic along the road during operations, the majority of the fugitive dust will remain in lowest 1-2 meters above ground level and settle within a few hundred meters of the road (DRI 1999). The haul route is an existing dirt road, and although traffic along the route is expected to increase with Project activities, no more than five trucks are expected to pass in a given hour. As such, while some dusting of vegetation may occur due to vehicle traffic during certain meteorological conditions, no substantive changes in air quality are expected due to such emissions as they will be localized in extent and short-term in duration.

Emissions due to blasting and on-site traffic at the mine site locations are not expected to cause substantive changes in air quality as they will be emitted inside a pit and the transport distances to the nearest sensitive receptors are relatively far (greater than 1.5 km). Emissions from the diesel locomotive used for transporting ore from the beneficiation area are not expected to increase from the current levels and should not cause substantive changes in air quality as such emissions will be intermittent (one trip per day) and short-term in duration. Emissions from the standby diesel generators installed at the worker’s camp will be intermittent, short-term in duration, and negligible relative to other emissions during operation.

As emissions occurring during construction are expected to be fractionally small compared to those occurring during operation, the maximum model-predicted concentrations during operation provide a conservative envelope for potential air changes in air quality due to emissions during this phase.

Therefore, on an overall basis, the modelling results show the local and regional changes in air quality due to Project-related emissions, including background, are not expected to be substantive.

9.0 CLOSURE

This report has been prepared by Jacques Whitford with the input and assistance of Labrador Iron Mines Ltd. for the sole benefit of Labrador Iron Mines Ltd. The report may not be relied upon by any other person, entity, other than for its intended purposes, without the express written consent of Jacques Whitford and Labrador Iron Mines Ltd.

This report was undertaken exclusively for the purpose outlined herein and is limited to the scope and purpose specifically expressed in this report. This report cannot be used or applied under any circumstances to another location or situation or for any other purpose without further evaluation of the data and related limitations. Any use of this report by a third party, or any reliance on decisions made based upon it, are the responsibility of such third parties. Jacques Whitford accepts no responsibility for damages, if any, suffered by any third party as a result of decisions made or actions taken based on this report.

Jacques Whitford makes no representation or warranty with respect to this report, other than the work was undertaken by trained professional and technical staff in accordance with generally accepted engineering and scientific practices current at the time the work was performed. Any information or facts provided by others and referred to or used in the preparation of this report should not be construed as legal advice.

This report presents the best professional judgement of Jacques Whitford personnel available at the time of its preparation. Jacques Whitford reserves the right to modify the contents of this report, in whole or in part, to reflect any new information that becomes available. If any conditions become apparent that differ significantly from our understanding of conditions as presented in this report, we request that we be notified immediately to reassess the conclusions provided herein.

This report has been prepared by a team of Jacques Whitford professionals on behalf of Labrador Iron Mines Ltd.

10.0 REFERENCES

Allwine, K.J., and C.D. Whiteman. 1985. *MELSAR: A mesoscale air quality model for complex terrain: Volume 1 – Overview, technical description and user's guide*. Pacific Northwest Laboratory, Richland, Washington.

Desert Research Institute (DRI). 1999. *Reconciling Urban Dust Emissions Inventory and Ambient Source Contribution Estimates: Summary of Current Knowledge and Needed Research*. Prepared by J.G. Watson and J.C. Chow. DRI Document No 6110.4D2.

Douglas, S., and R. Kessler. 1988. *User's guide to* the *diagnostic wind model*. California Air Resources Board, Sacramento, CA.

Environment Canada. 2008a. *National Air Pollution Surveillance Network (NAPS) Data (2005-2006).* Available at: http://www.etc-cte.ec.gc.ca/napsdata/Default.aspx. Accessed November 2008.

Environment Canada. 2008b. *Canadian Climate Normals; Schefferville, QC*. Available at: http://climate.weatheroffice.ec.gc.ca/climate_normals/index_e.html. Accessed November 2008.

Garratt, J.R. 1977. Review of drag coefficients over oceans and continents. *Mon. Wea. Rev*., 105, 915-929.

Hanna, S.R., L.L. Schulman, R.J. Paine, J.E. Pleim and M. Baer. 1985. Development and evaluation of the Offshore and Coastal Dispersion Model. JAPCA, 35, 1039-1047.

Holtslag, A.A.M., and A.P. van Ulden. 1983. *A simple scheme for daytime estimates of the surface fluxes from routine weather data*, J. Clim. and Appl. Meteor., **22**: 517-529.

Liu, M. K. and M. A. Yocke. 1980. *Siting of wind turbine generators in complex terrain*. Journal of Energy, **4**: 10:16.

Maul, P.R. 1980. Atmospheric transport of sulphur compound pollutants. Central Electricity Generating Bureau MID/SSD/80/0026/R. Nottingham, England.

Natural Resources Canada. 2008. Available at: http://cfs.nrcan.gc.ca/subsite/eosd/home. Accessed November 2008.

Newfoundland and Labrador Department of Environment and Conservation (NL DEC). 2008. Draft *Guidelines for Environmental Impact Statement Assessment: Schefferville Area Iron Ore Mine*, Issued to Labrador Iron Mines Limited, October 24, 2008.

Newfoundland and Labrador Department of Environment and Conservation (NL DEC). 2006. *Guideline for Plume Dispersion Modelling (1st Revision)*. Saint John's, NL. November 20, 2006.

O'Brien, J.J. 1970. A note on the vertical structure of the eddy exchange coefficient in the planetary boundary layer. *J. Atmos. Sci*., 27, 1213-1215.

Perry, S.G., D.J. Burns, L.H. Adams, R.J. Paine, M.G. Dennis, M.T. Mills, D.G. Strimaitis, R.J. Yamartino, E.M. Insley. 1989. User's Guide to the Complex Terrain Dispersion Model Plus Algorithms for Unstable Situations (CTDMPLUS) Volume 1: Model Description and User Instructions. EPA/600/8-89/041, U.S. Environmental Protection Agency, Research Triangle Park, North Carolina.

Scire, J.S., F.R. Robe, M.E. Fernau, and R.J. Yamartino. 2000a. *A User's Guide for the CALMET Meteorological Model (Version 5).* Earth Tech, Inc., Concord, MA.

Scire, J.S., D.G. Strimaitis, and R.J. Yamartino. 2000b. *A User's Guide for the CALPUFF* Dispersion Model *(Version 5).* Earth Tech, Inc., Concord, MA.

TRC Companies Inc. 2008. *CALPUFF Modelling System, Version 6.262*. Available at: http://www.src.com/calpuff/calpuff1.htm. Accessed November 2008.

United States Environmental Protection Agency. (USEPA). 1995. Amended 1996, 1997, 1998, 1999 and 2006. *Compilation of Air Pollutant Emission Factors, AP-42, Fifth Edition, Volume I: Stationary Point and Area Sources*.

United States Environmental Protection Agency (U.S. EPA). 1998. *Interagency Workgroup on Air Quality Model*ling *(IWAQM) Phase 1 Summary* Report *and Recommendations for Modelling Long Range Transport Impacts*. EPA-454/R-98-019.

United States Environmental Protection Agency. (USEPA). 2005. *Examination of the Multiplier Used to Estimate* $PM_{2.5}$ *Fugitive Dust Emissions from* PM_{10}. Available at: http://www.epa.gov/ttn/chief/conference/ei14/session5/pace.pdf. Accessed November 2008.

United States Geological Survey (USGS). 2008 Available at: http://edcsns17.cr.usgs.gov/glcc/ Accessed November 2008.

PERSONAL COMMUNICATIONS

Lawrence Barrie. Personal Communication. November 10 to 28, 2008. Environmental Scientist, NL DEC, Newfoundland Labrador.

ATTACHMENT A

On-site Ambient Monitoring Report

Jacques
Whitford

Environmental
Engineering
Scientific
Management
Consultants

7271 Warden Avenue
Markham ON
Canada L3R 5X5

Bus 905 474 7700
Fax 905 479 9326

www.jacqueswhitford.com

VIA E-MAIL

Project No.: 1043706

December 19, 2008

Linda Wrong
Labrador Iron Mines Limited
220 Bay Street, Suite 700
Toronto, Ontario
M5J 2W4

Dear Linda,

Re: Summary of Ambient Monitoring – Schefferville, Quebec
September to November 2008

This report summarizes the results of ambient air monitoring conducted by Jacques Whitford Limited for the period between September 11, 2008 and November 11, 2008 at the Silver Yards site near the James North Mine and Schefferville, Quebec. Labrador Iron Mines (LIM) is intending on using this property as the beneficiation area for an iron ore mining operation beginning in the spring of 2009. Due to the potential fugitive dust emissions present during the ore beneficiation operations and the proposed mine operations in the area, a baseline of particulate matter concentrations was requested.

The site is located approximately 3.5 km from the town of Schefferville, away from any major industry or emissions sources. The public roads to access the site are all unpaved, and could be used by both LIM personnel and local residents. A mobile ore crusher was being used on-site for some initial ore crushing as part of the 2008 exploration program during the ambient monitoring period.

MONITORING METHODOLOGY

Total Suspended Particulate (TSP) sampling was conducted following the Ontario Ministry of the Environment (MOE) Operation Manual for Point Source Air Quality Monitoring and U.S. Environmental Protection Agency (U.S. EPA) Procedures, for 24-hour periods. A sampling frequency of one sample every six days was attempted, although due to operator error and local weather conditions, there were some modifications that were deemed necessary to the original schedule.

Jacques
Whitford

An Environment
of Exceptional
Solutions

The beneficiation area is located in a natural valley oriented from the north-west to the south-east. The sides of the valley reach peaks approximately 650 m high, with the beneficiation area located at an elevation of approximately 530 m. The beneficiation area is approximately 500 m from the highest point of the valley on either side. One air sampler was located 25 m south-east from where the mobile crusher was operating, 150 m west from the main road onto the site, and 50 m west from an on-site unpaved road. The sampler was located on a rise of the south-west side of the valley floor, approximately 8 m above the crushing area, and at grade with the onsite road. A site map showing the location of the LIM site and the monitoring station is presented in Attachment A and photos of the site are presented in Attachment B

Ambient suspended particulate matter was collected onto pre-weighed, conditioned quartz fibre filters for a 24-hour period using a BGI Incorporated portable particulate monitor (model PQ100). The PQ100 operates by continuously drawing ambient air through a filter onto which particulate matter is deposited. After a pre-determined period of time (24-hours), a measurable amount of particulate is deposited on the filter. The exposed filters were collected and transported to a laboratory (Maxxam Analytics Inc.) where the filters were conditioned then weighed to determine the mass of deposited particulate. The particulate on the filter was subsequently analyzed for metals content using an Inductively Coupled Plasma (ICP) analytical technique. Operation of these instruments required changing of the filters on a six-day basis.

METEOROLOGICAL DATA

The meteorological data used in this report was obtained from Environment Canada for the Schefferville Airport. The hourly average meteorological data (atmospheric pressure, temperature, wind speed and wind direction) were averaged over each 24-hour sampling period for use in the PQ100 flow rate calculations and analysis.

RESULTS

Detailed monitoring results for TSP and metals are presented in Attachment C.

TSP MONITORING RESULTS

Table 1 presents the maximum and minimum TSP concentrations measured during the sampling period at the site. All samples from the site were below the Newfoundland and Labrador Department of Environment and Conservation (NL DEC) ambient air quality standard for TSP (120 µg/m^3).

To estimate the potential contribution of onsite crushing emissions to the measured TSP data at the monitoring station, the directionality of the wind during each sample period was examined. A TSP pollution rose for the site is presented as Figure 1. This figure plots the maximum measured particulate concentration in wind sectors of 22.5 degree increments.

The analysis of the TSP results and on-site conditions indicate that the highest TSP concentration measured at the site (42 µg/m^3) was from the west. During this measurement, the sampler was upwind of both the exploration crushing operations and the ore piles, although the mobile crusher was not operating during this sampling event. The next highest TSP concentration (28 µg/m^3) was also from the west.

Two measurements were taken while the wind direction was predominantly from the east, which would give an indication of localized ambient particulate levels. In both cases (samples from September 29, 2008 and October 29, 2008), the measured TSP concentration was 21 µg/m^3.

METALS RESULTS

The measured ambient metals concentrations for the monitoring station are presented in Attachment C. A total of nine metals were analysed for each of the eight samples collected during the monitoring period. There are no NL DEC standards for metals, so Ontario MOE criteria were used where applicable.

Table 2 summarizes the data for the analysed metals at the site. The majority of samples had metals concentrations below the laboratory detection limit and all measured concentrations were well below the relevant MOE criteria (less than 10%).

CONCLUSIONS

The following conclusions were made from the ambient monitoring data at the LIM site:

- All measured ambient TSP samples were below the NL DEC air quality 24-hour standard for TSP;
- All measured ambient metals samples were below the relevant Ontario MOE air quality criteria;
- The highest measured TSP concentrations at the site occurred when the mobile ore crusher was not operating;
- Measurements that were taken during days when the predominant wind direction was from the east indicate ambient TSP concentrations to be approximately 21 µg/m^3; and,
- Samples taken during the crushing operations were below the NL DEC air quality 24-hour standard for TSP.

CLOSURE

The assessment represents the conditions at the subject property at the time of the monitoring. The conclusions presented herein represent the best judgment of the assessor based on current environmental standards.

Should you have any questions, please do not hesitate to contact me at (905) 474-7700, Fax: (905) 479-9326 or my E-mail at ddsouza@jacqueswhitford.com at your convenience.

Yours truly,

JACQUES WHITFORD LIMITED

Original signed by:	***Orginial signed by:***
Don D'Souza, B.A.Sc. Project Scientist	Ben Coulson, P. Eng., M.A.Sc. Group Leader

cc: Dana Feltham, Jacques Whitford Limited

Enclosures:
- Tables 1-2
- Figure 1
- Attachment A: Site Plan
- Attachment B: Photographs
- Attachment C: Air Quality Monitoring Analyses

P:\CMiC Jobs\1040xxx\1043706\Reports\Letter Report LIM ambient monitoring 081203.doc

Table 1 Summary of TSP Monitoring Results - Silver Yards ambient monitoring

Sampling Date	TSP[1]	WS	WD	Temp	% of TSP Standard[1]	Activities in vicinity of sampler
(mm/dd/yyyy)	(µg/m3)	(km/hr)	(°) (Direction)	(°C)		
9/11/2008	10	16	264 (W)	8.3	9%	Crusher Operating
9/23/2008	10	19	307 (NW)	1.4	9%	Crusher Operating
9/29/2008	21	14	59 (NE)	3.2	17%	N/A
10/18/2008	28	15	292 (NW)	-3.7	23%	Hauling ore from Silver Yards
10/23/2008	28	19	268 (W)	-0.9	23%	N/A
10/29/2008	21	21	145 (SE)	6.2	17%	N/A
11/4/2008	10	13	238 (SW)	-4.0	9%	N/A
11/10/2008	42	7	279 (W)	-0.2	35%	N/A
# of Samples	8					
Minimum	10				9%	
Maximum	42				35%	
Average	21				18%	

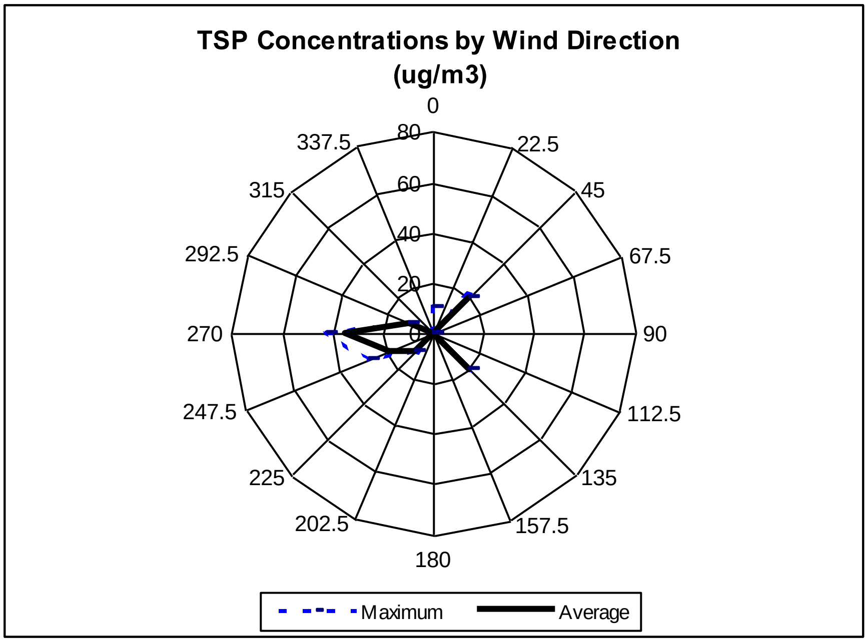
Notes:
The results from 11/4/2008 and 11/10/2008 are preliminary and subject to change. Maxxam Analytics will provide finalized results at a later date.
1 – NL DEC Standard for TSP is 120 µg/m^3

Table 2 Metal Results for Silver Yards Ambient Monitoring

Site ID	Metal	Maximum Concentration (µg/m3)	Minimum Concentration (µg/m3)	Mean Concentration (µg/m3)	MOE[1] Criteria (µg/m3)	% of MOE Criteria (using Maximum Concentration)
Silver Yards	Antimony	0.03	0.03	0.03	25	<1%
	Arsenic	0.02	0.02	0.02	0.3	7%
	Bismuth	0.02	0.02	0.02	N/A	N/A
	Phosphorus	0.09	0.09	0.09	N/A	N/A
	Selenium	0.03	0.03	0.03	10	<1%
	Silicon	1.90	0.83	1.39	N/A	N/A
	Sulphur	0.33	0.09	0.19	N/A	N/A
	Uranium	0.53	0.10	0.17	N/A	N/A
	Zirconium	0.01	0.003	0.00	N/A	N/A

Notes:
There are no NL DEC standards for ambient metals concentrations. Ontario MOE criteria were used where applicable.

Figure 1: TSP Pollution Rose



Attachment A

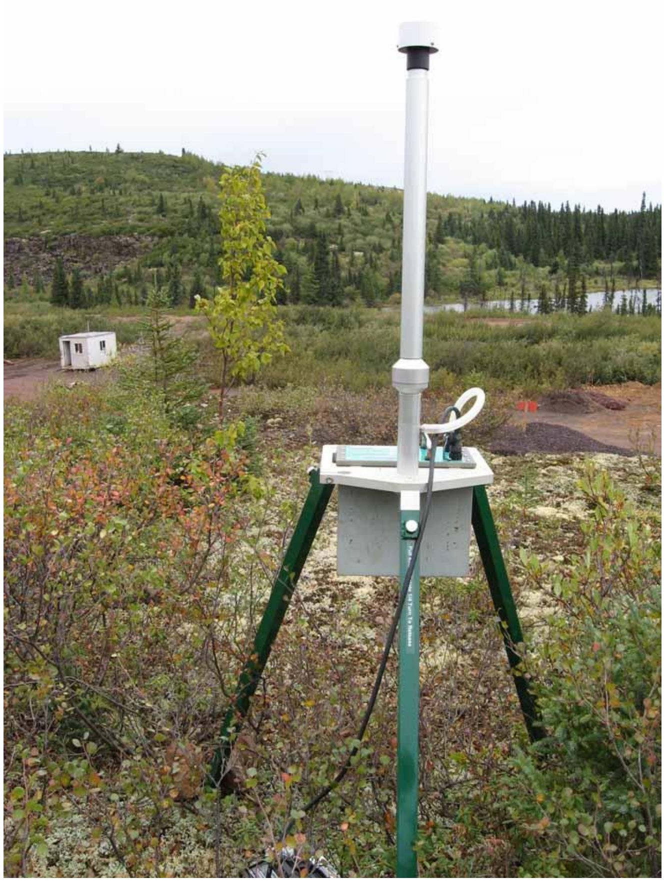
Site Map Showing Monitoring Station Locations

Reference: Google Earth, 2008

Attachment B

Monitoring Station Photos

Photograph 1: View of Sampler Location (facing north-east)



Photograph 2: View of Sampler Location (facing north-west)

Photograph 3: In front of Sampler Location (facing east)

Attachment C

Air Quality Monitoring Analyses

Your P.O. #: NSD016400
Your Project #: 1043706 PHASE Z9100
Site:LIM
Your C.O.C. #: EO223608

Attention: Don D'Souza
Jacques Whitford Limited
7271 Warden Ave
Markham, ON
L3R 5X5

Report Date: 2008/11/19

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: A8D0558
Received: 2008/11/05, 10:24

Sample Matrix: Filter
Samples Received: 4

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Total Metals on Low-Vol Filter(6010Bmod) (1)(2)	4	2008/11/11	2008/11/11	BRL SOP-00100 / BRL SOP-00102	EPA 6010Bmod
Particulates on Filter (M5/315/NJATM1) (1)(2)	4	N/A	2008/11/11	BRL SOP-00109	EPA 5/315/NJATM1

* RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

(1) This test was performed by Maxxam Analytics Mississauga
(2) This test was performed in Maxxam Mississauga under Maxxam Burlington SCC Accreditation

Encryption Key

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

THERESA STEPHENSON, Project Manager
Email: Theresa.Stephenson@MaxxamAnalytics.com
Phone# (905) 817-5763

==
Maxxam has procedures in place to guard against improper use of the electronic signature and have the required "signatories", as per section 5.10.2 of ISO/IEC 17025:2005(E), signing the reports. SCC and CALA have approved this reporting process and electronic report format.

For Service Group specific validation please refer to the Validation Signature Page

Total cover pages: 1

Maxxam Job #: A8D0558
Report Date: 2008/11/19

Jacques Whitford Limited
Client Project #: 1043706 PHASE Z9100
Project name: LIM
Your P.O. #: NSD016400

RESULTS OF ANALYSES OF FILTER

Maxxam ID		AZ1571	AZ1572	AZ1573	AZ1574		
Sampling Date		2008/09/11	2008/09/23	2008/09/29	2008/09/18		
COC Number		EO223608	EO223608	EO223608	EO223608		
	Units	**8090402**	**8090409**	**8090410**	**8090403**	**RDL**	**QC Batch**
Particulate Weight on Filter	mg	<0.30	<0.30	0.30	0.40	0.30	1668753

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Jacques Whitford Limited
Maxxam Job #: A8D0558
Client Project #: 1043706 PHASE Z9100
Report Date: 2008/11/19
Project name: LIM
Your P.O. #: NSD016400

MISCELLANEOUS (FILTER)

Maxxam ID		AZ1571	AZ1572	AZ1573	AZ1574		
Sampling Date		2008/09/11	2008/09/23	2008/09/29	2008/09/18		
COC Number		EO223608	EO223608	EO223608	EO223608		
	Units	**8090402**	**8090409**	**8090410**	**8090403**	**RDL**	**QC Batch**
Metals							
Antimony (Sb)	ug	<1.0	<1.0	<1.0	<1.0	1.0	1669114
Arsenic (As)	ug	<0.60	<0.60	<0.60	<0.60	0.60	1669114
Bismuth (Bi)	ug	<0.60	<0.60	<0.60	<0.60	0.60	1669114
Phosphorus (P)	ug	<2.5	<2.5	<2.5	<2.5	2.5	1669114
Selenium (Se)	ug	<1.0	<1.0	<1.0	<1.0	1.0	1669114
Silicon (Si)	ug	18.1	18.8	12.0	16.8	1.0	1669114
Sulphur (S)	ug	3.4	<2.5	<2.5	<2.5	2.5	1669114
Uranium (U)	ug	<3.0	<3.0	<3.0	<3.0	3.0	1669114
Zirconium (Zr)	ug	<0.10	<0.10	<0.10	<0.10	0.10	1669114

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam Job #: A8D0558
Report Date: 2008/11/19

Jacques Whitford Limited
Client Project #: 1043706 PHASE Z9100
Project name: LIM
Your P.O. #: NSD016400

GENERAL COMMENTS

Results relate only to the items tested.

Jacques Whitford Limited
Attention: Don D'Souza
Client Project #: 1043706 PHASE Z9100
P.O. #: NSD016400
Project name: LIM

Quality Assurance Report

Maxxam Job Number: GA8D0558

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
1669114	KCO	Spiked Blank	Antimony (Sb)	2008/11/11		108	%	85 - 115
		RPD	Antimony (Sb)	2008/11/11	3.9		%	20
		Spiked Blank	Arsenic (As)	2008/11/11		105	%	85 - 115
		RPD	Arsenic (As)	2008/11/11	4.0		%	20
		Spiked Blank	Bismuth (Bi)	2008/11/11		104	%	85 - 115
		RPD	Bismuth (Bi)	2008/11/11	2.9		%	20
		Spiked Blank	Phosphorus (P)	2008/11/11		104	%	85 - 115
		RPD	Phosphorus (P)	2008/11/11	0.08		%	20
		Spiked Blank	Selenium (Se)	2008/11/11		103	%	85 - 115
		RPD	Selenium (Se)	2008/11/11	0.4		%	20
		Spiked Blank	Silicon (Si)	2008/11/11		103	%	85 - 115
		RPD	Silicon (Si)	2008/11/11	0.5		%	20
		Spiked Blank	Sulphur (S)	2008/11/11		101	%	85 - 115
		RPD	Sulphur (S)	2008/11/11	0.3		%	20
		Spiked Blank	Uranium (U)	2008/11/11		105	%	85 - 115
		RPD	Uranium (U)	2008/11/11	2.8		%	20
		Spiked Blank	Zirconium (Zr)	2008/11/11		101	%	85 - 115
		RPD	Zirconium (Zr)	2008/11/11	0.4		%	20
		Method Blank	Antimony (Sb)	2008/11/11	<1.0		ug	
			Arsenic (As)	2008/11/11	<0.60		ug	
			Bismuth (Bi)	2008/11/11	<0.60		ug	
			Phosphorus (P)	2008/11/11	<2.5		ug	
			Selenium (Se)	2008/11/11	<1.0		ug	
			Silicon (Si)	2008/11/11	<1.0		ug	
			Sulphur (S)	2008/11/11	<2.5		ug	
			Uranium (U)	2008/11/11	<3.0		ug	
			Zirconium (Zr)	2008/11/11	<0.10		ug	

RPD = Relative Percent Difference
SPIKE = Fortified sample

Validation Signature Page

Maxxam Job #: A8D0558

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

FRANK MO, B.Sc., Inorganic Lab. Manager

==

Your Project #: 1043706,Z9100
Site:SCHEFFERVILLE
Your C.O.C. #: EO227308

Attention: Don D'Souza
Jacques Whitford Limited
7271 Warden Ave
Markham, ON
L3R 5X5

Report Date: 2008/12/04

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: A8D6812
Received: 2008/11/18, 13:13

Sample Matrix: Filter
Samples Received: 2

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Total Metals on Low-Vol Filter(6010Bmod) (1)	2	2008/12/02	2008/12/03	BRL SOP-00100 / BRL SOP-00102	EPA 6010Bmod
Particulates on Filter (M5/315/NJATM1) (1)	2	N/A	2008/12/02	BRL SOP-00109	EPA 5/315/NJATM1

(1) This test was performed in Maxxam Mississauga under Maxxam Burlington SCC Accreditation

MAXXAM ANALYTICS

THERESA STEPHENSON
Project Manager

TDS/poh
encl.

Authorized By : T. W. Obal

Taras W. Obal

TERRY OBAL, Ph.D., C. Chem
Manager, Scientific Services

Total cover pages: 1

Maxxam Job #: A8D6812
Report Date: 2008/12/04

Jacques Whitford Limited
Client Project #: 1043706,Z9100
Project name: SCHEFFERVILLE

RESULTS OF ANALYSES OF FILTER

Maxxam ID		BC2709	BC2710		
Sampling Date		2008/10/29	2008/11/09		
COC Number		EO227308	EO227308		
	Units	**8090407**	**8090406**	**DL**	**QC Batch**
Particulate Weight on Filter	mg	0.30	0.40	0.30	1688596

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

MISCELLANEOUS (FILTER)

Maxxam ID		BC2709	BC2710		
Sampling Date		2008/10/29	2008/11/09		
COC Number		EO227308	EO227308		
	Units	**8090407**	**8090406**	**DL**	**QC Batch**
Antimony (Sb)	ug	<1.0	<1.0	1.0	1689225
Arsenic (As)	ug	<0.60	<0.60	0.60	1689225
Bismuth (Bi)	ug	<0.60	<0.60	0.60	1689225
Phosphorus (P)	ug	<2.5	<2.5	2.5	1689225
Selenium (Se)	ug	<1.0	<1.0	1.0	1689225
Silicon (Si)	ug	27.3	27.4	1.0	1689225
Sulphur (S)	ug	4.5	4.8	2.5	1689225
Uranium (U)	ug	7.6	<3.0	3.0	1689225
Zirconium (Zr)	ug	0.11	<0.10	0.10	1689225

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Jacques Whitford Limited

Maxxam Job #: A8D6812
Report Date: 2008/12/04

Client Project #: 1043706,Z9100
Project name: SCHEFFERVILLE

GENERAL COMMENTS

Results relate only to the items tested.

Jacques Whitford Limited
Attention: Don D'Souza
Client Project #: 1043706,Z9100
P.O. #:
Project name: SCHEFFERVILLE

Quality Assurance Report

Maxxam Job Number: GA8D6812

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
1689225 KCO	Spiked Blank	Antimony (Sb)	2008/12/03		107	%	85 - 115
	RPD	Antimony (Sb)	2008/12/02	4.5		%	20
	Spiked Blank	Arsenic (As)	2008/12/03		95	%	85 - 115
	RPD	Arsenic (As)	2008/12/02	5.3		%	20
	Spiked Blank	Bismuth (Bi)	2008/12/03		98	%	85 - 115
	RPD	Bismuth (Bi)	2008/12/02	9.1		%	20
	Spiked Blank	Phosphorus (P)	2008/12/03		100	%	85 - 115
	RPD	Phosphorus (P)	2008/12/02	1.0		%	20
	Spiked Blank	Selenium (Se)	2008/12/03		100	%	85 - 115
	RPD	Selenium (Se)	2008/12/02	2.6		%	20
	Spiked Blank	Silicon (Si)	2008/12/03		97	%	85 - 115
	RPD	Silicon (Si)	2008/12/02	2.9		%	20
	Spiked Blank	Sulphur (S)	2008/12/03		101	%	85 - 115
	RPD	Sulphur (S)	2008/12/02	0.9		%	20
	Spiked Blank	Uranium (U)	2008/12/03		98	%	85 - 115
	RPD	Uranium (U)	2008/12/02	8.4		%	20
	Spiked Blank	Zirconium (Zr)	2008/12/03		102	%	85 - 115
	RPD	Zirconium (Zr)	2008/12/02	1.1		%	20
	Method Blank	Antimony (Sb)	2008/12/02	<1.0		ug	
		Arsenic (As)	2008/12/02	<0.60		ug	
		Bismuth (Bi)	2008/12/02	<0.60		ug	
		Phosphorus (P)	2008/12/02	<2.5		ug	
		Selenium (Se)	2008/12/02	<1.0		ug	
		Silicon (Si)	2008/12/02	<1.0		ug	
		Sulphur (S)	2008/12/02	<2.5		ug	
		Uranium (U)	2008/12/02	<3.0		ug	
		Zirconium (Zr)	2008/12/02	<0.10		ug	

RPD = Relative Percent Difference
SPIKE = Fortified sample

ATTACHMENT B

CALMET Input File

```
CALMET.INP      2.1             Hour Start and End Times with Seconds
met data from 2002 to 2006 - lab. lim facility -NOV 18-08


---------------- Run title (3 lines) 
------------------------------------------

                    CALMET MODEL CONTROL FILE
                    --------------------------

------------------------------------------------------------------------
-------

INPUT GROUP: 0 -- Input and Output File Names


Subgroup (a)
------------
Default Name  Type          File Name
------------  ----          ---------
GEO.DAT       input    ! GEODAT=geo.dat       !
SURF.DAT      input    ! SRFDAT=surf.dat      !
CLOUD.DAT     input    * CLDDAT=            *
PRECIP.DAT    input    * PRCDAT=            *
WT.DAT        input    * WTDAT=             *

CALMET.LST    output   ! METLST=CMET.LST     !
CALMET.DAT    output   ! METDAT=CMET.DAT    !
PACOUT.DAT    output   * PACDAT=            *

All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE

NUMBER OF UPPER AIR & OVERWATER STATIONS:

    Number of upper air stations (NUSTA)  No default     ! NUSTA =  1  !
    Number of overwater met stations
                                 (NOWSTA) No default     ! NOWSTA =  0
!

NUMBER OF PROGNOSTIC and IGF-CALMET FILEs:

    Number of MM4/MM5/3D.DAT files
                                 (NM3D) No default       ! NM3D =  0  !

    Number of IGF-CALMET.DAT files
                                 (NIGF)   No default     ! NIGF =  0  !

                       !END!
------------------------------------------------------------------------
--------
Subgroup (b)
---------------------------------
Upper air files (one per station)
---------------------------------
Default Name  Type       File Name
------------  ----       ---------
UP1.DAT       input     1  ! UPDAT=up.dat!    !END!
```

```
------------------------------------------------------------------------
--------
Subgroup (c)
-----------------------------------------
Overwater station files (one per station)
-----------------------------------------
Default Name  Type       File Name
------------  ----       ---------
SEA1.DAT       input     1  * SEADAT=SEA_449.DAT *    *END*
------------------------------------------------------------------------
--------
Subgroup (d)
------------------------------------------------
MM4/MM5/3D.DAT files (consecutive or overlapping)
------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
MM51.DAT       input     1  * M3DDAT=LSP2003.DAT *    *END*
------------------------------------------------------------------------
--------
Subgroup (e)
-------------------------------------------------
IGF-CALMET.DAT files (consecutive or overlapping)
-------------------------------------------------
Default Name  Type       File Name
------------  ----       ---------
IGFn.DAT       input     1  * IGFDAT=CALMET0.DAT *    *END*
------------------------------------------------------------------------
--------
Subgroup (f)
----------------
Other file names
----------------

Default Name  Type       File Name
------------  ----       ---------
DIAG.DAT      input      * DIADAT=                  *
PROG.DAT      input      * PRGDAT=                  *

TEST.PRT      output     * TSTPRT=                  *
TEST.OUT      output     * TSTOUT=                  *
TEST.KIN      output     * TSTKIN=                  *
TEST.FRD      output     * TSTFRD=                  *
TEST.SLP      output     * TSTSLP=                  *
DCST.GRD      output     * DCSTGD=                  *

------------------------------------------------------------------------
--------
NOTES: (1) File/path names can be up to 70 characters in length
       (2) Subgroups (a) and (f) must have ONE 'END' (surrounded by
           delimiters) at the end of the group
       (3) Subgroups (b) through (e) are included ONLY if the
corresponding
           number of files (NUSTA, NOWSTA, NM3D, NIGF) is not 0, and
each must have
           an 'END' (surround by delimiters) at the end of EACH LINE

                         !END!
```

```
------------------------------------------------------------------------
-------

INPUT GROUP: 1 -- General run control parameters
--------------

     Starting date:    Year   (IBYR)  --    No default   ! IBYR  =  2002
!
                       Month  (IBMO)  --    No default   ! IBMO  =  1  !
                       Day    (IBDY)  --    No default   ! IBDY  =  1  !
     Starting time:    Hour   (IBHR)  --    No default   ! IBHR  =  0  !
                       Second (IBSEC) --    No default   ! IBSEC =  0  !

     Ending date:      Year   (IEYR)  --    No default   ! IEYR  =  2006
!
                       Month  (IEMO)  --    No default   ! IEMO  =  12
!
                       Day    (IEDY)  --    No default   ! IEDY  =  31
!
     Ending time:      Hour   (IEHR)  --    No default   ! IEHR  =  23
!
                       Second (IESEC) --    No default   ! IESEC =  0  !

      UTC time zone         (ABTZ) -- No default       ! ABTZ= UTC-0400
!
         (character*8)
         PST = UTC-0800, MST = UTC-0700 , GMT = UTC-0000
         CST = UTC-0600, EST = UTC-0500

     Length of modeling time-step (seconds)
     Must divide evenly into 3600 (1 hour)
     (NSECDT)                         Default:3600     ! NSECDT =  3600
!
                                      Units: seconds

     Run type            (IRTYPE) -- Default: 1       ! IRTYPE=  1  !

        0 = Computes wind fields only
        1 = Computes wind fields and micrometeorological variables
            (u*, w*, L, zi, etc.)
        (IRTYPE must be 1 to run CALPUFF or CALGRID)

     Compute special data fields required
     by CALGRID (i.e., 3-D fields of W wind
     components and temperature)
     in additional to regular            Default: T    ! LCALGRD = T !
     fields ? (LCALGRD)
     (LCALGRD must be T to run CALGRID)

      Flag to stop run after
      SETUP phase (ITEST)             Default: 2       ! ITEST=  2   !
      (Used to allow checking
      of the model inputs, files, etc.)
      ITEST = 1 - STOPS program after SETUP phase
      ITEST = 2 - Continues with execution of
                  COMPUTATIONAL phase after SETUP


     Test options specified to see if
     they conform to regulatory
```

```
     values? (MREG)                  No Default       ! MREG =   1   !

        0 = NO checks are made
        1 = Technical options must conform to USEPA guidance
                  IMIXH    -1       Maul-Carson convective mixing height
                                    over land; OCD mixing height
overwater
                  ICOARE   0        OCD deltaT method for overwater
fluxes
                  THRESHL  0.0      Threshold buoyancy flux over land
needed
                                    to sustain convective mixing height
growth
                  ISURFT   > 0      Pick one representative station, OR
                           -2       in NOOBS mode (ITPROG=2) average all
                                    surface prognostic temperatures to
get
                                    a single representative surface
temp.
                  IUPT     > 0      Pick one representative station, OR
                           -2       in NOOBS mode (ITPROG>0) average all
surface
                                    prognostic temperatures to get a
single
                                    representative surface temp.

!END!

------------------------------------------------------------------------
-------

INPUT GROUP: 2 -- Map Projection and Grid control parameters
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                    Default: UTM    ! PMAP = UTM  !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area

     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                   Default=0.0     ! FEAST  = 0.000  !
     (FNORTH)                  Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                  No Default      ! IUTMZN =  19   !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                  Default: N      ! UTMHEM = N  !
         N   :  Northern hemisphere projection
```

```
        S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)                    No Default      ! RLAT0 = 54N  !
     (RLON0)                    No Default      ! RLON0 = 67E  !

        TTM :  RLON0 identifies central (true N/S) meridian of
projection
               RLAT0 selected for convenience
        LCC :  RLON0 identifies central (true N/S) meridian of
projection
               RLAT0 selected for convenience
        PS  :  RLON0 identifies central (grid N/S) meridian of
projection
               RLAT0 selected for convenience
        EM  :  RLON0 identifies central meridian of projection
               RLAT0 is REPLACED by 0.0N (Equator)
        LAZA:  RLON0 identifies longitude of tangent-point of mapping
plane
               RLAT0 identifies latitude of tangent-point of mapping
plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (XLAT1)                    No Default      ! XLAT1 = 0N  !
     (XLAT2)                    No Default      ! XLAT2 = 0N  !

        LCC :  Projection cone slices through Earth's surface at XLAT1
and XLAT2
        PS  :  Projection plane slices through Earth at XLAT1
               (XLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Datum-region
     ------------

     The Datum-Region for the coordinates is identified by a character
     string.  Many mapping products currently available use the model of
the
     Earth known as the World Geodetic System 1984 (WGS-84).  Other
local
     models may be in use, and their selection in CALMET will make its
output
     consistent with local mapping products.  The list of Datum-Regions
with
     official transformation parameters is provided by the National
Imagery and
     Mapping Agency (NIMA).

     NIMA Datum - Regions(Examples)

------------------------------------------------------------------------
```

```
------
     WGS-84    WGS-84 Reference Ellipsoid and Geoid, Global coverage
(WGS84)
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS
(NAD27)
     NAR-C     NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS
(NAD83)
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

     Datum-region for output coordinates
     (DATUM)                    Default: WGS-84    ! DATUM = WGS-84  !


     Horizontal grid definition:
     ---------------------------

     Rectangular grid defined for projection PMAP,
     with X the Easting and Y the Northing coordinate

            No. X grid cells (NX)      No default     ! NX =   60  !
            No. Y grid cells (NY)      No default     ! NY =   60  !

     Grid spacing (DGRIDKM)            No default     ! DGRIDKM = 0.5 !
                                       Units: km

     Reference grid coordinate of
     SOUTHWEST corner of grid cell (1,1)

        X coordinate (XORIGKM)         No default     ! XORIGKM =
623.000 !
        Y coordinate (YORIGKM)         No default     ! YORIGKM =
6060.000 !
                                       Units: km


     Vertical grid definition:
     -------------------------

        No. of vertical layers (NZ)    No default     ! NZ =  8  !

        Cell face heights in arbitrary
        vertical grid (ZFACE(NZ+1))    No defaults
                                       Units: m
         ! ZFACE = 0.,20.,50.,100.,200.,500.,1000.,2000.,3300. !

!END!


------------------------------------------------------------------------
-------

INPUT GROUP: 3 -- Output Options
--------------


    DISK OUTPUT OPTION

       Save met. fields in an unformatted
       output file ?              (LSAVE)  Default: T     ! LSAVE = T !
```

```
       (F = Do not save, T = Save)

       Type of unformatted output file:
       (IFORMO)                            Default: 1    ! IFORMO =  1
!

            1 = CALPUFF/CALGRID type file (CALMET.DAT)
            2 = MESOPUFF-II type file     (PACOUT.DAT)


    LINE PRINTER OUTPUT OPTIONS:

       Print met. fields ?  (LPRINT)       Default: F     ! LPRINT = F !
       (F = Do not print, T = Print)
       (NOTE: parameters below control which
              met. variables are printed)

       Print interval
       (IPRINF) in hours                   Default: 1     ! IPRINF =  1
!
       (Meteorological fields are printed
        every  1  hours)


       Specify which layers of U, V wind component
       to print (IUVOUT(NZ)) -- NOTE: NZ values must be entered
       (0=Do not print, 1=Print)
       (used only if LPRINT=T)        Defaults: NZ*0
       ! IUVOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !
       -----------------------


       Specify which levels of the W wind component to print
       (NOTE: W defined at TOP cell face --  10  values)
       (IWOUT(NZ)) -- NOTE: NZ values must be entered
       (0=Do not print, 1=Print)
       (used only if LPRINT=T & LCALGRD=T)
       -----------------------------------
                                            Defaults: NZ*0
        ! IWOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !


       Specify which levels of the 3-D temperature field to print
       (ITOUT(NZ)) -- NOTE: NZ values must be entered
       (0=Do not print, 1=Print)
       (used only if LPRINT=T & LCALGRD=T)
       -----------------------------------
                                            Defaults: NZ*0
        ! ITOUT =  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0 ,  0  !

       Specify which meteorological fields
       to print
       (used only if LPRINT=T)             Defaults: 0 (all variables)
       -----------------------


         Variable            Print ?
                        (0 = do not print,
                         1 = print)
         --------       ------------------
```

```
      !  STABILITY  =           0           ! - PGT stability class
      !  USTAR      =           0           ! - Friction velocity
      !  MONIN      =           0           ! - Monin-Obukhov length
      !  MIXHT      =           0           ! - Mixing height
      !  WSTAR      =           0           ! - Convective velocity
scale
      !  PRECIP     =           0           ! - Precipitation rate
      !  SENSHEAT   =           0           ! - Sensible heat flux
      !  CONVZI     =           0           ! - Convective mixing ht.


       Testing and debug print options for micrometeorological module

          Print input meteorological data and
          internal variables (LDB)         Default: F       ! LDB = F !
          (F = Do not print, T = print)
          (NOTE: this option produces large amounts of output)

          First time step for which debug data
          are printed (NN1)                Default: 1       ! NN1 =  1
!

          Last time step for which debug data
          are printed (NN2)                Default: 1       ! NN2 =  2
!

          Print distance to land
          internal variables (LDBCST)      Default: F       ! LDBCST = F
!
          (F = Do not print, T = print)
          (Output in .GRD file DCST.GRD, defined in input group 0)

       Testing and debug print options for wind field module
       (all of the following print options control output to
        wind field module's output files: TEST.PRT, TEST.OUT,
        TEST.KIN, TEST.FRD, and TEST.SLP)

          Control variable for writing the test/debug
          wind fields to disk files (IOUTD)
          (0=Do not write, 1=write)        Default: 0       ! IOUTD =  0
!

          Number of levels, starting at the surface,
          to print (NZPRN2)                Default: 1       ! NZPRN2 =
1  !

          Print the INTERPOLATED wind components ?
          (IPR0) (0=no, 1=yes)             Default: 0       !  IPR0 =  0
!

          Print the TERRAIN ADJUSTED surface wind
          components ?
          (IPR1) (0=no, 1=yes)             Default: 0       !  IPR1 =  0
!

          Print the SMOOTHED wind components and
          the INITIAL DIVERGENCE fields ?
          (IPR2) (0=no, 1=yes)             Default: 0       !  IPR2 =  0
!
```

```
          Print the FINAL wind speed and direction
          fields ?
          (IPR3) (0=no, 1=yes)             Default: 0       !  IPR3 =  0
!

          Print the FINAL DIVERGENCE fields ?
          (IPR4) (0=no, 1=yes)             Default: 0       !  IPR4 =  0
!

          Print the winds after KINEMATIC effects
          are added ?
          (IPR5) (0=no, 1=yes)             Default: 0       !  IPR5 =  0
!

          Print the winds after the FROUDE NUMBER
          adjustment is made ?
          (IPR6) (0=no, 1=yes)             Default: 0       !  IPR6 =  0
!

          Print the winds after SLOPE FLOWS
          are added ?
          (IPR7) (0=no, 1=yes)             Default: 0       !  IPR7 =  0
!

          Print the FINAL wind field components ?
          (IPR8) (0=no, 1=yes)             Default: 0       !  IPR8 =  0
!

!END!


------------------------------------------------------------------------
-------

INPUT GROUP: 4 -- Meteorological data options
--------------

    NO OBSERVATION MODE             (NOOBS)  Default: 0     ! NOOBS =  0
!
          0 = Use surface, overwater, and upper air stations
          1 = Use surface and overwater stations (no upper air
observations)
              Use MM4/MM5/3D.DAT for upper air data
          2 = No surface, overwater, or upper air observations
              Use MM4/MM5/3D.DAT for surface, overwater, and upper air
data

    NUMBER OF SURFACE & PRECIP. METEOROLOGICAL STATIONS

       Number of surface stations   (NSSTA)  No default     ! NSSTA =  2
!

       Number of precipitation stations
       (NPSTA=-1: flag for use of MM5/3D.DAT precip data)
                                    (NPSTA)  No default     ! NPSTA =  0
!

    CLOUD DATA OPTIONS
       Gridded cloud fields:
```

```
                                   (ICLOUD)  Default: 0     ! ICLOUD =
0  !
       ICLOUD = 0 - Gridded clouds not used
       ICLOUD = 1 - Gridded CLOUD.DAT generated as OUTPUT
       ICLOUD = 2 - Gridded CLOUD.DAT read as INPUT
       ICLOUD = 3 - Gridded cloud cover from Prognostic Rel. Humidity
                    at 850mb (Teixera)
       ICLOUD = 4 - Gridded cloud cover from Prognostic Rel. Humidity
                    at all levels (MM5toGrads algorithm)

    FILE FORMATS

       Surface meteorological data file format
                                   (IFORMS)  Default: 2     ! IFORMS =
2  !
       (1 = unformatted (e.g., SMERGE output))
       (2 = formatted   (free-formatted user input))

       Precipitation data file format
                                   (IFORMP)  Default: 2     ! IFORMP =
2  !
       (1 = unformatted (e.g., PMERGE output))
       (2 = formatted   (free-formatted user input))

       Cloud data file format
                                   (IFORMC)  Default: 2     ! IFORMC =
2  !
       (1 = unformatted - CALMET unformatted output)
       (2 = formatted   - free-formatted CALMET output or user input)

!END!


------------------------------------------------------------------------
-------

INPUT GROUP: 5 -- Wind Field Options and Parameters
--------------


    WIND FIELD MODEL OPTIONS
       Model selection variable (IWFCOD)     Default: 1      ! IWFCOD =
1  !
          0 = Objective analysis only
          1 = Diagnostic wind module

       Compute Froude number adjustment
       effects ? (IFRADJ)                    Default: 1      ! IFRADJ =
1  !
       (0 = NO, 1 = YES)

       Compute kinematic effects ? (IKINE)   Default: 0      ! IKINE  =
0  !
       (0 = NO, 1 = YES)

       Use O'Brien procedure for adjustment
       of the vertical velocity ? (IOBR)     Default: 0      ! IOBR =  0
!
       (0 = NO, 1 = YES)
```

```
       Compute slope flow effects ? (ISLOPE) Default: 1      ! ISLOPE  =
1  !
       (0 = NO, 1 = YES)

       Extrapolate surface wind observations
       to upper layers ? (IEXTRP)            Default: -4     ! IEXTRP =
-4  !
       (1 = no extrapolation is done,
        2 = power law extrapolation used,
        3 = user input multiplicative factors
            for layers 2 - NZ used (see FEXTRP array)
        4 = similarity theory used
        -1, -2, -3, -4 = same as above except layer 1 data
            at upper air stations are ignored

       Extrapolate surface winds even
       if calm? (ICALM)                      Default: 0      ! ICALM  =
0  !
       (0 = NO, 1 = YES)

       Layer-dependent biases modifying the weights of
       surface and upper air stations (BIAS(NZ))
         -1<=BIAS<=1
       Negative BIAS reduces the weight of upper air stations
         (e.g. BIAS=-0.1 reduces the weight of upper air stations
       by 10%; BIAS= -1, reduces their weight by 100 %)
       Positive BIAS reduces the weight of surface stations
         (e.g. BIAS= 0.2 reduces the weight of surface stations
       by 20%; BIAS=1 reduces their weight by 100%)
       Zero BIAS leaves weights unchanged (1/R**2 interpolation)
       Default: NZ*0
                               ! BIAS = -1 , -1 , -1 , -0.5 , -0.2 , 0.
, 0. , 0. !

       Minimum distance from nearest upper air station
       to surface station for which extrapolation
       of surface winds at surface station will be allowed
       (RMIN2: Set to -1 for IEXTRP = 4 or other situations
        where all surface stations should be extrapolated)
                                             Default: 4.     ! RMIN2 =
4.0 !

       Use gridded prognostic wind field model
       output fields as input to the diagnostic
       wind field model (IPROG)              Default: 0      ! IPROG =
0  !
       (0 = No, [IWFCOD = 0 or 1]
        1 = Yes, use CSUMM prog. winds as Step 1 field, [IWFCOD = 0]
        2 = Yes, use CSUMM prog. winds as initial guess field [IWFCOD =
1]
        3 = Yes, use winds from MM4.DAT file as Step 1 field [IWFCOD =
0]
        4 = Yes, use winds from MM4.DAT file as initial guess field
[IWFCOD = 1]
        5 = Yes, use winds from MM4.DAT file as observations [IWFCOD =
1]
        13 = Yes, use winds from MM5/3D.DAT file as Step 1 field [IWFCOD
= 0]
        14 = Yes, use winds from MM5/3D.DAT file as initial guess field
[IWFCOD = 1]
```

```
        15 = Yes, use winds from MM5/3D.DAT file as observations [IWFCOD
= 1]

       Timestep (seconds) of the prognostic
       model input data   (ISTEPPGS)         Default: 3600   ! ISTEPPGS
=  3600   !

       Use coarse CALMET fields as initial guess fields (IGFMET)
       (overwrites IGF based on prognostic wind fields if any)
                                             Default: 0      ! IGFMET =
0  !

    RADIUS OF INFLUENCE PARAMETERS

       Use varying radius of influence       Default: F      ! LVARY =
F!
       (if no stations are found within RMAX1,RMAX2,
        or RMAX3, then the closest station will be used)

       Maximum radius of influence over land
       in the surface layer (RMAX1)          No default      ! RMAX1 =
20. !
                                             Units: km
       Maximum radius of influence over land
       aloft (RMAX2)                         No default      ! RMAX2 =
20. !
                                             Units: km
       Maximum radius of influence over water
       (RMAX3)                               No default      ! RMAX3 =
20. !
                                             Units: km


    OTHER WIND FIELD INPUT PARAMETERS

       Minimum radius of influence used in
       the wind field interpolation (RMIN)   Default: 0.1    ! RMIN =
0.1 !
                                             Units: km
       Radius of influence of terrain
       features (TERRAD)                     No default      ! TERRAD =
5. !

                                             Units: km
       Relative weighting of the first
       guess field and observations in the
       SURFACE layer (R1)                    No default      ! R1 = 2. !
       (R1 is the distance from an           Units: km
       observational station at which the
       observation and first guess field are
       equally weighted)

       Relative weighting of the first
       guess field and observations in the
       layers ALOFT (R2)                     No default      ! R2 = 2. !
       (R2 is applied in the upper layers    Units: km
       in the same manner as R1 is used in
       the surface layer).

       Relative weighting parameter of the
```

```
       prognostic wind field data (RPROG)    No default      ! RPROG =
0. !
       (Used only if IPROG = 1)              Units: km
       ------------------------

       Maximum acceptable divergence in the
       divergence minimization procedure
       (DIVLIM)                              Default: 5.E-6  ! DIVLIM=
5.0E-06 !

       Maximum number of iterations in the
       divergence min. procedure (NITER)     Default: 50     ! NITER =
50  !

       Number of passes in the smoothing
       procedure (NSMTH(NZ))
       NOTE: NZ values must be entered
            Default: 2,(mxnz-1)*4 ! NSMTH =
 2 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4  !

       Maximum number of stations used in
       each layer for the interpolation of
       data to a grid point (NINTR2(NZ))
       NOTE: NZ values must be entered       Default: 99.    ! NINTR2 =
 4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4 ,  4  !

       Critical Froude number (CRITFN)       Default: 1.0    ! CRITFN =
1. !

       Empirical factor controlling the
       influence of kinematic effects
       (ALPHA)                               Default: 0.1    ! ALPHA =
0.1 !

       Multiplicative scaling factor for
       extrapolation of surface observations
       to upper layers (FEXTR2(NZ))          Default: NZ*0.0
       ! FEXTR2 = 0., 0., 0., 0., 0., 0., 0., 0. !
       (Used only if IEXTRP = 3 or -3)


    BARRIER INFORMATION

       Number of barriers to interpolation
       of the wind fields (NBAR)             Default: 0      ! NBAR =  0
!

       Level (1 to NZ) up to which barriers
       apply (KBAR)                          Default: NZ     ! KBAR =  8
!

       THE FOLLOWING 4 VARIABLES ARE INCLUDED
       ONLY IF NBAR > 0
       NOTE: NBAR values must be entered     No defaults
             for each variable               Units: km

          X coordinate of BEGINNING
          of each barrier (XBBAR(NBAR))      ! XBBAR = 0. !
          Y coordinate of BEGINNING
          of each barrier (YBBAR(NBAR))      ! YBBAR = 0. !
```

```
          X coordinate of ENDING
          of each barrier (XEBAR(NBAR))      ! XEBAR = 0. !
          Y coordinate of ENDING
          of each barrier (YEBAR(NBAR))      ! YEBAR = 0. !


    DIAGNOSTIC MODULE DATA INPUT OPTIONS

       Surface temperature (IDIOPT1)         Default: 0      ! IDIOPT1 =
0  !
          0 = Compute internally from
              hourly surface observations or prognostic fields
          1 = Read preprocessed values from
              a data file (DIAG.DAT)

          Surface met. station to use for
          the surface temperature (ISURFT)   Default: -1    ! ISURFT = 1
!
          (Must be a value from 1 to NSSTA,
           or -1 to use 2-D spatially varying
              surface temperatures,
           or -2 to use a domain-average prognostic
              surface temperatures (only with ITPROG=2))
          (Used only if IDIOPT1 = 0)
          --------------------------

       Temperature lapse rate used in the    Default: 0     ! IDIOPT2 =
0  !
          computation of terrain-induced
          circulations (IDIOPT2)
          0 = Compute internally from (at least) twice-daily
              upper air observations or prognostic fields
          1 = Read hourly preprocessed values
              from a data file (DIAG.DAT)

          Upper air station to use for
          the domain-scale lapse rate (IUPT) Default: -1    ! IUPT   = 1
!
          (Must be a value from 1 to NUSTA,
           or -1 to use 2-D spatially varying lapse rate,
           or -2 to use a domain-average prognostic
              lapse rate (only with ITPROG>0))
          (Used only if IDIOPT2 = 0)
          --------------------------

          Depth through which the domain-scale
          lapse rate is computed (ZUPT)      Default: 200.  ! ZUPT =
200. !
          (Used only if IDIOPT2 = 0)         Units: meters
          --------------------------

       Initial Guess Field Winds
       (IDIOPT3)                             Default: 0     ! IDIOPT3 =
0  !
          0 = Compute internally from
              observations or prognostic wind fields
          1 = Read hourly preprocessed domain-average wind values
              from a data file (DIAG.DAT)
```

```
          Upper air station to use for
          the initial guess winds (IUPWND)   Default: -1    ! IUPWND = 1
!
          (Must be a value from -1 to NUSTA, with
          -1 indicating 3-D initial guess fields,
          and IUPWND>1 domain-scaled (i.e. constant) IGF)
          (Used only if IDIOPT3 = 0 and noobs=0)
          --------------------------------------

          Bottom and top of layer through
          which the domain-scale winds
          are computed
          (ZUPWND(1), ZUPWND(2))        Defaults: 1., 1000. ! ZUPWND=
1., 1000. !
          (Used only if IDIOPT3 = 0, NOOBS>0 and IUPWND>0)    Units:
meters
          --------------------------

       Observed surface wind components
       for wind field module (IDIOPT4)  Default: 0     ! IDIOPT4 =  0  !
          0 = Read WS, WD from a surface
              data file (SURF.DAT)
          1 = Read hourly preprocessed U, V from
              a data file (DIAG.DAT)

       Observed upper air wind components
       for wind field module (IDIOPT5)  Default: 0     ! IDIOPT5 =  0  !
          0 = Read WS, WD from an upper
              air data file (UP1.DAT, UP2.DAT, etc.)
          1 = Read hourly preprocessed U, V from
              a data file (DIAG.DAT)

       LAKE BREEZE INFORMATION

          Use Lake Breeze Module  (LLBREZE)
                                           Default: F      ! LLBREZE = F
!

           Number of lake breeze regions (NBOX)            ! NBOX =  0
!

        X Grid line 1 defining the region of interest
                                                        ! XG1 = 0. !
        X Grid line 2 defining the region of interest
                                                        ! XG2 = 0. !
        Y Grid line 1 defining the region of interest
                                                        ! YG1 = 0. !
        Y Grid line 2 defining the region of interest
                                                        ! YG2 = 0. !

         X Point defining the coastline (Straight line)
                   (XBCST)  (KM)   Default: none    ! XBCST = 0. !

         Y Point defining the coastline (Straight line)
                   (YBCST)  (KM)   Default: none    ! YBCST = 0. !

         X Point defining the coastline (Straight line)
                   (XECST)  (KM)   Default: none    ! XECST = 0. !

         Y Point defining the coastline (Straight line)
```

```
                   (YECST)  (KM)   Default: none    ! YECST = 0. !


       Number of stations in the region     Default: none ! NLB =  0 !
       (Surface stations + upper air stations)

       Station ID's  in the region   (METBXID(NLB))
       (Surface stations first, then upper air stations)
         ! METBXID =  0 !

!END!


------------------------------------------------------------------------
-------

INPUT GROUP: 6 -- Mixing Height, Temperature and Precipitation
Parameters
--------------

    EMPIRICAL MIXING HEIGHT CONSTANTS

       Neutral, mechanical equation
       (CONSTB)                              Default: 1.41   ! CONSTB =
1.41 !
       Convective mixing ht. equation
       (CONSTE)                              Default: 0.15   ! CONSTE =
0.15 !
       Stable mixing ht. equation
       (CONSTN)                              Default: 2400.  ! CONSTN =
2400.!
       Overwater mixing ht. equation
       (CONSTW)                              Default: 0.16   ! CONSTW =
0.16 !
       Absolute value of Coriolis
       parameter (FCORIOL)                   Default: 1.E-4  ! FCORIOL =
1.0E-04!
                                             Units: (1/s)

    SPATIAL AVERAGING OF MIXING HEIGHTS

       Conduct spatial averaging
       (IAVEZI)  (0=no, 1=yes)               Default: 1      ! IAVEZI =
1  !

       Max. search radius in averaging
       process (MNMDAV)                      Default: 1      ! MNMDAV =
1  !
                                             Units: Grid
                                                    cells
       Half-angle of upwind looking cone
       for averaging (HAFANG)                Default: 30.    ! HAFANG =
30. !
                                             Units: deg.
       Layer of winds used in upwind
       averaging (ILEVZI)                    Default: 1      ! ILEVZI =
1  !
       (must be between 1 and NZ)
```

```
    CONVECTIVE MIXING HEIGHT OPTIONS:
       Method to compute the convective
       mixing height(IMIHXH)                 Default: 1      ! IMIXH =
-1  !
           1: Maul-Carson for land and water cells
          -1: Maul-Carson for land cells only -
              OCD mixing height overwater
           2: Batchvarova and Gryning for land and water cells
          -2: Batchvarova and Gryning for land cells only
              OCD mixing height overwater

       Threshold buoyancy flux required to
       sustain convective mixing height growth
       overland (THRESHL)                    Default: 0.0    ! THRESHL =
0. !
       (expressed as a heat flux             units: W/m3
        per meter of boundary layer)


       Threshold buoyancy flux required to
       sustain convective mixing height growth
       overwater (THRESHW)                   Default: 0.05   ! THRESHW =
0.05 !
       (expressed as a heat flux             units: W/m3
        per meter of boundary layer)


       Option for overwater lapse rates used
       in convective mixing height growth
       (ITWPROG)                             Default: 0      ! ITWPROG =
0  !
       0 : use SEA.DAT lapse rates and deltaT (or assume neutral
           conditions if missing)
       1 : use prognostic lapse rates (only if IPROG>2)
           and SEA.DAT deltaT (or neutral if missing)
       2 : use prognostic lapse rates and prognostic delta T
           (only if iprog>12 and 3D.DAT version# 2.0 or higher)

       Land Use category ocean in 3D.DAT datasets
       (ILUOC3D)                             Default: 16     ! ILUOC3D =
16  !
       Note: if 3D.DAT from MM5 version 3.0, iluoc3d = 16
             if MM4.DAT,           typically iluoc3d = 7


    OTHER MIXING HEIGHT VARIABLES

       Minimum potential temperature lapse
       rate in the stable layer above the
       current convective mixing ht.         Default: 0.001  ! DPTMIN =
0.001 !
       (DPTMIN)                              Units: deg. K/m
       Depth of layer above current conv.
       mixing height through which lapse     Default: 200.   ! DZZI =
200. !
       rate is computed (DZZI)               Units: meters

       Minimum overland mixing height        Default:  50.   ! ZIMIN =
50. !
       (ZIMIN)                               Units: meters
```

```
       Maximum overland mixing height        Default: 3000.  ! ZIMAX =
3000. !
       (ZIMAX)                               Units: meters
       Minimum overwater mixing height       Default:   50.  ! ZIMINW =
50. !
       (ZIMINW) -- (Not used if observed     Units: meters
       overwater mixing hts. are used)
       Maximum overwater mixing height       Default: 3000.  ! ZIMAXW =
3000. !
       (ZIMAXW) -- (Not used if observed     Units: meters
       overwater mixing hts. are used)


    OVERWATER SURFACE FLUXES METHOD and PARAMETERS
          (ICOARE)                           Default: 10      ! ICOARE =
0   !
           0: original deltaT method (OCD)
          10: COARE with no wave parameterization (jwave=0, Charnock)
          11: COARE with wave option jwave=1 (Oost et al.)
              and default wave properties
         -11: COARE with wave option jwave=1 (Oost et al.)
              and observed wave properties (must be in SEA.DAT files)
          12: COARE with wave option 2 (Taylor and Yelland)
               and default wave properties
         -12: COARE with wave option 2 (Taylor and Yelland)
              and observed wave properties (must be in SEA.DAT files)

          Note:  When ICOARE=0, similarity wind profile stability PSI
functions
                 based on Van Ulden and Holtslag (1985) are substituted
for
                 later formulations used with the COARE module, and
temperatures
                 used for surface layer parameters are obtained from
either the
                 nearest surface station temperature or prognostic model
2D
                 temperatures (if ITPROG=2).


          Coastal/Shallow water length scale (DSHELF)
          (for modified z0 in shallow water)
          ( COARE fluxes only)
                                          Default : 0.        ! DSHELF =
0. !
                                          units: km

           COARE warm layer computation (IWARM)               ! IWARM =
0   !
           1: on - 0: off (must be off if SST measured with
           IR radiometer)                 Default: 0

           COARE cool skin layer computation (ICOOL)          ! ICOOL =
0   !
           1: on - 0: off (must be off if SST measured with
           IR radiometer)                 Default: 0

    RELATIVE HUMIDITY PARAMETERS

       3D relative humidity from observations or
```

```
       from prognostic data? (IRHPROG)       Default:0        ! IRHPROG
=  0   !

          0 = Use RH from SURF.DAT file
              (only if NOOBS = 0,1)
          1 = Use prognostic RH
              (only if NOOBS = 0,1,2)

    TEMPERATURE PARAMETERS

       3D temperature from observations or
       from prognostic data? (ITPROG)        Default:0        ! ITPROG =
0   !

          0 = Use Surface and upper air stations
              (only if NOOBS = 0)
          1 = Use Surface stations (no upper air observations)
              Use MM5/3D.DAT for upper air data
              (only if NOOBS = 0,1)
          2 = No surface or upper air observations
              Use MM5/3D.DAT for surface and upper air data
              (only if NOOBS = 0,1,2)

       Interpolation type
       (1 = 1/R ; 2 = 1/R**2)                Default:1         ! IRAD =
1  !

       Radius of influence for temperature
       interpolation (TRADKM)                Default: 500.     ! TRADKM
= 500. !
                                             Units: km

       Maximum Number of stations to include
       in temperature interpolation (NUMTS)  Default: 5        ! NUMTS =
5  !

       Conduct spatial averaging of temp-
       eratures (IAVET)  (0=no, 1=yes)       Default: 1        ! IAVET =
1  !
       (will use mixing ht MNMDAV,HAFANG
        so make sure they are correct)

       Default temperature gradient          Default: -.0098   ! TGDEFB
= -0.0098 !
       below the mixing height over          Units: K/m
       water (TGDEFB)

       Default temperature gradient          Default: -.0045   ! TGDEFA
= -0.0045 !
       above the mixing height over          Units: K/m
       water (TGDEFA)

       Beginning (JWAT1) and ending (JWAT2)
       land use categories for temperature                    ! JWAT1 =
55  !
       interpolation over water -- Make                       ! JWAT2 =
55  !
       bigger than largest land use to disable

   PRECIP INTERPOLATION PARAMETERS
```

```
       Method of interpolation (NFLAGP)      Default: 2       ! NFLAGP =
2  !
        (1=1/R,2=1/R**2,3=EXP/R**2)
       Radius of Influence  (SIGMAP)         Default: 100.0   ! SIGMAP =
50. !
        (0.0 => use half dist. btwn          Units: km
         nearest stns w & w/out
         precip when NFLAGP = 3)
       Minimum Precip. Rate Cutoff (CUTP)    Default: 0.01    ! CUTP =
0.01 !
        (values < CUTP = 0.0 mm/hr)          Units: mm/hr
!END!


------------------------------------------------------------------------
-------

INPUT GROUP: 7 -- Surface meteorological station parameters
--------------

     SURFACE STATION VARIABLES
     (One record per station --  4  records in all)


             1     2
         Name   ID            X coord.   Y coord.   Time   Anem.
                               (km)       (km)      zone   Ht.(m)
       ----------------------------------------------------------
! SS1  ='SCH'       101         640.284     6074.848    4    10 !
! SS2  ='WEB'       102         643.38      5866.985    4    10  !
-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit integer for station ID

!END!


------------------------------------------------------------------------
-------

INPUT GROUP: 8 -- Upper air meteorological station parameters
--------------

     UPPER AIR STATION VARIABLES
     (One record per station --  1  records in all)

             1     2
         Name    ID      X coord.   Y coord.  Time zone
                           (km)       (km)
        -----------------------------------------------
! US1  ='WLAB'   15708    192.814    5956.791      5  !
-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)
```

```
      2
        Five digit integer for station ID

!END!


------------------------------------------------------------------------
-------

INPUT GROUP: 9 -- Precipitation station parameters
--------------

     PRECIPITATION STATION VARIABLES
     (One record per station --  4  records in all)
     (NOT INCLUDED IF NPSTA = 0)

            1          2
         Name   Station    X coord.  Y coord.
                  Code       (km)      (km)
         ------------------------------------


-------------------
      1
        Four character string for station name
        (MUST START IN COLUMN 9)

      2
        Six digit station code composed of state
        code (first 2 digits) and station ID (last
        4 digits)

!END!
```

ATTACHMENT C

BPIP Input and Output Files

```
P:\CMiC Jobs\1045xxx\1046156\Background\bpip\LIM1.bpv

                             BPIP (Dated: 04274)
DATE : 11/28/2008
TIME : 17:29:29
P:\CMiC Jobs\1045xxx\1046156\Background\bpip\LIM1.bpv

============================
BPIP PROCESSING INFORMATION:
============================

  The P  flag has been set for preparing downwash related data
         for a model run utilizing the PRIME algorithm.

  Inputs entered in Meters     will be converted to meters using
   a conversion factor of    1.0000.  Output will be in meters.

  UTMP is set to UTMN.  The input is assumed to be in a local
   X-Y coordinate system as opposed to a UTM coordinate system.
   True North is in the positive Y direction.

  Plant north is set to   0.00 degrees with respect to True North.


P:\CMiC Jobs\1045xxx\1046156\Background\bpip\LIM1.bpv



               PRELIMINARY* GEP STACK HEIGHT RESULTS TABLE
                        (Output Units: meters)

                           Stack-Building             Preliminary*
        Stack    Stack     Base Elevation    GEP**    GEP Stack
        Name     Height    Differences       EQN1     Height Value


       STCK1      33.40         0.00        81.00        81.00
       GEN1        5.00         0.00        81.00        81.00
       GEN2        5.00         0.00        81.00        81.00
       GEN3        5.00         0.00        81.00        81.00
       GEN4        5.00         0.00        81.00        81.00
       DC1        33.40         0.00        81.00        81.00

  * Results are based on Determinants 1 & 2 on pages 1 & 2 of the GEP
    Technical Support Document.  Determinant 3 may be investigated for
    additional stack height credit.  Final values result after
    Determinant 3 has been taken into consideration.
 ** Results were derived from Equation 1 on page 6 of GEP Technical
    Support Document.  Values have been adjusted for any stack-building
    base elevation differences.

    Note:  Criteria for determining stack heights for modeling emission
    limitations for a source can be found in Table 3.1 of the
    GEP Technical Support Document.



                             BPIP (Dated: 04274)
```

```
 DATE : 11/28/2008
 TIME : 17:29:29


 P:\CMiC Jobs\1045xxx\1046156\Background\bpip\LIM1.bpv

  BPIP output is in meters


     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT STCK1      32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDWID STCK1      55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID STCK1      56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID STCK1      44.00   36.50   42.00   47.75   52.00
54.62
     SO BUILDWID STCK1      55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID STCK1      56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID STCK1      44.00   36.00   42.00   47.75   52.00
54.56
     SO BUILDLEN STCK1      58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN STCK1      47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN STCK1      48.50   47.00   52.50   56.50   58.50
59.50
     SO BUILDLEN STCK1      58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN STCK1      47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN STCK1      48.25   47.00   52.50   56.50   59.00
59.00
     SO XBADJ    STCK1     -14.00  -14.00  -14.00  -13.00  -11.50  -
17.25
     SO XBADJ    STCK1     -23.00  -28.00  -32.19  -35.41  -37.62  -
38.75
     SO XBADJ    STCK1     -38.25  -39.00  -42.50  -45.00  -46.00  -
46.00
     SO XBADJ    STCK1     -43.50  -40.50  -36.50  -30.50  -24.50  -
25.00
     SO XBADJ    STCK1     -24.75  -24.00  -22.38  -20.16  -17.38  -
14.25
     SO XBADJ    STCK1     -10.00   -8.00  -10.00  -11.00  -12.50  -
13.50
     SO YBADJ    STCK1       7.55   10.12   12.25   13.88   15.50
16.25
     SO YBADJ    STCK1      16.75   16.50   16.25   14.75   13.00
```

```
11.00
     SO YBADJ    STCK1       9.00    6.25    3.75    0.88   -2.00   -
4.88
     SO YBADJ    STCK1      -7.64  -10.12  -12.12  -14.12  -15.50  -
16.25
     SO YBADJ    STCK1     -17.25  -16.50  -15.75  -15.00  -13.50  -
11.50
     SO YBADJ    STCK1      -9.00   -6.50   -3.75   -0.88    2.00
4.91


     SO BUILDHGT GEN1       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN1       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN1       32.40    4.30    4.30   32.40   32.40
32.40
     SO BUILDHGT GEN1       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN1       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN1       32.40    4.30    4.30   32.40   32.40
32.40
     SO BUILDWID GEN1       55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID GEN1       56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID GEN1       44.00    8.50    8.75   47.75   52.00
54.62
     SO BUILDWID GEN1       55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID GEN1       56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID GEN1       44.00    8.50    9.25   47.75   52.00
54.56
     SO BUILDLEN GEN1       58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN GEN1       47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN GEN1       48.50    4.50    5.50   56.50   58.50
59.50
     SO BUILDLEN GEN1       58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN GEN1       47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN GEN1       48.25    4.50    6.00   56.50   59.00
59.00
     SO XBADJ    GEN1      -44.00  -49.00  -52.00  -53.50  -53.00  -
58.50
     SO XBADJ    GEN1      -62.75  -65.12  -65.50  -63.88  -60.38  -
55.00
     SO XBADJ    GEN1      -47.75   -8.50  -18.50  -33.00  -27.00  -
21.00
     SO XBADJ    GEN1      -13.00   -5.50    2.00   10.00   17.00
16.25
     SO XBADJ    GEN1       15.00   13.12   10.94    8.31    5.38
2.25
     SO XBADJ    GEN1       -0.75   -2.00   -3.00  -23.50  -31.50  -
38.50
     SO YBADJ    GEN1       36.02   32.88   28.75   23.38   17.50
```

```
11.25
     SO YBADJ    GEN1        4.25   -2.00   -8.75  -15.75  -21.50  -
27.00
     SO YBADJ    GEN1      -31.50   -2.75   -5.88  -38.88  -39.12  -
38.19
     SO YBADJ    GEN1      -36.11  -32.88  -28.38  -23.62  -17.50  -
11.25
     SO YBADJ    GEN1       -4.75    2.50    9.25   15.50   21.50
27.00
     SO YBADJ    GEN1       31.50    2.25    2.38   38.88   39.25
38.22


     SO BUILDHGT GEN2       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN2       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN2       32.40    4.30   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN2       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN2       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN2       32.40    4.30   32.40   32.40   32.40
32.40
     SO BUILDWID GEN2       55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID GEN2       56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID GEN2       44.00    8.50   42.00   47.75   52.00
54.62
     SO BUILDWID GEN2       55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID GEN2       56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID GEN2       44.00    8.50   42.00   47.75   52.00
54.56
     SO BUILDLEN GEN2       58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN GEN2       47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN GEN2       48.50    4.50   52.50   56.50   58.50
59.50
     SO BUILDLEN GEN2       58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN GEN2       47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN GEN2       48.25    4.50   52.50   56.50   59.00
59.00
     SO XBADJ    GEN2      -47.50  -51.50  -54.00  -54.00  -53.00  -
57.50
     SO XBADJ    GEN2      -60.75  -62.25  -61.88  -59.59  -55.62  -
49.75
     SO XBADJ    GEN2      -42.50   -3.00  -32.50  -28.00  -22.50  -
17.00
     SO XBADJ    GEN2      -10.00   -3.00    3.50   11.00   17.00
15.25
     SO XBADJ    GEN2       13.00   10.25    7.31    4.03    0.62   -
3.00
     SO XBADJ    GEN2       -6.00   -7.50  -20.50  -28.50  -36.00  -
```

```
42.50
     SO YBADJ    GEN2       31.77   28.12   23.50   18.12   12.00
6.25
     SO YBADJ    GEN2       -0.75   -7.00  -12.75  -18.75  -24.50  -
29.00
     SO YBADJ    GEN2      -32.00   -2.75  -36.25  -36.88  -36.25  -
34.56
     SO YBADJ    GEN2      -31.83  -28.12  -23.38  -18.38  -12.00   -
6.25
     SO YBADJ    GEN2        0.25    7.00   13.25   19.00   24.00
28.50
     SO YBADJ    GEN2       32.00    1.75   36.50   36.88   36.38
34.59


     SO BUILDHGT GEN3       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN3       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN3       32.40    4.30   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN3       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN3       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN3       32.40    4.30   32.40   32.40   32.40
32.40
     SO BUILDWID GEN3       55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID GEN3       56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID GEN3       44.00    8.50   42.00   47.75   52.00
54.62
     SO BUILDWID GEN3       55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID GEN3       56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID GEN3       44.00    8.00   42.00   47.75   52.00
54.56
     SO BUILDLEN GEN3       58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN GEN3       47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN GEN3       48.50    4.50   52.50   56.50   58.50
59.50
     SO BUILDLEN GEN3       58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN GEN3       47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN GEN3       48.25    4.50   52.50   56.50   59.00
59.00
     SO XBADJ    GEN3      -51.00  -54.00  -55.50  -54.50  -52.50  -
56.00
     SO XBADJ    GEN3      -58.50  -59.12  -57.94  -55.03  -50.50  -
44.50
     SO XBADJ    GEN3      -36.75    2.50  -27.00  -23.00  -18.00  -
13.00
     SO XBADJ    GEN3       -6.50   -1.00    5.00   11.50   16.50
13.75
     SO XBADJ    GEN3       10.75    7.00    3.38   -0.53   -4.38   -
```

```
8.25
     SO XBADJ    GEN3      -11.50    3.50  -26.00  -33.50  -40.50  -
46.50
     SO YBADJ    GEN3       27.17   23.12   18.00   12.62    6.50
0.75
     SO YBADJ    GEN3       -5.75  -11.50  -16.75  -22.25  -26.50  -
30.50
     SO YBADJ    GEN3      -32.50   -2.25  -35.00  -34.38  -33.12  -
30.62
     SO YBADJ    GEN3      -27.27  -23.00  -17.88  -12.62   -6.50   -
0.75
     SO YBADJ    GEN3        5.25   11.50   17.25   22.00   26.50
30.00
     SO YBADJ    GEN3       33.00    2.50   35.00   34.62   33.12
30.66


     SO BUILDHGT GEN4       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN4       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN4       32.40    4.30   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN4       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN4       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT GEN4       32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDWID GEN4       55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID GEN4       56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID GEN4       44.00    8.50   42.00   47.75   52.00
54.62
     SO BUILDWID GEN4       55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID GEN4       56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID GEN4       44.00   36.00   42.00   47.75   52.00
54.56
     SO BUILDLEN GEN4       58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN GEN4       47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN GEN4       48.50    4.50   52.50   56.50   58.50
59.50
     SO BUILDLEN GEN4       58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN GEN4       47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN GEN4       48.25   47.00   52.50   56.50   59.00
59.00
     SO XBADJ    GEN4      -53.50  -56.00  -57.00  -55.50  -52.50  -
55.00
     SO XBADJ    GEN4      -56.75  -56.62  -54.81  -51.34  -46.38  -
40.00
     SO XBADJ    GEN4      -32.25    7.50  -22.00  -18.50  -14.00   -
9.50
     SO XBADJ    GEN4       -3.50    1.50    6.50   12.00   16.50
```

```
12.75
     SO XBADJ    GEN4        9.00    4.62    0.25   -4.22   -8.50  -
12.75
     SO XBADJ    GEN4      -16.25  -21.50  -30.50  -37.50  -44.50  -
50.00
     SO YBADJ    GEN4       23.48   18.88   13.75    7.88    2.00   -
3.75
     SO YBADJ    GEN4      -10.25  -15.50  -20.25  -24.75  -29.00  -
31.50
     SO YBADJ    GEN4      -33.50   -2.25  -34.00  -32.62  -30.62  -
27.50
     SO YBADJ    GEN4      -23.58  -18.88  -13.38   -8.12   -2.00
3.75
     SO YBADJ    GEN4        9.75   15.50   20.75   25.00   28.50
31.50
     SO YBADJ    GEN4       33.50   34.00   34.00   32.88   30.62
27.53


     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDHGT DC1        32.40   32.40   32.40   32.40   32.40
32.40
     SO BUILDWID DC1        55.53   54.75   52.50   48.25   47.00
52.50
     SO BUILDWID DC1        56.50   59.00   59.50   57.50   55.00
50.00
     SO BUILDWID DC1        44.00   36.50   42.00   47.75   52.00
54.62
     SO BUILDWID DC1        55.53   54.75   52.25   48.25   47.00
52.50
     SO BUILDWID DC1        56.50   59.00   59.50   58.00   55.00
50.00
     SO BUILDWID DC1        44.00   36.00   42.00   47.75   52.00
54.56
     SO BUILDLEN DC1        58.00   55.00   50.00   44.00   36.00
42.00
     SO BUILDLEN DC1        47.75   52.00   54.62   55.50   54.75
52.50
     SO BUILDLEN DC1        48.50   47.00   52.50   56.50   58.50
59.50
     SO BUILDLEN DC1        58.00   55.00   50.00   43.50   36.00
42.25
     SO BUILDLEN DC1        47.75   52.00   54.56   55.53   54.88
52.50
     SO BUILDLEN DC1        48.25   47.00   52.50   56.50   59.00
59.00
     SO XBADJ    DC1       -27.50  -28.50  -29.00  -28.00  -26.50  -
31.50
     SO XBADJ    DC1       -36.00  -39.50  -41.75  -42.72  -42.50  -
41.00
     SO XBADJ    DC1       -38.00  -36.00  -37.00  -37.00  -36.00  -
```

```
34.00
     SO XBADJ    DC1       -30.00  -26.00  -21.00  -15.00   -9.50  -
10.75
     SO XBADJ    DC1       -11.75  -12.50  -12.81  -12.81  -12.50  -
11.75
     SO XBADJ    DC1       -10.50  -11.00  -15.50  -19.00  -22.50  -
25.50
     SO YBADJ    DC1        14.89   15.00   14.50   13.62   12.50
10.75
     SO YBADJ    DC1         8.75    6.50    4.25    1.25   -1.50   -
4.00
     SO YBADJ    DC1        -6.00   -8.75  -10.50  -12.12  -13.50  -
14.44
     SO YBADJ    DC1       -14.98  -15.00  -14.38  -13.88  -12.50  -
10.75
     SO YBADJ    DC1        -9.25   -6.50   -3.75   -1.50    1.00
3.50
     SO YBADJ    DC1         6.50    8.50   10.50   12.12   13.50
14.47
```

```
'P:\CMiC Jobs\1045xxx\1046156\Background\bpip\LIM1.bpv'
'P'
'Meters'  1.00000000
'UTMN'  0.0000
14
'BLDG1'  1         532.000  'Crushing building'
    4         32.400
           639250.070     6073005.700
           639275.910     6073030.180
           639304.650     6072995.500
           639278.450     6072970.900
'SP3'  1         532.000  'Lump ore stockpile'
    8         10.000
           639146.700     6073228.070
           639137.860     6073221.950
           639137.860     6073206.990
           639175.260     6073162.790
           639188.180     6073161.430
           639195.660     6073168.230
           639197.020     6073181.150
           639160.300     6073226.710
'SP4'  1         532.000  'Sinter fine ore stockpile'
    8         10.000
           639202.460     6073160.070
           639194.300     6073153.270
           639194.300     6073138.980
           639251.430     6073071.660
           639265.030     6073069.620
           639273.870     6073077.100
           639273.190     6073090.700
           639213.340     6073159.390
'TK1'  1         532.000  'Diesel storage tank'
    8         10.700
           639371.790     6073030.410
           639377.400     6073032.730
           639379.720     6073038.340
           639377.400     6073043.950
           639371.790     6073046.270
           639366.190     6073043.950
           639363.860     6073038.340
           639366.190     6073032.730
'T1'  1         532.000  'Transformers'
    4          2.100
           639307.190     6072996.180
           639312.420     6073001.050
           639320.110     6072992.780
           639314.640     6072987.620
'GENE1'  1         532.000  'Diesel generator 1'
    4          4.300
           639315.430     6073012.700
           639318.170     6073009.410
           639311.730     6073003.710
           639308.990     6073006.830
'GENE2'  1         532.000  'generator enclosure 2'
    4          4.300
           639305.030     6073010.970
           639311.290     6073017.160
           639314.160     6073013.720
           639307.850     6073007.980
'GENE3'  1         532.000  'generator enclosure 3'
```

```
    4           4.300
           639301.250     6073014.860
           639307.560     6073020.890
           639310.430     6073017.450
           639303.880     6073011.830
'GENE4'  1         532.000  'generator enclosure 4'
    4           4.300
           639297.890     6073019.270
           639300.890     6073015.940
           639306.930     6073021.190
           639304.090     6073024.490
'TK2'  1         532.000  'Process water tank'
    8          10.700
           639282.640     6072956.960
           639287.260     6072958.870
           639289.180     6072963.490
           639287.260     6072968.110
           639282.640     6072970.030
           639278.020     6072968.110
           639276.110     6072963.490
           639278.020     6072958.870
'PWP1'  1         532.000  'Process water pump'
    4           4.300
           639272.810     6072961.620
           639266.880     6072955.900
           639274.460     6072947.290
           639280.660     6072952.800
'SP1'  1         542.000  'Blue ore stockpile'
    8          10.000
           639291.030     6072768.250
           639317.870     6072728.000
           639331.290     6072727.100
           639341.120     6072736.050
           639336.650     6072782.560
           639317.870     6072799.550
           639305.340     6072799.550
           639295.510     6072793.290
'SP2'  1         542.000  'Red ore stockpile'
    8          10.000
           639389.430     6072775.400
           639393.900     6072729.780
           639407.320     6072719.050
           639423.420     6072725.310
           639435.940     6072771.830
           639424.310     6072793.290
           639411.790     6072796.870
           639397.480     6072792.400
'BLDG2'  1         532.000  'Mobile offices'
    4           3.200
           639354.830     6072953.920
           639372.030     6072969.840
           639378.400     6072962.830
           639361.200     6072945.640
6
'STCK1'         532.000         33.400      639282.240     6072984.480
'Boiler'
'GEN1'         532.000           5.000      639315.570     6073009.700
'Genset 1'
'GEN2'         532.000           5.000      639311.920     6073013.630
'Genset 2'
```

```
'GEN3'         532.000           5.000      639307.990     6073017.560
'Genset 3'
'GEN4'         532.000           5.000      639304.900     6073021.210
'Genset 4'
'DC1'          532.000          33.400      639291.830     6072996.410
'Dust collector'
```

ATTACHMENT D

Sample CALPUFF Input File

```
Labrador Lim -Nov 26, 2008


---------------- Run title (3 lines) 
------------------------------------------

                    CALPUFF MODEL CONTROL FILE
                    --------------------------

------------------------------------------------------------------------
-------

INPUT GROUP: 0 -- Input and Output File Names

--------------
Default Name  Type          File Name
------------  ----          ---------
CALMET.DAT    input    ! METDAT =CMET.DAT   !
    or
ISCMET.DAT    input    * ISCDAT =             *
    or
PLMMET.DAT    input    * PLMDAT =             *
    or
PROFILE.DAT   input    * PRFDAT =             *
SURFACE.DAT   input    * SFCDAT =             *
RESTARTB.DAT  input    * RSTARTB=             *
------------------------------------------------------------------------
--------
CALPUFF.LST   output   ! PUFLST =CPUFF.LST  !
CONC.DAT      output   ! CONDAT =CPUFF.CON     !
DFLX.DAT      output   * DFDAT  =             *
WFLX.DAT      output   * WFDAT  =             *

VISB.DAT      output   * VISDAT =             *
TK2D.DAT      output   * T2DDAT =             *
RHO2D.DAT     output   * RHODAT =             *
RESTARTE.DAT  output   * RSTARTE=             *
------------------------------------------------------------------------
--------
Emission Files
--------------
PTEMARB.DAT   input    * PTDAT  =             *
VOLEMARB.DAT  input    * VOLDAT =             *
BAEMARB.DAT   input    * ARDAT  =             *
LNEMARB.DAT   input    * LNDAT  =             *
------------------------------------------------------------------------
--------
Other Files
-----------
OZONE.DAT     input    * OZDAT  =             *
VD.DAT        input    * VDDAT  =             *
CHEM.DAT      input    * CHEMDAT=             *
H2O2.DAT      input    * H2O2DAT=             *
HILL.DAT      input    * HILDAT=             *
HILLRCT.DAT   input    * RCTDAT=             *
COASTLN.DAT   input    * CSTDAT=             *
FLUXBDY.DAT   input    * BDYDAT=             *
BCON.DAT      input    * BCNDAT=             *
DEBUG.DAT     output   * DEBUG =             *
MASSFLX.DAT   output   * FLXDAT=             *
```

```
MASSBAL.DAT   output   * BALDAT=             *
FOG.DAT       output   * FOGDAT=             *
RISE.DAT      output   * RISDAT=             *
-----------------------------------------------------------------------
--------
All file names will be converted to lower case if LCFILES = T
Otherwise, if LCFILES = F, file names will be converted to UPPER CASE
         T = lower case      ! LCFILES = T !
         F = UPPER CASE
NOTE: (1) file/path names can be up to 70 characters in length


Provision for multiple input files
----------------------------------

     Number of CALMET.DAT files for run (NMETDAT)
                                     Default: 1       ! NMETDAT =   1
!

     Number of PTEMARB.DAT files for run (NPTDAT)
                                     Default: 0       ! NPTDAT =  0  !

     Number of BAEMARB.DAT files for run (NARDAT)
                                     Default: 0       ! NARDAT =  0  !

     Number of VOLEMARB.DAT files for run (NVOLDAT)
                                     Default: 0       ! NVOLDAT =  0  !

!END!

-------------
Subgroup (0a)
-------------

  The following CALMET.DAT filenames are processed in sequence if
NMETDAT>1

Default Name  Type          File Name
------------  ----          ---------
 none         input    * METDAT=     *   *END*


-----------------------------------------------------------------------
--------

INPUT GROUP: 1 -- General run control parameters
--------------

    Option to run all periods found
    in the met. file     (METRUN)   Default: 0       ! METRUN =   0  !

         METRUN = 0 - Run period explicitly defined below
         METRUN = 1 - Run all periods in met. file

     Starting date:    Year   (IBYR)  --    No default   ! IBYR  =  2002
!
                       Month  (IBMO)  --    No default   ! IBMO  =  4  !
                       Day    (IBDY)  --    No default   ! IBDY  =  1  !
     Starting time:    Hour   (IBHR)  --    No default   ! IBHR  =  0  !
                       Minute (IBMIN) --    No default   ! IBMIN =  0  !
```

```
                       Second (IBSEC) --    No default   ! IBSEC =  0  !

     Ending date:      Year   (IEYR)  --    No default   ! IEYR  =  2002
!
                       Month  (IEMO)  --    No default   ! IEMO  =  10
!
                       Day    (IEDY)  --    No default   ! IEDY  =  31
!
     Ending time:      Hour   (IEHR)  --    No default   ! IEHR  =  0  !
                       Minute (IEMIN) --    No default   ! IEMIN =  0  !
                       Second (IESEC) --    No default   ! IESEC =  0  !

     (These are only used if METRUN = 0)

     Base time zone        (XBTZ) -- No default       ! XBTZ= 4.0  !
     The zone is the number of hours that must be
     ADDED to the time to obtain UTC (or GMT)
     Examples: PST = 8., MST = 7.
               CST = 6., EST = 5.

     Length of modeling time-step (seconds)
     Equal to update period in the primary
     meteorological data files, or an
     integer fraction of it (1/2, 1/3 ...)
     Must be no larger than 1 hour
     (NSECDT)                        Default:3600     ! NSECDT =  3600
!
                                     Units: seconds

     Number of chemical species (NSPEC)
                                     Default: 5       ! NSPEC =  4   !

     Number of chemical species
     to be emitted  (NSE)            Default: 3       ! NSE =  4   !

     Flag to stop run after
     SETUP phase (ITEST)             Default: 2       ! ITEST =  2   !
     (Used to allow checking
     of the model inputs, files, etc.)
           ITEST = 1 - STOPS program after SETUP phase
           ITEST = 2 - Continues with execution of program
                       after SETUP

     Restart Configuration:

        Control flag (MRESTART)      Default: 0       ! MRESTART =  0
!

           0 = Do not read or write a restart file
           1 = Read a restart file at the beginning of
               the run
           2 = Write a restart file during run
           3 = Read a restart file at beginning of run
               and write a restart file during run

        Number of periods in Restart
        output cycle (NRESPD)        Default: 0       ! NRESPD =  0   !

           0 = File written only at last period
          >0 = File updated every NRESPD periods
```

```
     Meteorological Data Format (METFM)
                                     Default: 1       ! METFM =  1   !

           METFM = 1 - CALMET binary file (CALMET.MET)
           METFM = 2 - ISC ASCII file (ISCMET.MET)
           METFM = 3 - AUSPLUME ASCII file (PLMMET.MET)
           METFM = 4 - CTDM plus tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)
           METFM = 5 - AERMET tower file (PROFILE.DAT) and
                       surface parameters file (SURFACE.DAT)

     Meteorological Profile Data Format (MPRFFM)
            (used only for METFM = 1, 2, 3)
                                     Default: 1       ! MPRFFM =  1   !

           MPRFFM = 1 - CTDM plus tower file (PROFILE.DAT)
           MPRFFM = 2 - AERMET tower file (PROFILE.DAT)

     PG sigma-y is adjusted by the factor (AVET/PGTIME)**0.2
     Averaging Time (minutes) (AVET)
                                     Default: 60.0    ! AVET = 60. !
     PG Averaging Time (minutes) (PGTIME)
                                     Default: 60.0    ! PGTIME = 60. !


!END!


------------------------------------------------------------------------
-------

INPUT GROUP: 2 -- Technical options
--------------


     Vertical distribution used in the
     near field (MGAUSS)                   Default: 1     ! MGAUSS =  1
!
        0 = uniform
        1 = Gaussian

     Terrain adjustment method
     (MCTADJ)                              Default: 3     ! MCTADJ =  3
!
        0 = no adjustment
        1 = ISC-type of terrain adjustment
        2 = simple, CALPUFF-type of terrain
            adjustment
        3 = partial plume path adjustment

     Subgrid-scale complex terrain
     flag (MCTSG)                          Default: 0     ! MCTSG =  0
!
        0 = not modeled
        1 = modeled

     Near-field puffs modeled as
     elongated slugs? (MSLUG)              Default: 0     ! MSLUG =  0
!
```

```
        0 = no
        1 = yes (slug model used)

     Transitional plume rise modeled?
     (MTRANS)                              Default: 1     ! MTRANS =  1
!
        0 = no  (i.e., final rise only)
        1 = yes (i.e., transitional rise computed)

     Stack tip downwash? (MTIP)            Default: 1     ! MTIP =  1  !
        0 = no  (i.e., no stack tip downwash)
        1 = yes (i.e., use stack tip downwash)

     Method used to compute plume rise for
     point sources not subject to building
     downwash? (MRISE)                     Default: 1     ! MRISE =  1
!
        1 = Briggs plume rise
        2 = Numerical plume rise

     Method used to simulate building
     downwash? (MBDW)                      Default: 1     ! MBDW =   2
!
        1 = ISC method
        2 = PRIME method

     Vertical wind shear modeled above
     stack top? (MSHEAR)                   Default: 0     ! MSHEAR =  1
!
        0 = no  (i.e., vertical wind shear not modeled)
        1 = yes (i.e., vertical wind shear modeled)

     Puff splitting allowed? (MSPLIT)      Default: 0     ! MSPLIT =  1
!
        0 = no (i.e., puffs not split)
        1 = yes (i.e., puffs are split)

     Chemical mechanism flag (MCHEM)       Default: 1     ! MCHEM =  0
!
        0 = chemical transformation not
            modeled
        1 = transformation rates computed
            internally (MESOPUFF II scheme)
        2 = user-specified transformation
            rates used
        3 = transformation rates computed
            internally (RIVAD/ARM3 scheme)
        4 = secondary organic aerosol formation
            computed (MESOPUFF II scheme for OH)

     Aqueous phase transformation flag (MAQCHEM)
     (Used only if MCHEM = 1, or 3)        Default: 0     ! MAQCHEM =  0
!
        0 = aqueous phase transformation
            not modeled
        1 = transformation rates adjusted
            for aqueous phase reactions

     Wet removal modeled ? (MWET)          Default: 1     ! MWET =  0
!
```

```
        0 = no
        1 = yes

     Dry deposition modeled ? (MDRY)       Default: 1     ! MDRY =  0
!
        0 = no
        1 = yes
        (dry deposition method specified
         for each species in Input Group 3)


     Gravitational settling (plume tilt)
     modeled ? (MTILT)                     Default: 0     ! MTILT =  0
!
        0 = no
        1 = yes
        (puff center falls at the gravitational
         settling velocity for 1 particle species)

     Restrictions:
         - MDRY  = 1
         - NSPEC = 1  (must be particle species as well)
         - sg    = 0  GEOMETRIC STANDARD DEVIATION in Group 8 is
                      set to zero for a single particle diameter

     Method used to compute dispersion
     coefficients (MDISP)                  Default: 3     ! MDISP =  2
!

        1 = dispersion coefficients computed from measured values
            of turbulence, sigma v, sigma w
        2 = dispersion coefficients from internally calculated
            sigma v, sigma w using micrometeorological variables
            (u*, w*, L, etc.)
        3 = PG dispersion coefficients for RURAL areas (computed using
            the ISCST multi-segment approximation) and MP coefficients
in
            urban areas
        4 = same as 3 except PG coefficients computed using
            the MESOPUFF II eqns.
        5 = CTDM sigmas used for stable and neutral conditions.
            For unstable conditions, sigmas are computed as in
            MDISP = 3, described above.  MDISP = 5 assumes that
            measured values are read

     Sigma-v/sigma-theta, sigma-w measurements used? (MTURBVW)
     (Used only if MDISP = 1 or 5)         Default: 3     ! MTURBVW =  3
!
        1 = use sigma-v or sigma-theta measurements
            from PROFILE.DAT to compute sigma-y
            (valid for METFM = 1, 2, 3, 4, 5)
        2 = use sigma-w measurements
            from PROFILE.DAT to compute sigma-z
            (valid for METFM = 1, 2, 3, 4, 5)
        3 = use both sigma-(v/theta) and sigma-w
            from PROFILE.DAT to compute sigma-y and sigma-z
            (valid for METFM = 1, 2, 3, 4, 5)
        4 = use sigma-theta measurements
            from PLMMET.DAT to compute sigma-y
            (valid only if METFM = 3)
```

```
     Back-up method used to compute dispersion
     when measured turbulence data are
     missing (MDISP2)                      Default: 3     ! MDISP2 =  3
!
     (used only if MDISP = 1 or 5)
        2 = dispersion coefficients from internally calculated
            sigma v, sigma w using micrometeorological variables
            (u*, w*, L, etc.)
        3 = PG dispersion coefficients for RURAL areas (computed using
            the ISCST multi-segment approximation) and MP coefficients
in
            urban areas
        4 = same as 3 except PG coefficients computed using
            the MESOPUFF II eqns.

     [DIAGNOSTIC FEATURE]
     Method used for Lagrangian timescale for Sigma-y
     (used only if MDISP=1,2 or MDISP2=1,2)
     (MTAULY)                              Default: 0     ! MTAULY =  0
!
        0 = Draxler default 617.284 (s)
        1 = Computed as Lag. Length / (.75 q) -- after SCIPUFF
       10 < Direct user input (s)             -- e.g., 306.9


     [DIAGNOSTIC FEATURE]
     Method used for Advective-Decay timescale for Turbulence
     (used only if MDISP=2 or MDISP2=2)
     (MTAUADV)                             Default: 0     ! MTAUADV =  0
!
        0 = No turbulence advection
        1 = Computed (OPTION NOT IMPLEMENTED)
       10 < Direct user input (s)   -- e.g., 800


     Method used to compute turbulence sigma-v &
     sigma-w using micrometeorological variables
     (Used only if MDISP = 2 or MDISP2 = 2)
     (MCTURB)                              Default: 1     ! MCTURB =  1
!
        1 = Standard CALPUFF subroutines
        2 = AERMOD subroutines

     PG sigma-y,z adj. for roughness?      Default: 0     ! MROUGH =  0
!
     (MROUGH)
        0 = no
        1 = yes

     Partial plume penetration of          Default: 1     ! MPARTL =  1
!
     elevated inversion modeled for
     point sources?
     (MPARTL)
        0 = no
        1 = yes

     Partial plume penetration of          Default: 1     ! MPARTLBA =
1  !
```

```
     elevated inversion modeled for
     buoyant area sources?
     (MPARTLBA)
        0 = no
        1 = yes

     Strength of temperature inversion     Default: 0     ! MTINV =  0
!
     provided in PROFILE.DAT extended records?
     (MTINV)
        0 = no (computed from measured/default gradients)
        1 = yes

     PDF used for dispersion under convective conditions?
                                           Default: 0     ! MPDF =  1  !
     (MPDF)
        0 = no
        1 = yes

     Sub-Grid TIBL module used for shore line?
                                           Default: 0     ! MSGTIBL = 0
!
     (MSGTIBL)
        0 = no
        1 = yes

     Boundary conditions (concentration) modeled?
                                           Default: 0     ! MBCON = 0  !
     (MBCON)
        0 = no
        1 = yes, using formatted BCON.DAT file
        2 = yes, using unformatted CONC.DAT file

     Note:  MBCON > 0 requires that the last species modeled
            be 'BCON'.  Mass is placed in species BCON when
            generating boundary condition puffs so that clean
            air entering the modeling domain can be simulated
            in the same way as polluted air.  Specify zero
            emission of species BCON for all regular sources.

     Individual source contributions saved?
                                           Default: 0     ! MSOURCE = 0
!
     (MSOURCE)
        0 = no
        1 = yes


     Analyses of fogging and icing impacts due to emissions from
     arrays of mechanically-forced cooling towers can be performed
     using CALPUFF in conjunction with a cooling tower emissions
     processor (CTEMISS) and its associated postprocessors.  Hourly
     emissions of water vapor and temperature from each cooling tower
     cell are computed for the current cell configuration and ambient
     conditions by CTEMISS. CALPUFF models the dispersion of these
     emissions and provides cloud information in a specialized format
     for further analysis. Output to FOG.DAT is provided in either
     'plume mode' or 'receptor mode' format.

     Configure for FOG Model output?
```

```
                                           Default: 0     ! MFOG =  0
!
     (MFOG)
        0 = no
        1 = yes  - report results in PLUME Mode format
        2 = yes  - report results in RECEPTOR Mode format


     Test options specified to see if
     they conform to regulatory
     values? (MREG)                        Default: 1     ! MREG =  0
!

        0 = NO checks are made
        1 = Technical options must conform to USEPA
            Long Range Transport (LRT) guidance
                       METFM    1 or 2
                       AVET     60. (min)
                       PGTIME   60. (min)
                       MGAUSS   1
                       MCTADJ   3
                       MTRANS   1
                       MTIP     1
                       MRISE    1
                       MCHEM    1 or 3 (if modeling SOx, NOx)
                       MWET     1
                       MDRY     1
                       MDISP    2 or 3
                       MPDF     0 if MDISP=3
                                1 if MDISP=2
                       MROUGH   0
                       MPARTL   1
                       MPARTLBA 0
                       SYTDEP   550. (m)
                       MHFTSZ   0
                       SVMIN    0.5 (m/s)


!END!


------------------------------------------------------------------------
-------

INPUT GROUP: 3a, 3b -- Species list
-------------------

------------
Subgroup (3a)
------------

  The following species are modeled:

! CSPEC =          SO2 !         !END!
! CSPEC =          NOX !         !END!
! CSPEC =          VOC !         !END!
! CSPEC =           CO !         !END!

                                                       Dry
OUTPUT GROUP
```

```
    SPECIES          MODELED          EMITTED       DEPOSITED
NUMBER
     NAME         (0=NO, 1=YES)    (0=NO, 1=YES)    (0=NO,
(0=NONE,
   (Limit: 12                                        1=COMPUTED-GAS
1=1st CGRUP,
    Characters                                       2=COMPUTED-PARTICLE
2=2nd CGRUP,
    in length)                                       3=USER-SPECIFIED)
3= etc.)

!          SO2  =         1,               1,           0,
0   !
!          NOX  =         1,               1,           0,
0   !
!          VOC  =         1,               1,           0,
0   !
!           CO  =         1,               1,           0,
0   !

!END!

  Note:  The last species in (3a) must be 'BCON' when using the
         boundary condition option (MBCON > 0).  Species BCON should
         typically be modeled as inert (no chem transformation or
         removal).


-------------
Subgroup (3b)
-------------
  The following names are used for Species-Groups in which results
  for certain species are combined (added) prior to output.  The
  CGRUP name will be used as the species name in output files.
  Use this feature to model specific particle-size distributions
  by treating each size-range as a separate species.
  Order must be consistent with 3(a) above.



------------------------------------------------------------------------
-------


INPUT GROUP: 4 -- Map Projection and Grid control parameters
--------------

     Projection for all (X,Y):
     -------------------------

     Map projection
     (PMAP)                     Default: UTM    ! PMAP = UTM  !

         UTM :  Universal Transverse Mercator
         TTM :  Tangential Transverse Mercator
         LCC :  Lambert Conformal Conic
          PS :  Polar Stereographic
          EM :  Equatorial Mercator
        LAZA :  Lambert Azimuthal Equal Area
```

```
     False Easting and Northing (km) at the projection origin
     (Used only if PMAP= TTM, LCC, or LAZA)
     (FEAST)                   Default=0.0     ! FEAST  = 0.000  !
     (FNORTH)                  Default=0.0     ! FNORTH = 0.000  !

     UTM zone (1 to 60)
     (Used only if PMAP=UTM)
     (IUTMZN)                  No Default      ! IUTMZN =  19   !

     Hemisphere for UTM projection?
     (Used only if PMAP=UTM)
     (UTMHEM)                  Default: N      ! UTMHEM = N  !
         N   :  Northern hemisphere projection
         S   :  Southern hemisphere projection

     Latitude and Longitude (decimal degrees) of projection origin
     (Used only if PMAP= TTM, LCC, PS, EM, or LAZA)
     (RLAT0)                   No Default      ! RLAT0 = 0N  !
     (RLON0)                   No Default      ! RLON0 = 0E  !

         TTM :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
         LCC :  RLON0 identifies central (true N/S) meridian of
projection
                RLAT0 selected for convenience
         PS  :  RLON0 identifies central (grid N/S) meridian of
projection
                RLAT0 selected for convenience
         EM  :  RLON0 identifies central meridian of projection
                RLAT0 is REPLACED by 0.0N (Equator)
         LAZA:  RLON0 identifies longitude of tangent-point of mapping
plane
                RLAT0 identifies latitude of tangent-point of mapping
plane

     Matching parallel(s) of latitude (decimal degrees) for projection
     (Used only if PMAP= LCC or PS)
     (XLAT1)                   No Default      ! XLAT1 = 0N  !
     (XLAT2)                   No Default      ! XLAT2 = 0N  !

         LCC :  Projection cone slices through Earth's surface at XLAT1
and XLAT2
         PS  :  Projection plane slices through Earth at XLAT1
                (XLAT2 is not used)

     ----------
     Note:  Latitudes and longitudes should be positive, and include a
            letter N,S,E, or W indicating north or south latitude, and
            east or west longitude.  For example,
            35.9  N Latitude  =  35.9N
            118.7 E Longitude = 118.7E


     Datum-region
     ------------

     The Datum-Region for the coordinates is identified by a character
     string.  Many mapping products currently available use the model of
the
```

```
     Earth known as the World Geodetic System 1984 (WGS-84).  Other
local
     models may be in use, and their selection in CALMET will make its
output
     consistent with local mapping products.  The list of Datum-Regions
with
     official transformation parameters is provided by the National
Imagery and
     Mapping Agency (NIMA).

     NIMA Datum - Regions(Examples)

------------------------------------------------------------------------
------
     WGS-84    WGS-84 Reference Ellipsoid and Geoid, Global coverage
(WGS84)
     NAS-C     NORTH AMERICAN 1927 Clarke 1866 Spheroid, MEAN FOR CONUS
(NAD27)
     NAR-C     NORTH AMERICAN 1983 GRS 80 Spheroid, MEAN FOR CONUS
(NAD83)
     NWS-84    NWS 6370KM Radius, Sphere
     ESR-S     ESRI REFERENCE 6371KM Radius, Sphere

     Datum-region for output coordinates
     (DATUM)                    Default: WGS-84    ! DATUM = WGS-84  !


METEOROLOGICAL Grid:

     Rectangular grid defined for projection PMAP,
     with X the Easting and Y the Northing coordinate

            No. X grid cells (NX)      No default     ! NX =  60   !
            No. Y grid cells (NY)      No default     ! NY =  60   !
         No. vertical layers (NZ)      No default     ! NZ =  8   !

           Grid spacing (DGRIDKM)      No default     ! DGRIDKM = .5 !
                                       Units: km

                Cell face heights
                    (ZFACE(nz+1))      No defaults
                                       Units: m
   ! ZFACE = .0, 20.0, 50.0, 100.0, 200.0, 500.0, 1000.0, 2000.0, 3300.0
!

            Reference Coordinates
           of SOUTHWEST corner of
                 grid cell(1, 1):

            X coordinate (XORIGKM)     No default     ! XORIGKM = 623.0
!
            Y coordinate (YORIGKM)     No default     ! YORIGKM = 6060.0
!
                                      Units: km


COMPUTATIONAL Grid:

     The computational grid is identical to or a subset of the MET.
grid.
```

```
     The lower left (LL) corner of the computational grid is at grid
point
     (IBCOMP, JBCOMP) of the MET. grid.  The upper right (UR) corner of
the
     computational grid is at grid point (IECOMP, JECOMP) of the MET.
grid.
     The grid spacing of the computational grid is the same as the MET.
grid.

        X index of LL corner (IBCOMP)      No default     ! IBCOMP =  1
!
                  (1 <= IBCOMP <= NX)

        Y index of LL corner (JBCOMP)      No default     ! JBCOMP =  1
!
                  (1 <= JBCOMP <= NY)


        X index of UR corner (IECOMP)      No default     ! IECOMP =  60
!
                  (1 <= IECOMP <= NX)

        Y index of UR corner (JECOMP)      No default     ! JECOMP =  60
!
                  (1 <= JECOMP <= NY)



SAMPLING Grid (GRIDDED RECEPTORS):

     The lower left (LL) corner of the sampling grid is at grid point
     (IBSAMP, JBSAMP) of the MET. grid.  The upper right (UR) corner of
the
     sampling grid is at grid point (IESAMP, JESAMP) of the MET. grid.
     The sampling grid must be identical to or a subset of the
computational
     grid.  It may be a nested grid inside the computational grid.
     The grid spacing of the sampling grid is DGRIDKM/MESHDN.

        Logical flag indicating if gridded
        receptors are used (LSAMP)         Default: T     ! LSAMP = F !
        (T=yes, F=no)

        X index of LL corner (IBSAMP)      No default     ! IBSAMP =  0
!
         (IBCOMP <= IBSAMP <= IECOMP)

        Y index of LL corner (JBSAMP)      No default     ! JBSAMP =  0
!
         (JBCOMP <= JBSAMP <= JECOMP)


        X index of UR corner (IESAMP)      No default     ! IESAMP =  0
!
         (IBCOMP <= IESAMP <= IECOMP)

        Y index of UR corner (JESAMP)      No default     ! JESAMP =  0
!
         (JBCOMP <= JESAMP <= JECOMP)
```

```
       Nesting factor of the sampling
        grid (MESHDN)                      Default: 1     ! MESHDN =  1
!
        (MESHDN is an integer >= 1)

!END!


------------------------------------------------------------------------
-------


INPUT GROUP: 5 -- Output Options
--------------
                                             *
*
     FILE                        DEFAULT VALUE             VALUE THIS RUN
     ----                        -------------             --------------

   Concentrations (ICON)              1                   !  ICON =  1
!
   Dry Fluxes (IDRY)                  1                   !  IDRY =  0
!
   Wet Fluxes (IWET)                  1                   !  IWET =  0
!
   2D Temperature (IT2D)              0                   !  IT2D =  0
!
   2D Density (IRHO)                  0                   !  IRHO =  0
!
   Relative Humidity (IVIS)           1                   !  IVIS =  0
!
    (relative humidity file is
     required for visibility
     analysis)
   Use data compression option in output file?
   (LCOMPRS)                           Default: T         ! LCOMPRS = T
!

   *
    0 = Do not create file, 1 = create file


    QA PLOT FILE OUTPUT OPTION:

       Create a standard series of output files (e.g.
       locations of sources, receptors, grids ...)
       suitable for plotting?
       (IQAPLOT)                       Default: 1         !  IQAPLOT =
1   !
         0 = no
         1 = yes

    DIAGNOSTIC MASS FLUX OUTPUT OPTIONS:

       Mass flux across specified boundaries
       for selected species reported?
       (IMFLX)                         Default: 0         ! IMFLX =  0
!
         0 = no
```

```
         1 = yes (FLUXBDY.DAT and MASSFLX.DAT filenames
                  are specified in Input Group 0)

       Mass balance for each species
       reported?
       (IMBAL)                         Default: 0         ! IMBAL =  0
!
         0 = no
         1 = yes (MASSBAL.DAT filename is
              specified in Input Group 0)


    NUMERICAL RISE OUTPUT OPTION:

       Create a file with plume properties for each rise
       increment, for each model timestep?
       This applies to sources modeled with numerical rise
       and is limited to ONE source in the run.
       (INRISE)                        Default: 0         ! INRISE =  0
!
         0 = no
         1 = yes (RISE.DAT filename is
                  specified in Input Group 0)


    LINE PRINTER OUTPUT OPTIONS:

       Print concentrations (ICPRT)    Default: 0         ! ICPRT =  0
!
       Print dry fluxes (IDPRT)        Default: 0         ! IDPRT =  0
!
       Print wet fluxes (IWPRT)        Default: 0         ! IWPRT =  0
!
       (0 = Do not print, 1 = Print)

       Concentration print interval
       (ICFRQ) in timesteps            Default: 1         ! ICFRQ =  1
!
       Dry flux print interval
       (IDFRQ) in timesteps            Default: 1         ! IDFRQ =  1
!
       Wet flux print interval
       (IWFRQ) in timesteps            Default: 1         ! IWFRQ =  1
!

       Units for Line Printer Output
       (IPRTU)                         Default: 1         ! IPRTU =  1
!
                       for            for
                  Concentration    Deposition
           1 =       g/m**3         g/m**2/s
           2 =      mg/m**3        mg/m**2/s
           3 =      ug/m**3        ug/m**2/s
           4 =      ng/m**3        ng/m**2/s
           5 =     Odour Units

       Messages tracking progress of run
       written to the screen ?
       (IMESG)                         Default: 2         ! IMESG =  2
!
```

```
         0 = no
         1 = yes (advection step, puff ID)
         2 = yes (YYYYJJJHH, # old puffs, # emitted puffs)


     SPECIES (or GROUP for combined species) LIST FOR OUTPUT OPTIONS

                 ---- CONCENTRATIONS ----   ------ DRY FLUXES ------
------ WET FLUXES ------   -- MASS FLUX --
   SPECIES
   /GROUP        PRINTED?  SAVED ON DISK?   PRINTED?  SAVED ON DISK?
PRINTED?  SAVED ON DISK?   SAVED ON DISK?
   -------       ------------------------   ------------------------
------------------------   ---------------
!          SO2 =     0,            1,            0,            0,
0,           0,           0   !
!          NOX =     0,            1,            0,            0,
0,           0,           0   !
!          VOC =     0,            1,            0,            0,
0,           0,           0   !
!           CO =     0,            1,            0,            0,
0,           0,           0   !

  Note:  Species BCON (for MBCON > 0) does not need to be saved on disk.


     OPTIONS FOR PRINTING "DEBUG" QUANTITIES (much output)

       Logical for debug output
       (LDEBUG)                                 Default: F     ! LDEBUG
= F !

       First puff to track
       (IPFDEB)                                 Default: 1     ! IPFDEB
=  1  !

       Number of puffs to track
       (NPFDEB)                                 Default: 1     ! NPFDEB
=  1  !

       Met. period to start output
       (NN1)                                    Default: 1     ! NN1 =
1   !

       Met. period to end output
       (NN2)                                    Default: 10    ! NN2 =
10  !

!END!


------------------------------------------------------------------------
-------


INPUT GROUP: 6a, 6b, & 6c -- Subgrid scale complex terrain inputs
-------------------------

---------------
Subgroup (6a)
```

```
---------------
       Number of terrain features (NHILL)       Default: 0     ! NHILL =
0   !

       Number of special complex terrain
       receptors  (NCTREC)                      Default: 0     ! NCTREC
=  0   !

       Terrain and CTSG Receptor data for
       CTSG hills input in CTDM format ?
       (MHILL)                                  No Default     ! MHILL =
2   !
       1 = Hill and Receptor data created
           by CTDM processors & read from
           HILL.DAT and HILLRCT.DAT files
       2 = Hill data created by OPTHILL &
           input below in Subgroup (6b);
           Receptor data in Subgroup (6c)

       Factor to convert horizontal dimensions  Default: 1.0   ! XHILL2M
= 1.0 !
       to meters (MHILL=1)

       Factor to convert vertical dimensions    Default: 1.0   ! ZHILL2M
= 1.0 !
       to meters (MHILL=1)

       X-origin of CTDM system relative to      No Default     ! XCTDMKM
= 0 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

       Y-origin of CTDM system relative to      No Default     ! YCTDMKM
= 0 !
       CALPUFF coordinate system, in Kilometers (MHILL=1)

! END !

---------------
Subgroup (6b)
---------------

                      1 **
     HILL information


HILL           XC        YC       THETAH  ZGRID  RELIEF    EXPO 1
EXPO 2   SCALE 1    SCALE 2    AMAX1     AMAX2
 NO.          (km)      (km)      (deg.)   (m)     (m)      (m)
(m)       (m)        (m)       (m)       (m)
----          ----      ----      ------  -----  ------    ------
------   -------    -------    -----     -----

---------------
Subgroup (6c)
---------------

    COMPLEX TERRAIN RECEPTOR INFORMATION

                      XRCT         YRCT        ZRCT          XHH
                      (km)         (km)         (m)
```

```
                     ------        -----      ------         ----


-------------------
1
     Description of Complex Terrain Variables:
          XC, YC  = Coordinates of center of hill
          THETAH  = Orientation of major axis of hill (clockwise from
                    North)
          ZGRID   = Height of the  0  of the grid above mean sea
                    level
          RELIEF  = Height of the crest of the hill above the grid
elevation
          EXPO 1  = Hill-shape exponent for the major axis
          EXPO 2  = Hill-shape exponent for the major axis
          SCALE 1 = Horizontal length scale along the major axis
          SCALE 2 = Horizontal length scale along the minor axis
          AMAX    = Maximum allowed axis length for the major axis
          BMAX    = Maximum allowed axis length for the major axis

          XRCT, YRCT = Coordinates of the complex terrain receptors
          ZRCT    = Height of the ground (MSL) at the complex terrain
                    Receptor
          XHH     = Hill number associated with each complex terrain
receptor
                    (NOTE: MUST BE ENTERED AS A REAL NUMBER)

   **
     NOTE: DATA for each hill and CTSG receptor are treated as a
separate
           input subgroup and therefore must end with an input group
terminator.

------------------------------------------------------------------------
-------


INPUT GROUP: 7 -- Chemical parameters for dry deposition of gases
--------------

      SPECIES     DIFFUSIVITY      ALPHA STAR      REACTIVITY
MESOPHYLL RESISTANCE     HENRY'S LAW COEFFICIENT
       NAME        (cm**2/s)
(s/cm)                (dimensionless)
      -------     -----------      ----------      ----------
--------------------     -----------------------


!END!


------------------------------------------------------------------------
-------


INPUT GROUP: 8 -- Size parameters for dry deposition of particles
--------------

     For SINGLE SPECIES, the mean and standard deviation are used to
     compute a deposition velocity for NINT (see group 9) size-ranges,
```

```
     and these are then averaged to obtain a mean deposition velocity.

     For GROUPED SPECIES, the size distribution should be explicitly
     specified (by the 'species' in the group), and the standard
deviation
     for each should be entered as 0.  The model will then use the
     deposition velocity for the stated mean diameter.

      SPECIES      GEOMETRIC MASS MEAN        GEOMETRIC STANDARD
       NAME             DIAMETER                   DEVIATION
                        (microns)                  (microns)
      -------      -------------------        ------------------

!END!


------------------------------------------------------------------------
-------


INPUT GROUP: 9 -- Miscellaneous dry deposition parameters
--------------

     Reference cuticle resistance (s/cm)
     (RCUTR)                           Default: 30    !  RCUTR = 30.0 !
     Reference ground resistance  (s/cm)
     (RGR)                             Default: 10    !    RGR = 10.0 !
     Reference pollutant reactivity
     (REACTR)                          Default: 8     ! REACTR = 8.0 !

     Number of particle-size intervals used to
     evaluate effective particle deposition velocity
     (NINT)                            Default: 9     !   NINT =  9  !

     Vegetation state in unirrigated areas
     (IVEG)                            Default: 1     !   IVEG =  1   !
        IVEG=1 for active and unstressed vegetation
        IVEG=2 for active and stressed vegetation
        IVEG=3 for inactive vegetation

!END!


------------------------------------------------------------------------
-------


INPUT GROUP: 10 -- Wet Deposition Parameters
---------------


                      Scavenging Coefficient -- Units: (sec)**(-1)

       Pollutant      Liquid Precip.       Frozen Precip.
       ---------      --------------       --------------

!END!


------------------------------------------------------------------------
```

```
-------


INPUT GROUP: 11 -- Chemistry Parameters
---------------

     Ozone data input option (MOZ)     Default: 1            ! MOZ =  0
!
     (Used only if MCHEM = 1, 3, or 4)
        0 = use a monthly background ozone value
        1 = read hourly ozone concentrations from
            the OZONE.DAT data file

     Monthly ozone concentrations
     (Used only if MCHEM = 1, 3, or 4 and
      MOZ = 0 or MOZ = 1 and all hourly O3 data missing)
     (BCKO3) in ppb                    Default: 12*80.
     !  BCKO3 = 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00, 80.00,
80.00, 80.00, 80.00, 80.00 !

     Monthly ammonia concentrations
     (Used only if MCHEM = 1, or 3)
     (BCKNH3) in ppb                   Default: 12*10.
     !  BCKNH3 = 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00, 10.00,
10.00, 10.00, 10.00, 10.00 !

     Nighttime SO2 loss rate (RNITE1)
     in percent/hour                   Default: 0.2          ! RNITE1 =
.2 !

     Nighttime NOx loss rate (RNITE2)
     in percent/hour                   Default: 2.0          ! RNITE2 =
2.0 !

     Nighttime HNO3 formation rate (RNITE3)
     in percent/hour                   Default: 2.0          ! RNITE3 =
2.0 !

     H2O2 data input option (MH2O2)    Default: 1            ! MH2O2 =
1   !
     (Used only if MAQCHEM = 1)
        0 = use a monthly background H2O2 value
        1 = read hourly H2O2 concentrations from
            the H2O2.DAT data file

     Monthly H2O2 concentrations
     (Used only if MQACHEM = 1 and
      MH2O2 = 0 or MH2O2 = 1 and all hourly H2O2 data missing)
     (BCKH2O2) in ppb                  Default: 12*1.
     !  BCKH2O2 = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00,
1.00, 1.00, 1.00 !


 --- Data for SECONDARY ORGANIC AEROSOL (SOA) Option
     (used only if MCHEM = 4)

     The SOA module uses monthly values of:
          Fine particulate concentration in ug/m^3 (BCKPMF)
          Organic fraction of fine particulate     (OFRAC)
          VOC / NOX ratio (after reaction)         (VCNX)
```

```
     to characterize the air mass when computing
     the formation of SOA from VOC emissions.
     Typical values for several distinct air mass types are:

        Month    1    2    3    4    5    6    7    8    9   10   11
12
                Jan  Feb  Mar  Apr  May  Jun  Jul  Aug  Sep  Oct  Nov
Dec

     Clean Continental
        BCKPMF   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.   1.
1.
        OFRAC  .15  .15  .20  .20  .20  .20  .20  .20  .20  .20  .20
.15
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.
50.

     Clean Marine (surface)
        BCKPMF  .5   .5   .5   .5   .5   .5   .5   .5   .5   .5   .5
.5
        OFRAC  .25  .25  .30  .30  .30  .30  .30  .30  .30  .30  .30
.25
        VCNX    50.  50.  50.  50.  50.  50.  50.  50.  50.  50.  50.
50.

     Urban - low biogenic (controls present)
        BCKPMF  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.  30.
30.
        OFRAC  .20  .20  .25  .25  .25  .25  .25  .25  .20  .20  .20
.20
        VCNX     4.   4.   4.   4.   4.   4.   4.   4.   4.   4.   4.
4.

     Urban - high biogenic (controls present)
        BCKPMF  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.  60.
60.
        OFRAC  .25  .25  .30  .30  .30  .55  .55  .55  .35  .35  .35
.25
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.
15.

     Regional Plume
        BCKPMF  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.  20.
20.
        OFRAC  .20  .20  .25  .35  .25  .40  .40  .40  .30  .30  .30
.20
        VCNX    15.  15.  15.  15.  15.  15.  15.  15.  15.  15.  15.
15.

     Urban - no controls present
        BCKPMF 100. 100. 100. 100. 100. 100. 100. 100. 100. 100. 100.
100.
        OFRAC  .30  .30  .35  .35  .35  .55  .55  .55  .35  .35  .35
.30
        VCNX     2.   2.   2.   2.   2.   2.   2.   2.   2.   2.   2.
2.

     Default: Clean Continental
     !  BCKPMF = 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00, 1.00,
1.00, 1.00, 1.00 !
```

```
     !  OFRAC  = 0.15, 0.15, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20, 0.20,
0.20, 0.20, 0.15 !
     !  VCNX   = 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00, 50.00,
50.00, 50.00, 50.00, 50.00 !


!END!


-----------------------------------------------------------------------
-------


INPUT GROUP: 12 -- Misc. Dispersion and Computational Parameters
---------------

     Horizontal size of puff (m) beyond which
     time-dependent dispersion equations (Heffter)
     are used to determine sigma-y and
     sigma-z (SYTDEP)                           Default: 550.   ! SYTDEP
= 5.5E02 !

     Switch for using Heffter equation for sigma z
     as above (0 = Not use Heffter; 1 = use Heffter
     (MHFTSZ)                                   Default: 0      ! MHFTSZ
=  0   !

     Stability class used to determine plume
     growth rates for puffs above the boundary
     layer (JSUP)                               Default: 5      ! JSUP =
5   !

     Vertical dispersion constant for stable
     conditions (k1 in Eqn. 2.7-3)  (CONK1)     Default: 0.01   ! CONK1
= .01 !

     Vertical dispersion constant for neutral/
     unstable conditions (k2 in Eqn. 2.7-4)
     (CONK2)                                    Default: 0.1    ! CONK2
= .1 !

     Factor for determining Transition-point from
     Schulman-Scire to Huber-Snyder Building Downwash
     scheme (SS used for Hs < Hb + TBD * HL)
     (TBD)                                      Default: 0.5    ! TBD =
.5 !
        TBD < 0   ==> always use Huber-Snyder
        TBD = 1.5 ==> always use Schulman-Scire
        TBD = 0.5 ==> ISC Transition-point

     Range of land use categories for which
     urban dispersion is assumed
     (IURB1, IURB2)                             Default: 10     ! IURB1
=  10  !
                                                         19     ! IURB2
=  19  !

     Site characterization parameters for single-point Met data files
---------
     (needed for METFM = 2,3,4,5)
```

```
        Land use category for modeling domain
        (ILANDUIN)                              Default: 20     !
ILANDUIN =  20  !

        Roughness length (m) for modeling domain
        (Z0IN)                                  Default: 0.25   ! Z0IN =
.25 !

        Leaf area index for modeling domain
        (XLAIIN)                                Default: 3.0    ! XLAIIN
= 3.0 !

        Elevation above sea level (m)
        (ELEVIN)                                Default: 0.0    ! ELEVIN
= .0 !

        Latitude (degrees) for met location
        (XLATIN)                                Default: -999.  ! XLATIN
= -999.0 !

        Longitude (degrees) for met location
        (XLONIN)                                Default: -999.  ! XLONIN
= -999.0 !

     Specialized information for interpreting single-point Met data
files -----

        Anemometer height (m) (Used only if METFM = 2,3)
        (ANEMHT)                                Default: 10.    ! ANEMHT
= 10.0 !

        Form of lateral turbulance data in PROFILE.DAT file
        (Used only if METFM = 4,5 or MTURBVW = 1 or 3)
        (ISIGMAV)                               Default: 1      !
ISIGMAV =  1  !
            0 = read sigma-theta
            1 = read sigma-v

        Choice of mixing heights (Used only if METFM = 4)
        (IMIXCTDM)                              Default: 0      !
IMIXCTDM =  0  !
            0 = read PREDICTED mixing heights
            1 = read OBSERVED mixing heights

     Maximum length of a slug (met. grid units)
     (XMXLEN)                                   Default: 1.0    ! XMXLEN
= 1.0 !

     Maximum travel distance of a puff/slug (in
     grid units) during one sampling step
     (XSAMLEN)                                  Default: 1.0    !
XSAMLEN = 1.0 !

     Maximum Number of slugs/puffs release from
     one source during one time step
     (MXNEW)                                    Default: 99     ! MXNEW
=  99   !

     Maximum Number of sampling steps for
```

```
     one puff/slug during one time step
     (MXSAM)                                    Default: 99     ! MXSAM
=  99   !

     Number of iterations used when computing
     the transport wind for a sampling step
     that includes gradual rise (for CALMET
     and PROFILE winds)
     (NCOUNT)                                   Default: 2      ! NCOUNT
=  2   !

     Minimum sigma y for a new puff/slug (m)
     (SYMIN)                                    Default: 1.0    ! SYMIN
= 1.0  !

     Minimum sigma z for a new puff/slug (m)
     (SZMIN)                                    Default: 1.0    ! SZMIN
= 1.0  !

     Maximum sigma z (m) allowed to avoid
     numerical problem in calculating virtual
     time or distance.  Cap should be large
     enough to have no influence on normal events.
     Enter a negative cap to disable.
     (SZCAP_M)                                  Default: 5.0e06 !
SZCAP_M = 5.0E06 !

     Default minimum turbulence velocities sigma-v and sigma-w
     for each stability class over land and over water (m/s)
     (SVMIN(12) and SWMIN(12))

                     ----------  LAND  ----------       ---------  WATER
----------
        Stab Class :  A    B    C    D    E    F         A    B    C
D    E    F
                     ---  ---  ---  ---  ---  ---       ---  ---  ---
---  ---  ---
     Default SVMIN : .50, .50, .50, .50, .50, .50,      .37, .37, .37,
.37, .37, .37
     Default SWMIN : .20, .12, .08, .06, .03, .016,     .20, .12, .08,
.06, .03, .016

          ! SVMIN = 0.500, 0.500, 0.500, 0.500, 0.500, 0.500, 0.370,
0.370, 0.370, 0.370, 0.370, 0.370!
          ! SWMIN = 0.200, 0.120, 0.080, 0.060, 0.030, 0.016, 0.200,
0.120, 0.080, 0.060, 0.030, 0.016!

     Divergence criterion for dw/dz across puff
     used to initiate adjustment for horizontal
     convergence (1/s)
     Partial adjustment starts at CDIV(1), and
     full adjustment is reached at CDIV(2)
     (CDIV(2))                                  Default: 0.0,0.0  ! CDIV
= .0, .0 !

     Search radius (number of cells) for nearest
     land and water cells used in the subgrid
     TIBL module
     (NLUTIBL)                                  Default: 4      !
NLUTIBL =  4  !
```

```
     Minimum wind speed (m/s) allowed for
     non-calm conditions. Also used as minimum
     speed returned when using power-law
     extrapolation toward surface
     (WSCALM)                                   Default: 0.5    ! WSCALM
= .5 !

     Maximum mixing height (m)
     (XMAXZI)                                   Default: 3000.  ! XMAXZI
= 3000.0 !

     Minimum mixing height (m)
     (XMINZI)                                   Default: 50.    ! XMINZI
= 50.0 !

     Default wind speed classes --
     5 upper bounds (m/s) are entered;
     the 6th class has no upper limit
     (WSCAT(5))                      Default   :
                                     ISC RURAL : 1.54, 3.09, 5.14, 8.23,
10.8 (10.8+)

                              Wind Speed Class :  1     2     3     4
5
                                                 ---   ---   ---   ---
---
                                       ! WSCAT = 1.54, 3.09, 5.14, 8.23,
10.80 !

     Default wind speed profile power-law
     exponents for stabilities 1-6
     (PLX0(6))                       Default   : ISC RURAL values
                                     ISC RURAL : .07, .07, .10, .15,
.35, .55
                                     ISC URBAN : .15, .15, .20, .25,
.30, .30

                               Stability Class :  A     B     C     D
E     F
                                                 ---   ---   ---   ---
---   ---
                                        ! PLX0 = 0.07, 0.07, 0.10, 0.15,
0.35, 0.55 !

     Default potential temperature gradient
     for stable classes E, F (degK/m)
     (PTG0(2))                       Default: 0.020, 0.035
                                        ! PTG0 = 0.020,   0.035 !

     Default plume path coefficients for
     each stability class (used when option
     for partial plume height terrain adjustment
     is selected -- MCTADJ=3)
     (PPC(6))                  Stability Class :  A     B     C     D
E     F
                                  Default  PPC : .50,  .50,  .50,  .50,
.35,  .35
                                                 ---   ---   ---   ---
---   ---
```

```
                                        !  PPC = 0.50, 0.50, 0.50, 0.50,
0.35, 0.35 !

     Slug-to-puff transition criterion factor
     equal to sigma-y/length of slug
     (SL2PF)                               Default: 10.        ! SL2PF =
10.0 !

     Puff-splitting control variables ------------------------

       VERTICAL SPLIT
       --------------

       Number of puffs that result every time a puff
       is split - nsplit=2 means that 1 puff splits
       into 2
       (NSPLIT)                            Default:   3        ! NSPLIT
=  3  !

       Time(s) of a day when split puffs are eligible to
       be split once again; this is typically set once
       per day, around sunset before nocturnal shear develops.
       24 values: 0 is midnight (00:00) and 23 is 11 PM (23:00)
       0=do not re-split    1=eligible for re-split
       (IRESPLIT(24))                      Default:  Hour 17 = 1
       !  IRESPLIT = 0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,0,1,0,0,0,0,0,0 !

       Split is allowed only if last hour's mixing
       height (m) exceeds a minimum value
       (ZISPLIT)                           Default: 100.       ! ZISPLIT
= 100.0 !

       Split is allowed only if ratio of last hour's
       mixing ht to the maximum mixing ht experienced
       by the puff is less than a maximum value (this
       postpones a split until a nocturnal layer develops)
       (ROLDMAX)                           Default: 0.25       ! ROLDMAX
= 0.25 !


       HORIZONTAL SPLIT
       ----------------

       Number of puffs that result every time a puff
       is split - nsplith=5 means that 1 puff splits
       into 5
       (NSPLITH)                           Default:   5        ! NSPLITH
=  5  !

       Minimum sigma-y (Grid Cells Units) of puff
       before it may be split
       (SYSPLITH)                          Default:  1.0       !
SYSPLITH = 1.0 !

       Minimum puff elongation rate (SYSPLITH/hr) due to
       wind shear, before it may be split
       (SHSPLITH)                          Default:  2.        !
SHSPLITH = 2.0 !

       Minimum concentration (g/m^3) of each
```

```
       species in puff before it may be split
       Enter array of NSPEC values; if a single value is
       entered, it will be used for ALL species
       (CNSPLITH)                         Default:  1.0E-07   !
CNSPLITH = 1.0E-07 !

     Integration control variables ------------------------

       Fractional convergence criterion for numerical SLUG
       sampling integration
       (EPSSLUG)                          Default:   1.0e-04  ! EPSSLUG
= 1.0E-04 !

       Fractional convergence criterion for numerical AREA
       source integration
       (EPSAREA)                          Default:   1.0e-06  ! EPSAREA
= 1.0E-06 !

       Trajectory step-length (m) used for numerical rise
       integration
       (DSRISE)                           Default:   1.0      ! DSRISE
= 1.0 !

       Boundary Condition (BC) Puff control variables
------------------------

       Minimum height (m) to which BC puffs are mixed as they are
emitted
       (MBCON=2 ONLY).  Actual height is reset to the current mixing
height
       at the release point if greater than this minimum.
       (HTMINBC)                          Default:   500.     ! HTMINBC
= 500.0 !

       Search radius (km) about a receptor for sampling nearest BC puff.
       BC puffs are typically emitted with a spacing of one grid cell
       length, so the search radius should be greater than DGRIDKM.
       (RSAMPBC)                          Default:   10.      ! RSAMPBC
= 10.0 !

       Near-Surface depletion adjustment to concentration profile used
when
       sampling BC puffs?
       (MDEPBC)                           Default:   1        ! MDEPBC
=  1  !
          0 = Concentration is NOT adjusted for depletion
          1 = Adjust Concentration for depletion

!END!


-------------------------------------------------------------------------
-------


INPUT GROUPS: 13a, 13b, 13c, 13d -- Point source parameters
--------------------------------

---------------
Subgroup (13a)
```

```
---------------

     Number of point sources with
     parameters provided below      (NPT1)  No default  !  NPT1 =  5  !

     Units used for point source
     emissions below                (IPTU)  Default: 1  !  IPTU =   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (13d)        (NSPT1) Default: 0  !  NSPT1 =  0  !

     Number of point sources with
     variable emission parameters
     provided in external file      (NPT2)  No default  !  NPT2 =  0  !

     (If NPT2 > 0, these point
     source emissions are read from
     the file: PTEMARB.DAT)

!END!

---------------
Subgroup (13b)
---------------
                                      a
          POINT SOURCE: CONSTANT DATA
          -----------------------------

b          c
  Source       X          Y       Stack    Base     Stack    Exit  Exit
Bldg.  Emission
   No.     Coordinate Coordinate Height Elevation Diameter  Vel.  Temp.
Dwash   Rates
              (km)      (km)       (m)      (m)       (m)  (m/s) (deg.
K)
  ------   ---------- ---------- ------  ------   -------- -----
-------- ----- --------
   1 ! SRCNAM = STCK1 !
   1 ! X =  639.282, 6072.984,    33.4,532.25,        .9,  25.0,  500.0,
1.0,1.7E-01, 2.1E-01,  0.0E00,
      1.1E-01 !
   1 ! ZPLTFM  =       .0 !
   1 ! FMFAC  =      1.0 !   !END!
   2 ! SRCNAM = GEN1 !
   2 ! X =639.31557,6073.0097,    5.0,532.25,        .2,  25.0,  500.0,
1.0,4.1E-01,  1.6E00, 8.9E-02,
      7.0E-01 !
   2 ! ZPLTFM  =       .0 !
   2 ! FMFAC  =      1.0 !   !END!
   3 ! SRCNAM = GEN2 !
   3 ! X =639.31192,6073.01363,    5.0,532.25,        .2,  25.0,  500.0,
```

```
1.0,4.1E-01,  1.6E00, 8.9E-02,
      7.0E-01 !
   3 ! ZPLTFM  =       .0 !
   3 ! FMFAC  =      1.0 !   !END!
   4 ! SRCNAM = GEN3 !
   4 ! X =639.30799,6073.01756,    5.0,532.25,        .2,  25.0,  500.0,
1.0,4.1E-01,  1.6E00, 8.9E-02,
      7.0E-01 !
   4 ! ZPLTFM  =       .0 !
   4 ! FMFAC  =      1.0 !   !END!
   5 ! SRCNAM = DC1 !
   5 ! X =639.29183,6072.99641,    33.4,532.25,        .5,  10.0,
.0,  1.0, 0.0E00,  0.0E00,  0.0E00,
       0.0E00 !
   5 ! ZPLTFM  =       .0 !
   5 ! FMFAC  =      1.0 !   !END!
```

----

a
Data for each source are treated as a separate input subgroup and therefore must end with an input group terminator.

SRCNAM is a 12-character name for a source
(No default)

X is an array holding the source data listed by the column headings
(No default)

SIGYZI is an array holding the initial sigma-y and sigma-z (m)
(Default: 0.,0.)

FMFAC is a vertical momentum flux factor (0. or 1.0) used to represent the effect of rain-caps or other physical configurations that reduce momentum rise associated with the actual exit velocity.
(Default: 1.0 -- full momentum used)

ZPLTFM is the platform height (m) for sources influenced by an isolated structure that has a significant open area between the surface and the bulk of the structure, such as an offshore oil platform. The Base Elevation is that of the surface (ground or ocean), and the Stack Height is the release height above the Base (not above the platform). Building heights entered in Subgroup 13c must be those of the buildings on the platform, measured from the platform deck. ZPLTFM is used only with MBDW=1 (ISC downwash method) for sources with building downwash.
(Default: 0.0)

b
0. = No building downwash modeled
1. = Downwash modeled for buildings resting on the surface
2. = Downwash modeled for buildings raised above the surface (ZPLTFM > 0.)

```
     NOTE: must be entered as a REAL number (i.e., with decimal point)

    c
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IPTU
     (e.g. 1 for g/s).

---------------
Subgroup (13c)
---------------

           BUILDING DIMENSION DATA FOR SOURCES SUBJECT TO DOWNWASH
           -------------------------------------------------------
Source
a
 No.       Effective building height, width, length and X/Y offset (in
meters)
           every 10 degrees.  LENGTH, XBADJ, and YBADJ are only needed
for
           MBDW=2 (PRIME downwash option)
------
--------------------------------------------------------------------

 1    ! SRCNAM  =   STCK1 !
 1    ! HEIGHT  =  32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4!
 1    ! WIDTH  =   55.53,   54.75,   52.5,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   57.5,   55.0,   50.0,
                   44.0,   36.5,   42.0,   47.75,   52.0,   54.62,
                   55.53,   54.75,   52.25,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   58.0,   55.0,   50.0,
                   44.0,   36.0,   42.0,   47.75,   52.0,   54.56!
 1    ! LENGTH =   58.0,   55.0,   50.0,   44.0,   36.0,   42.0,
                   47.75,   52.0,   54.62,   55.5,   54.75,   52.5,
                   48.5,   47.0,   52.5,   56.5,   58.5,   59.5,
                   58.0,   55.0,   50.0,   43.5,   36.0,   42.25,
                   47.75,   52.0,   54.56,   55.53,   54.88,   52.5,
                   48.25,   47.0,   52.5,   56.5,   59.0,   59.0!
 1    ! XBADJ  =   -14.0,   -14.0,   -14.0,   -13.0,   -11.5,   -17.25,
                   -23.0,   -28.0,   -32.19,   -35.41,   -37.62,   -
38.75,
                   -38.25,   -39.0,   -42.5,   -45.0,   -46.0,   -46.0,
                   -43.5,   -40.5,   -36.5,   -30.5,   -24.5,   -25.0,
                   -24.75,   -24.0,   -22.38,   -20.16,   -17.38,   -
14.25,
                   -10.0,   -8.0,   -10.0,   -11.0,   -12.5,   -13.5!
 1    ! YBADJ  =   7.55,   10.12,   12.25,   13.88,   15.5,   16.25,
                   16.75,   16.5,   16.25,   14.75,   13.0,   11.0,
                   9.0,   6.25,   3.75,   .88,   -2.0,   -4.88,
                   -7.64,   -10.12,   -12.12,   -14.12,   -15.5,   -
16.25,
                   -17.25,   -16.5,   -15.75,   -15.0,   -13.5,   -11.5,
                   -9.0,   -6.5,   -3.75,   -.88,   2.0,   4.91!
!END!
 2    ! SRCNAM  =   GEN1 !
```

```
 2    ! HEIGHT  =  32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   4.3,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   4.3,   32.4,   32.4,   32.4!
 2    ! WIDTH  =   55.53,   54.75,   52.5,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   57.5,   55.0,   50.0,
                   44.0,   8.5,   8.75,   47.75,   52.0,   54.62,
                   55.53,   54.75,   52.25,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   58.0,   55.0,   50.0,
                   44.0,   8.5,   9.25,   47.75,   52.0,   54.56!
 2    ! LENGTH =   58.0,   55.0,   50.0,   44.0,   36.0,   42.0,
                   47.75,   52.0,   54.62,   55.5,   54.75,   52.5,
                   48.5,   4.5,   5.5,   56.5,   58.5,   59.5,
                   58.0,   55.0,   50.0,   43.5,   36.0,   42.25,
                   47.75,   52.0,   54.56,   55.53,   54.88,   52.5,
                   48.25,   4.5,   6.0,   56.5,   59.0,   59.0!
 2    ! XBADJ  =   -44.0,   -49.0,   -52.0,   -53.5,   -53.0,   -58.5,
                   -62.75,   -65.12,   -65.5,   -63.88,   -60.38,   -
55.0,
                   -47.75,   -8.5,   -18.5,   -33.0,   -27.0,   -21.0,
                   -13.0,   -5.5,   2.0,   10.0,   17.0,   16.25,
                   15.0,   13.12,   10.94,   8.31,   5.38,   2.25,
                   -.75,   -2.0,   -3.0,   -23.5,   -31.5,   -38.5!
 2    ! YBADJ  =   36.02,   32.88,   28.75,   23.38,   17.5,   11.25,
                   4.25,   -2.0,   -8.75,   -15.75,   -21.5,   -27.0,
                   -31.5,   -2.75,   -5.88,   -38.88,   -39.12,   -
38.19,
                   -36.11,   -32.88,   -28.38,   -23.62,   -17.5,   -
11.25,
                   -4.75,   2.5,   9.25,   15.5,   21.5,   27.0,
                   31.5,   2.25,   2.38,   38.88,   39.25,   38.22!
!END!
 3    ! SRCNAM  =   GEN2 !
 3    ! HEIGHT  =  32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   32.4,   32.4,   32.4,   32.4!
 3    ! WIDTH  =   55.53,   54.75,   52.5,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   57.5,   55.0,   50.0,
                   44.0,   8.5,   42.0,   47.75,   52.0,   54.62,
                   55.53,   54.75,   52.25,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   58.0,   55.0,   50.0,
                   44.0,   8.5,   42.0,   47.75,   52.0,   54.56!
 3    ! LENGTH =   58.0,   55.0,   50.0,   44.0,   36.0,   42.0,
                   47.75,   52.0,   54.62,   55.5,   54.75,   52.5,
                   48.5,   4.5,   52.5,   56.5,   58.5,   59.5,
                   58.0,   55.0,   50.0,   43.5,   36.0,   42.25,
                   47.75,   52.0,   54.56,   55.53,   54.88,   52.5,
                   48.25,   4.5,   52.5,   56.5,   59.0,   59.0!
 3    ! XBADJ  =   -47.5,   -51.5,   -54.0,   -54.0,   -53.0,   -57.5,
                   -60.75,   -62.25,   -61.88,   -59.59,   -55.62,   -
49.75,
                   -42.5,   -3.0,   -32.5,   -28.0,   -22.5,   -17.0,
                   -10.0,   -3.0,   3.5,   11.0,   17.0,   15.25,
                   13.0,   10.25,   7.31,   4.03,   .62,   -3.0,
                   -6.0,   -7.5,   -20.5,   -28.5,   -36.0,   -42.5!
```

```
 3    ! YBADJ  =   31.77,   28.12,   23.5,   18.12,   12.0,   6.25,
                   -.75,   -7.0,   -12.75,   -18.75,   -24.5,   -29.0,
                   -32.0,   -2.75,   -36.25,   -36.88,   -36.25,   -
34.56,
                   -31.83,   -28.12,   -23.38,   -18.38,   -12.0,   -
6.25,
                   .25,   7.0,   13.25,   19.0,   24.0,   28.5,
                   32.0,   1.75,   36.5,   36.88,   36.38,   34.59!
!END!
 4    ! SRCNAM  =   GEN3 !
 4    ! HEIGHT  =  32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   4.3,   32.4,   32.4,   32.4,   32.4!
 4    ! WIDTH  =   55.53,   54.75,   52.5,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   57.5,   55.0,   50.0,
                   44.0,   8.5,   42.0,   47.75,   52.0,   54.62,
                   55.53,   54.75,   52.25,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   58.0,   55.0,   50.0,
                   44.0,   8.0,   42.0,   47.75,   52.0,   54.56!
 4    ! LENGTH =   58.0,   55.0,   50.0,   44.0,   36.0,   42.0,
                   47.75,   52.0,   54.62,   55.5,   54.75,   52.5,
                   48.5,   4.5,   52.5,   56.5,   58.5,   59.5,
                   58.0,   55.0,   50.0,   43.5,   36.0,   42.25,
                   47.75,   52.0,   54.56,   55.53,   54.88,   52.5,
                   48.25,   4.5,   52.5,   56.5,   59.0,   59.0!
 4    ! XBADJ  =   -51.0,   -54.0,   -55.5,   -54.5,   -52.5,   -56.0,
                   -58.5,   -59.12,   -57.94,   -55.03,   -50.5,   -
44.5,
                   -36.75,   2.5,   -27.0,   -23.0,   -18.0,   -13.0,
                   -6.5,   -1.0,   5.0,   11.5,   16.5,   13.75,
                   10.75,   7.0,   3.38,   -.53,   -4.38,   -8.25,
                   -11.5,   3.5,   -26.0,   -33.5,   -40.5,   -46.5!
 4    ! YBADJ  =   27.17,   23.12,   18.0,   12.62,   6.5,   .75,
                   -5.75,   -11.5,   -16.75,   -22.25,   -26.5,   -30.5,
                   -32.5,   -2.25,   -35.0,   -34.38,   -33.12,   -
30.62,
                   -27.27,   -23.0,   -17.88,   -12.62,   -6.5,   -.75,
                   5.25,   11.5,   17.25,   22.0,   26.5,   30.0,
                   33.0,   2.5,   35.0,   34.62,   33.12,   30.66!
!END!
 5    ! SRCNAM  =   DC1 !
 5    ! HEIGHT  =  32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4,
                   32.4,   32.4,   32.4,   32.4,   32.4,   32.4!
 5    ! WIDTH  =   55.53,   54.75,   52.5,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   57.5,   55.0,   50.0,
                   44.0,   36.5,   42.0,   47.75,   52.0,   54.62,
                   55.53,   54.75,   52.25,   48.25,   47.0,   52.5,
                   56.5,   59.0,   59.5,   58.0,   55.0,   50.0,
                   44.0,   36.0,   42.0,   47.75,   52.0,   54.56!
 5    ! LENGTH =   58.0,   55.0,   50.0,   44.0,   36.0,   42.0,
                   47.75,   52.0,   54.62,   55.5,   54.75,   52.5,
                   48.5,   47.0,   52.5,   56.5,   58.5,   59.5,
                   58.0,   55.0,   50.0,   43.5,   36.0,   42.25,
```

```
                   47.75,   52.0,   54.56,   55.53,   54.88,   52.5,
                   48.25,   47.0,   52.5,   56.5,   59.0,   59.0!
 5    ! XBADJ  =   -27.5,   -28.5,   -29.0,   -28.0,   -26.5,   -31.5,
                   -36.0,   -39.5,   -41.75,   -42.72,   -42.5,   -41.0,
                   -38.0,   -36.0,   -37.0,   -37.0,   -36.0,   -34.0,
                   -30.0,   -26.0,   -21.0,   -15.0,   -9.5,   -10.75,
                   -11.75,   -12.5,   -12.81,   -12.81,   -12.5,   -
11.75,
                   -10.5,   -11.0,   -15.5,   -19.0,   -22.5,   -25.5!
 5    ! YBADJ  =   14.89,   15.0,   14.5,   13.62,   12.5,   10.75,
                   8.75,   6.5,   4.25,   1.25,   -1.5,   -4.0,
                   -6.0,   -8.75,   -10.5,   -12.12,   -13.5,   -14.44,
                   -14.98,   -15.0,   -14.38,   -13.88,   -12.5,   -
10.75,
                   -9.25,   -6.5,   -3.75,   -1.5,   1.0,   3.5,
                   6.5,   8.5,   10.5,   12.12,   13.5,   14.47!
!END!

--------

    a
     Building height, width, length, and X/Y offset from the source are
treated
     as a separate input subgroup for each source and therefore must end
with
     an input group terminator.  The X/Y offset is the position,
relative to the
     stack, of the center of the upwind face of the projected building,
with the
     x-axis pointing along the flow direction.

---------------
Subgroup (13d)
---------------
                                                a
          POINT SOURCE: VARIABLE EMISSIONS DATA
          ---------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 13b.  Factors entered multiply the rates in 13b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use PTEMARB.DAT and NPT2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                Default: 0
           0 =      Constant
           1 =      Diurnal cycle (24 scaling factors: hours 1-24)
           2 =      Monthly cycle (12 scaling factors: months 1-12)
           3 =      Hour & Season (4 groups of 24 hourly scaling
factors,
                                    where first group is DEC-JAN-FEB)
           4 =      Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =      Temperature   (12 scaling factors, where
temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)
```

```
--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


------------------------------------------------------------------------
-------


INPUT GROUPS: 14a, 14b, 14c, 14d -- Area source parameters
--------------------------------

---------------
Subgroup (14a)
---------------

     Number of polygon area sources with
     parameters specified below (NAR1)       No default  !  NAR1 =  0
!

     Units used for area source
     emissions below            (IARU)       Default: 1  !  IARU =   1
!
           1 =        g/m**2/s
           2 =       kg/m**2/hr
           3 =       lb/m**2/hr
           4 =     tons/m**2/yr
           5 =     Odour Unit * m/s  (vol. flux/m**2 of odour compound)
           6 =     Odour Unit * m/min
           7 =     metric tons/m**2/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (14d)        (NSAR1) Default: 0  !  NSAR1 =  0  !

     Number of buoyant polygon area sources
     with variable location and emission
     parameters (NAR2)                      No default  !  NAR2 =  0   !
     (If NAR2 > 0, ALL parameter data for
     these sources are read from the file: BAEMARB.DAT)

!END!

---------------
Subgroup (14b)
---------------
                                     a
          AREA SOURCE: CONSTANT DATA
          ----------------------------
                                                         b
Source           Effect.    Base      Initial    Emission
 No.             Height   Elevation   Sigma z     Rates
                   (m)       (m)        (m)
-------          ------    ------     --------   ---------
```

```
--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.
    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IARU
     (e.g. 1 for g/m**2/s).

---------------
Subgroup (14c)
---------------

           COORDINATES (km) FOR EACH VERTEX(4) OF EACH POLYGON
           --------------------------------------------------------
Source                                                             a
 No.       Ordered list of X followed by list of Y, grouped by source
------     ------------------------------------------------------------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.


---------------
Subgroup (14d)
---------------
                                                    a
          AREA SOURCE: VARIABLE EMISSIONS DATA
          --------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 14b.  Factors entered multiply the rates in 14b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use BAEMARB.DAT and NAR2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling
factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where
temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)
```

```
--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


------------------------------------------------------------------------
-------

INPUT GROUPS: 15a, 15b, 15c -- Line source parameters
---------------------------

---------------
Subgroup (15a)
---------------

     Number of buoyant line sources
     with variable location and emission
     parameters (NLN2)                              No default  !  NLN2
=  0   !

     (If NLN2 > 0, ALL parameter data for
      these sources are read from the file: LNEMARB.DAT)

     Number of buoyant line sources (NLINES)        No default   !
NLINES =  0  !

     Units used for line source
     emissions below                (ILNU)          Default: 1  !  ILNU
=   1  !
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (15c)        (NSLN1) Default: 0  !  NSLN1 =  0  !

     Maximum number of segments used to model
     each line (MXNSEG)                             Default: 7   !
MXNSEG =  7  !

     The following variables are required only if NLINES > 0.  They are
     used in the buoyant line source plume rise calculations.

        Number of distances at which                Default: 6   !
NLRISE =  6  !
        transitional rise is computed

        Average building length (XL)                No default   ! XL =
.0 !
                                                    (in meters)

        Average building height (HBL)               No default   ! HBL =
.0 !
```

```
                                                    (in meters)

        Average building width (WBL)                No default   ! WBL =
.0 !
                                                    (in meters)

        Average line source width (WML)             No default   ! WML =
.0 !
                                                    (in meters)

        Average separation between buildings (DXL)  No default   ! DXL =
.0 !
                                                    (in meters)

        Average buoyancy parameter (FPRIMEL)        No default   !
FPRIMEL = .0 !
                                                    (in m**4/s**3)

!END!

---------------
Subgroup (15b)
---------------

          BUOYANT LINE SOURCE: CONSTANT DATA
          ----------------------------------

a
Source     Beg. X      Beg. Y      End. X    End. Y     Release    Base
Emission
 No.     Coordinate  Coordinate  Coordinate Coordinate  Height
Elevation      Rates
            (km)        (km)        (km)       (km)       (m)       (m)
------   ----------  ----------  ---------  ----------  -------
---------    ---------

--------

    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by ILNTU
     (e.g. 1 for g/s).

---------------
Subgroup (15c)
---------------
                                                       a
          BUOYANT LINE SOURCE: VARIABLE EMISSIONS DATA
          ----------------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 15b.  Factors entered multiply the rates in 15b.
     Skip sources here that have constant emissions.

     IVARY determines the type of variation, and is source-specific:
```

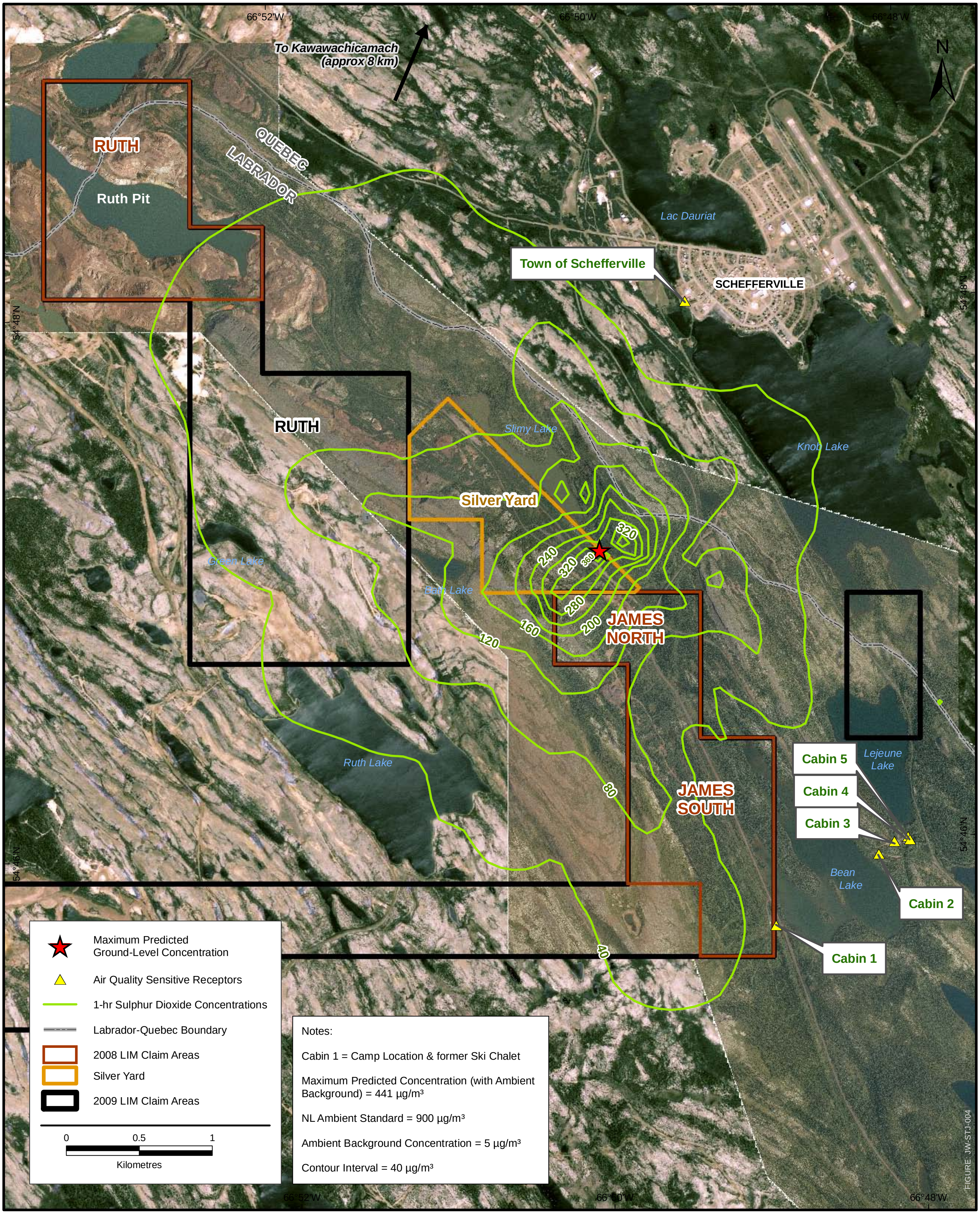
```
     (IVARY)                                Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling
factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where
temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


------------------------------------------------------------------------
-------


INPUT GROUPS: 16a, 16b, 16c -- Volume source parameters
---------------------------

---------------
Subgroup (16a)
---------------

     Number of volume sources with
     parameters provided in 16b,c (NVL1)     No default  !  NVL1 =  0
!

     Units used for volume source
     emissions below in 16b       (IVLU)     Default: 1  !  IVLU =   1
!
           1 =        g/s
           2 =       kg/hr
           3 =       lb/hr
           4 =     tons/yr
           5 =     Odour Unit * m**3/s  (vol. flux of odour compound)
           6 =     Odour Unit * m**3/min
           7 =     metric tons/yr

     Number of source-species
     combinations with variable
     emissions scaling factors
     provided below in (16c)      (NSVL1)    Default: 0  !  NSVL1 =  0
!

     Number of volume sources with
     variable location and emission
     parameters                   (NVL2)     No default  !  NVL2 =   0
```

```
!

     (If NVL2 > 0, ALL parameter data for
      these sources are read from the VOLEMARB.DAT file(s) )

!END!

---------------
Subgroup (16b)
---------------
                                        a
           VOLUME SOURCE: CONSTANT DATA
           ------------------------------

b
         X           Y        Effect.    Base     Initial    Initial
Emission
     Coordinate  Coordinate   Height   Elevation  Sigma y    Sigma z
Rates
        (km)       (km)         (m)       (m)        (m)       (m)
     ----------  ----------   ------    ------    --------   --------
--------


--------
    a
     Data for each source are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     An emission rate must be entered for every pollutant modeled.
     Enter emission rate of zero for secondary pollutants that are
     modeled, but not emitted.  Units are specified by IVLU
     (e.g. 1 for g/s).

---------------
Subgroup (16c)
---------------
                                                 a
          VOLUME SOURCE: VARIABLE EMISSIONS DATA
          ----------------------------------------

     Use this subgroup to describe temporal variations in the emission
     rates given in 16b.  Factors entered multiply the rates in 16b.
     Skip sources here that have constant emissions.  For more elaborate
     variation in source parameters, use VOLEMARB.DAT and NVL2 > 0.

     IVARY determines the type of variation, and is source-specific:
     (IVARY)                                Default: 0
           0 =       Constant
           1 =       Diurnal cycle (24 scaling factors: hours 1-24)
           2 =       Monthly cycle (12 scaling factors: months 1-12)
           3 =       Hour & Season (4 groups of 24 hourly scaling
factors,
                                    where first group is DEC-JAN-FEB)
           4 =       Speed & Stab. (6 groups of 6 scaling factors, where
                                    first group is Stability Class A,
                                    and the speed classes have upper
                                    bounds (m/s) defined in Group 12
           5 =       Temperature   (12 scaling factors, where
```

```
temperature
                                    classes have upper bounds (C) of:
                                    0, 5, 10, 15, 20, 25, 30, 35, 40,
                                    45, 50, 50+)



--------
    a
     Data for each species are treated as a separate input subgroup
     and therefore must end with an input group terminator.


------------------------------------------------------------------------
-------

INPUT GROUPS: 17a & 17b -- Non-gridded (discrete) receptor information
-----------------------

---------------
Subgroup (17a)
---------------

     Number of non-gridded receptors (NREC)  No default  !  NREC =  3621
!

!END!

---------------
Subgroup (17b)
---------------
                                                a
           NON-GRIDDED (DISCRETE) RECEPTOR DATA
           ------------------------------------

                   X            Y          Ground          Height   b
Receptor       Coordinate   Coordinate    Elevation    Above Ground
  No.             (km)         (km)          (m)            (m)
--------       ----------   ----------    ---------    ------------



-------------
    a
     Data for each receptor are treated as a separate input subgroup
     and therefore must end with an input group terminator.

    b
     Receptor height above ground is optional.  If no value is entered,
     the receptor is placed on the ground.
```

ATTACHMENT E

Contour Plots



Notes:

Cabin 1 = Camp Location & former Ski Chalet

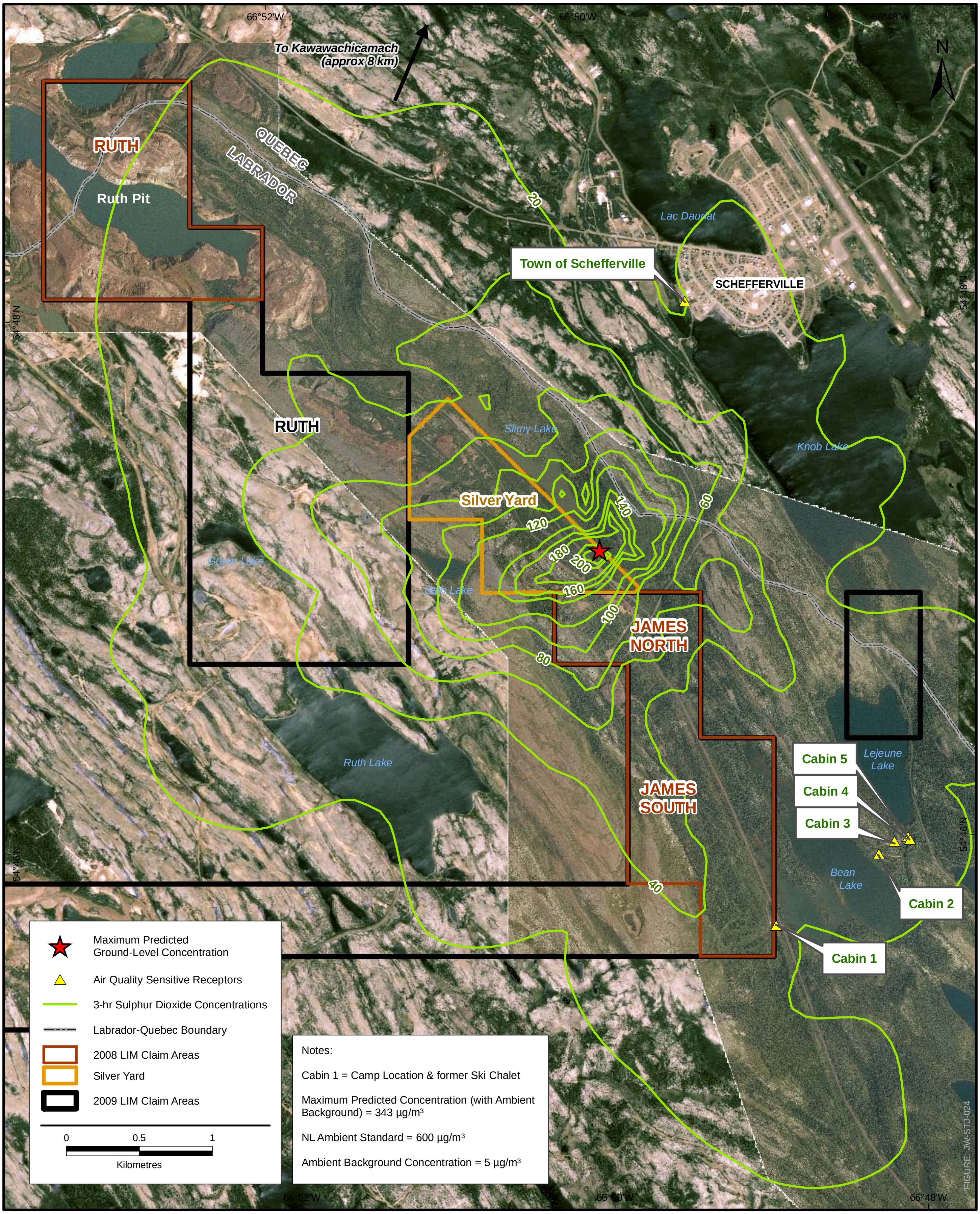
Maximum Predicted Concentration (with Ambient Background) = 441 µg/m³

NL Ambient Standard = 900 µg/m³

Ambient Background Concentration = 5 µg/m³

Contour Interval = 40 µg/m³

FIGURE NO:		DRAFT DATE:
E-1	**Maximum Predicted 1-hr Total Sulphur Dioxide Ground-level Concentrations**	08/12/2008
		REVISION DATE:
		12/8/2009



Notes:

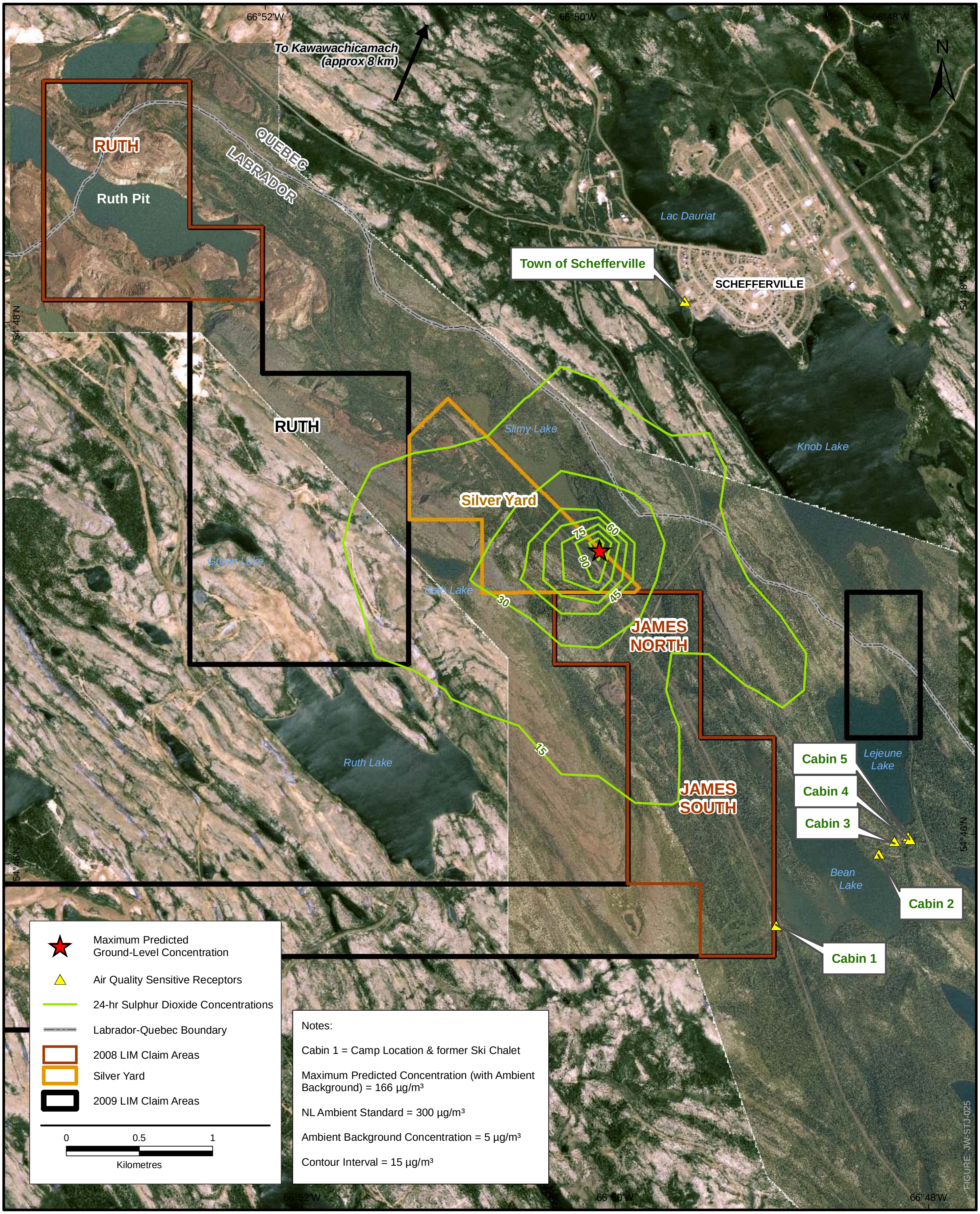
Cabin 1 = Camp Location & former Ski Chalet

Maximum Predicted Concentration (with Ambient Background) = 343 µg/m³

NL Ambient Standard = 600 µg/m³

Ambient Background Concentration = 5 µg/m³

FIGURE NO: **E-2**	DRAFT DATE: 08/12/2008
Maximum Predicted 3-hr Sulphur Dioxide Ground-level Concentrations	REVISION DATE: 12/8/2009



Notes:

Cabin 1 = Camp Location & former Ski Chalet

Maximum Predicted Concentration (with Ambient Background) = 166 µg/m³

NL Ambient Standard = 300 µg/m³

Ambient Background Concentration = 5 µg/m³

Contour Interval = 15 µg/m³

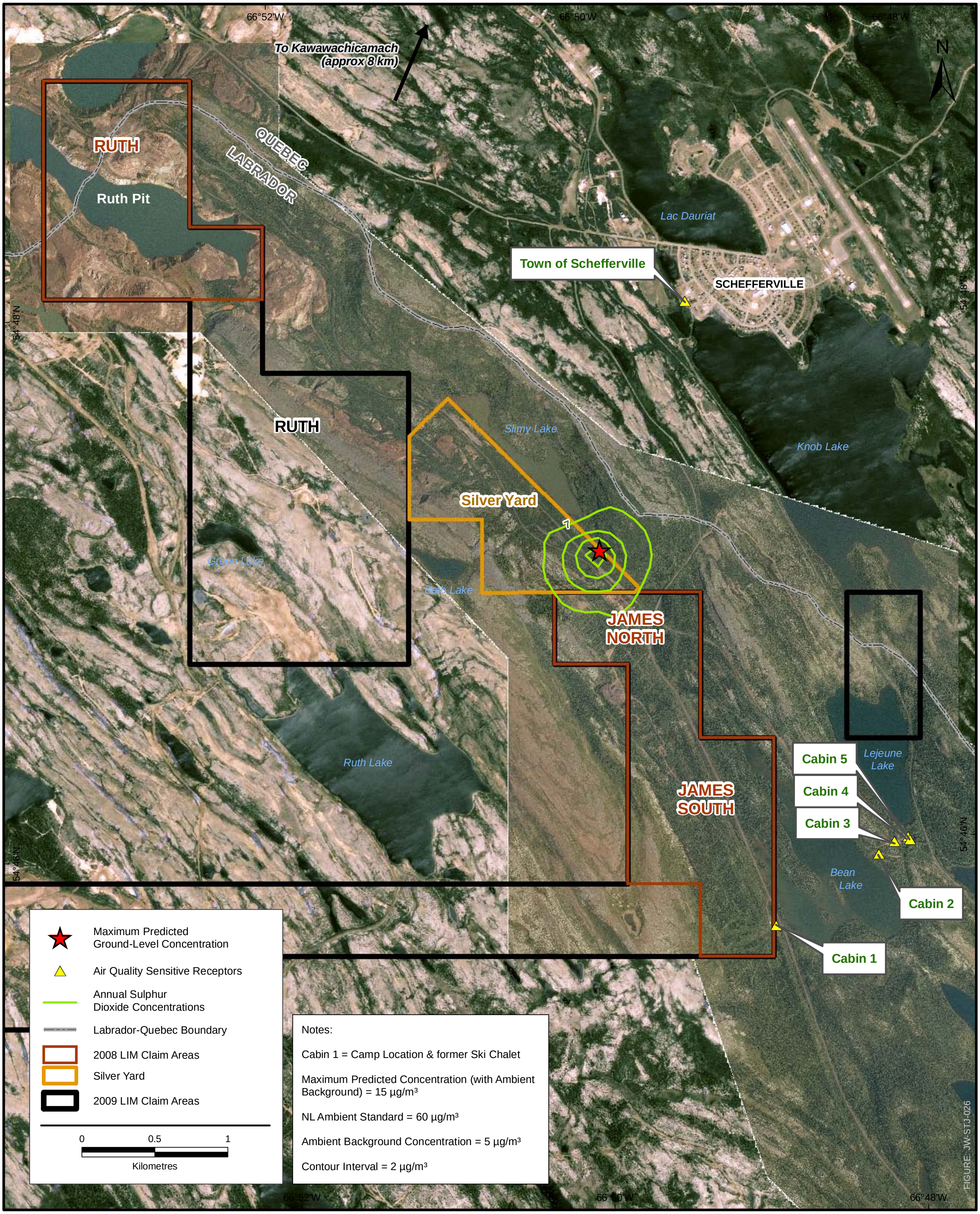
FIGURE NO:

E-3

Maximum Predicted 24-hr Sulphur Dioxide Ground-level Concentrations

DRAFT DATE:
08/12/2008

REVISION DATE:
12/8/2009



★ Maximum Predicted Ground-Level Concentration

△ Air Quality Sensitive Receptors

— Annual Sulphur Dioxide Concentrations

--- Labrador-Quebec Boundary

▭ 2008 LIM Claim Areas

▭ Silver Yard

▭ 2009 LIM Claim Areas

0 0.5 1

Kilometres

Notes:

Cabin 1 = Camp Location & former Ski Chalet

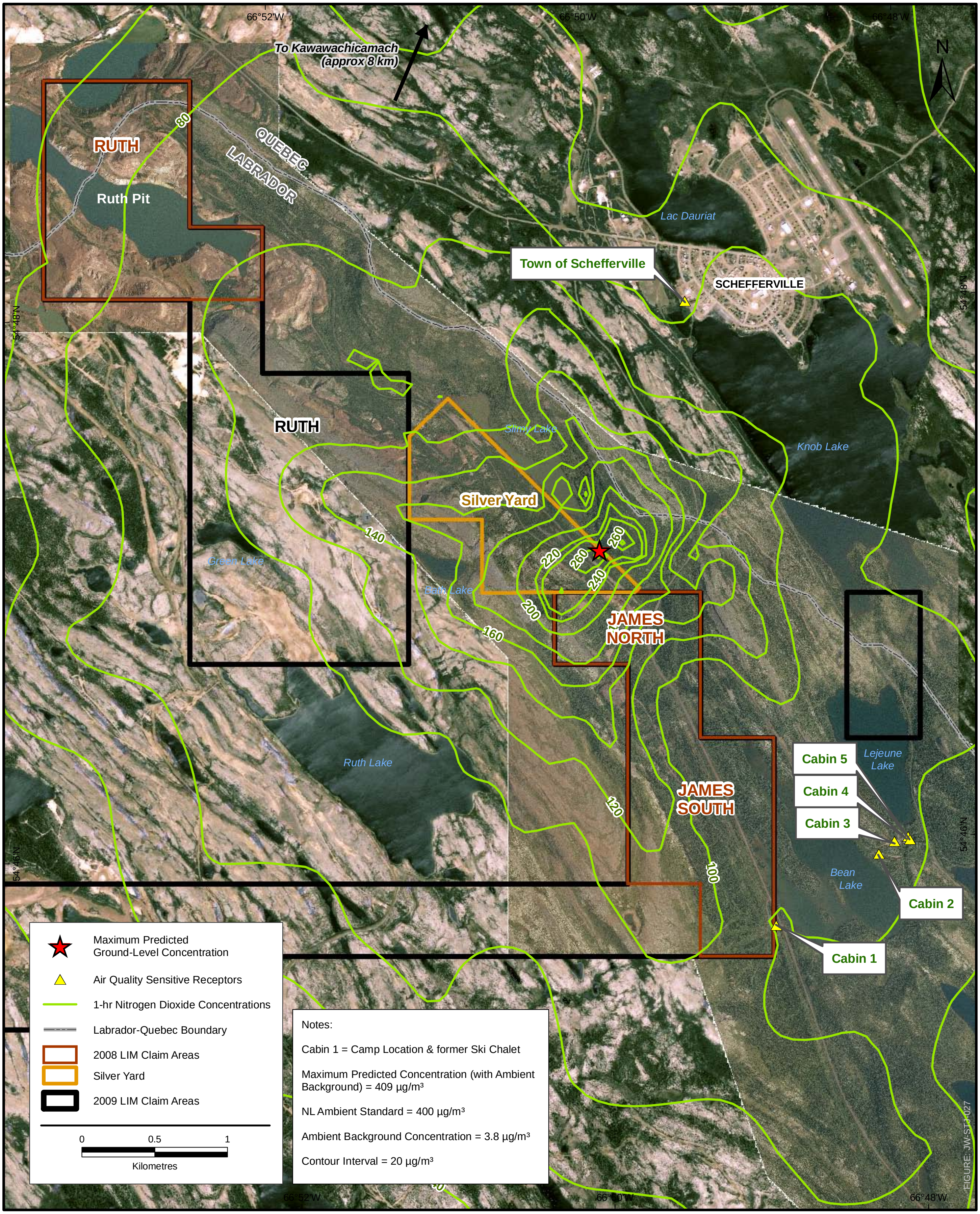
Maximum Predicted Concentration (with Ambient Background) = 15 µg/m³

NL Ambient Standard = 60 µg/m³

Ambient Background Concentration = 5 µg/m³

Contour Interval = 2 µg/m³

FIGURE NO:		DRAFT DATE:
E-4	**Maximum Predicted Annual Sulphur Dioxide Ground-level Concentrations**	08/12/2008
		REVISION DATE: 12/8/2009



Notes:

Cabin 1 = Camp Location & former Ski Chalet

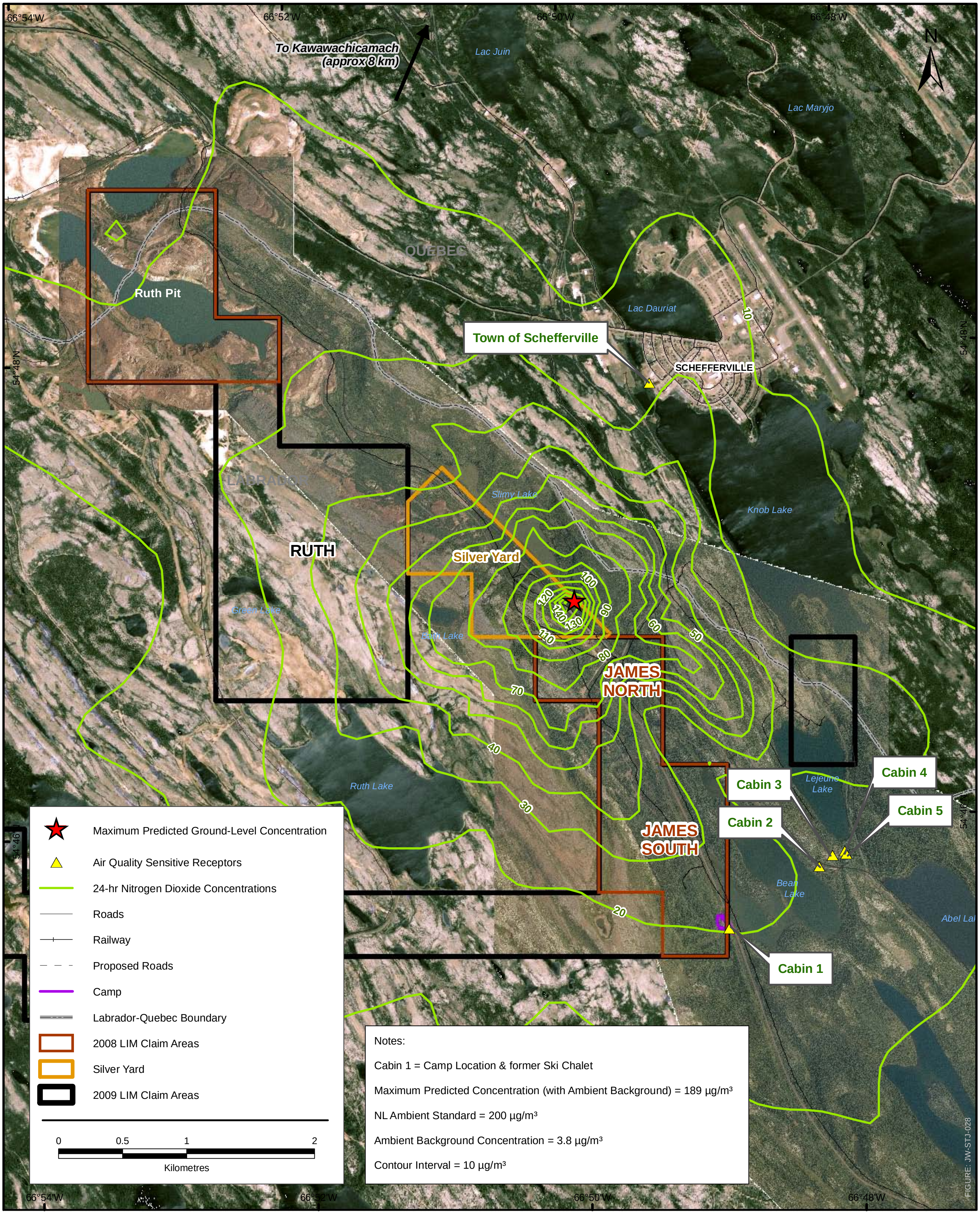
Maximum Predicted Concentration (with Ambient Background) = 409 µg/m³

NL Ambient Standard = 400 µg/m³

Ambient Background Concentration = 3.8 µg/m³

Contour Interval = 20 µg/m³

FIGURE NO: **E-5**	**Maximum Predicted 1-hr Nitrogen Dioxide Ground-level Concentrations**	DRAFT DATE: 08/12/2008 REVISION DATE: 12/8/2009



Notes:

Cabin 1 = Camp Location & former Ski Chalet

Maximum Predicted Concentration (with Ambient Background) = 189 µg/m³

NL Ambient Standard = 200 µg/m³

Ambient Background Concentration = 3.8 µg/m³

Contour Interval = 10 µg/m³

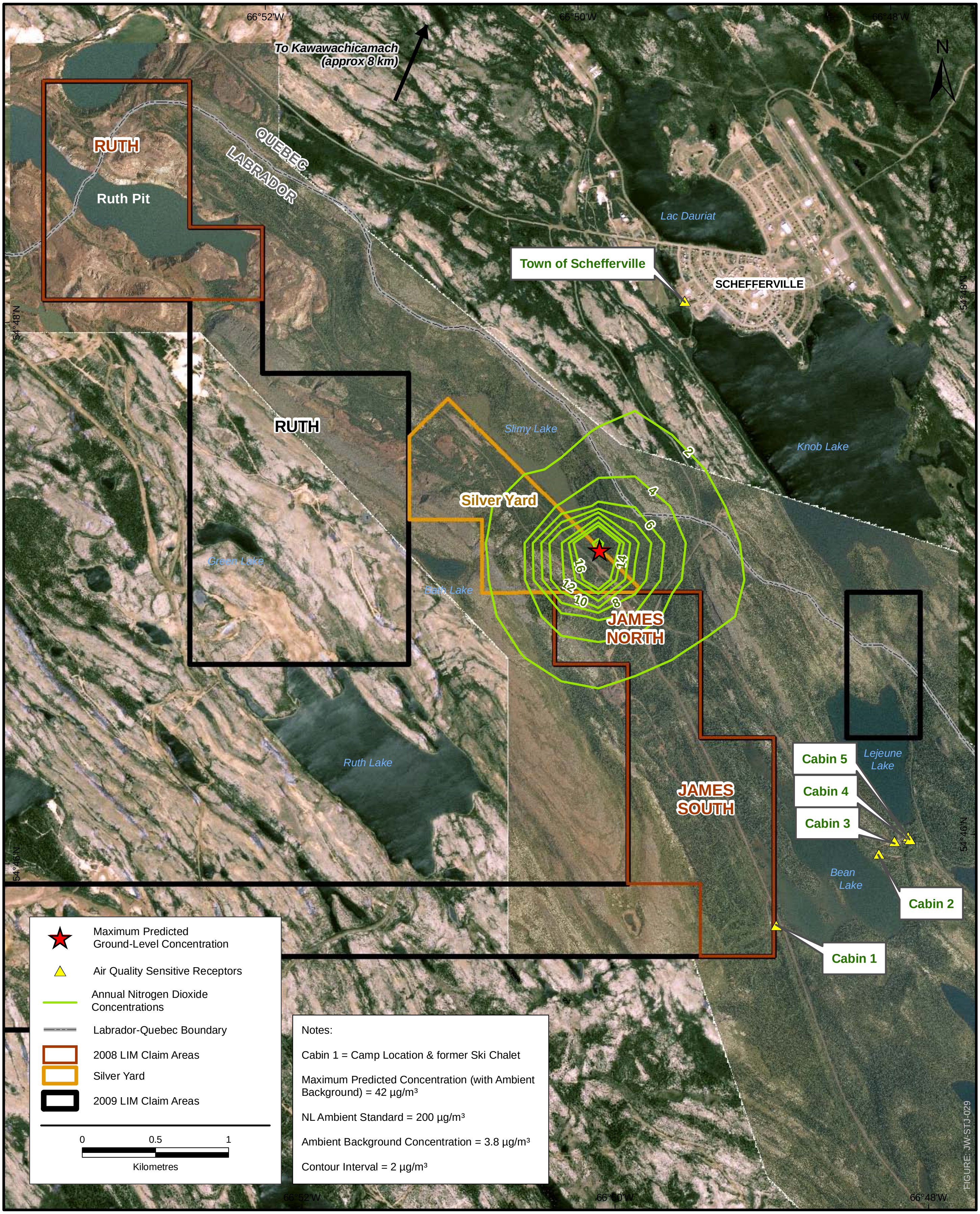
FIGURE NO:

E-6

Maximum Predicted 24-hr Nitrogen Dioxide Ground-level Concentrations

DRAFT DATE: 08/12/2008

REVISION DATE: 13/8/2009



Notes:

Cabin 1 = Camp Location & former Ski Chalet

Maximum Predicted Concentration (with Ambient Background) = 42 µg/m³

NL Ambient Standard = 200 µg/m³

Ambient Background Concentration = 3.8 µg/m³

Contour Interval = 2 µg/m³

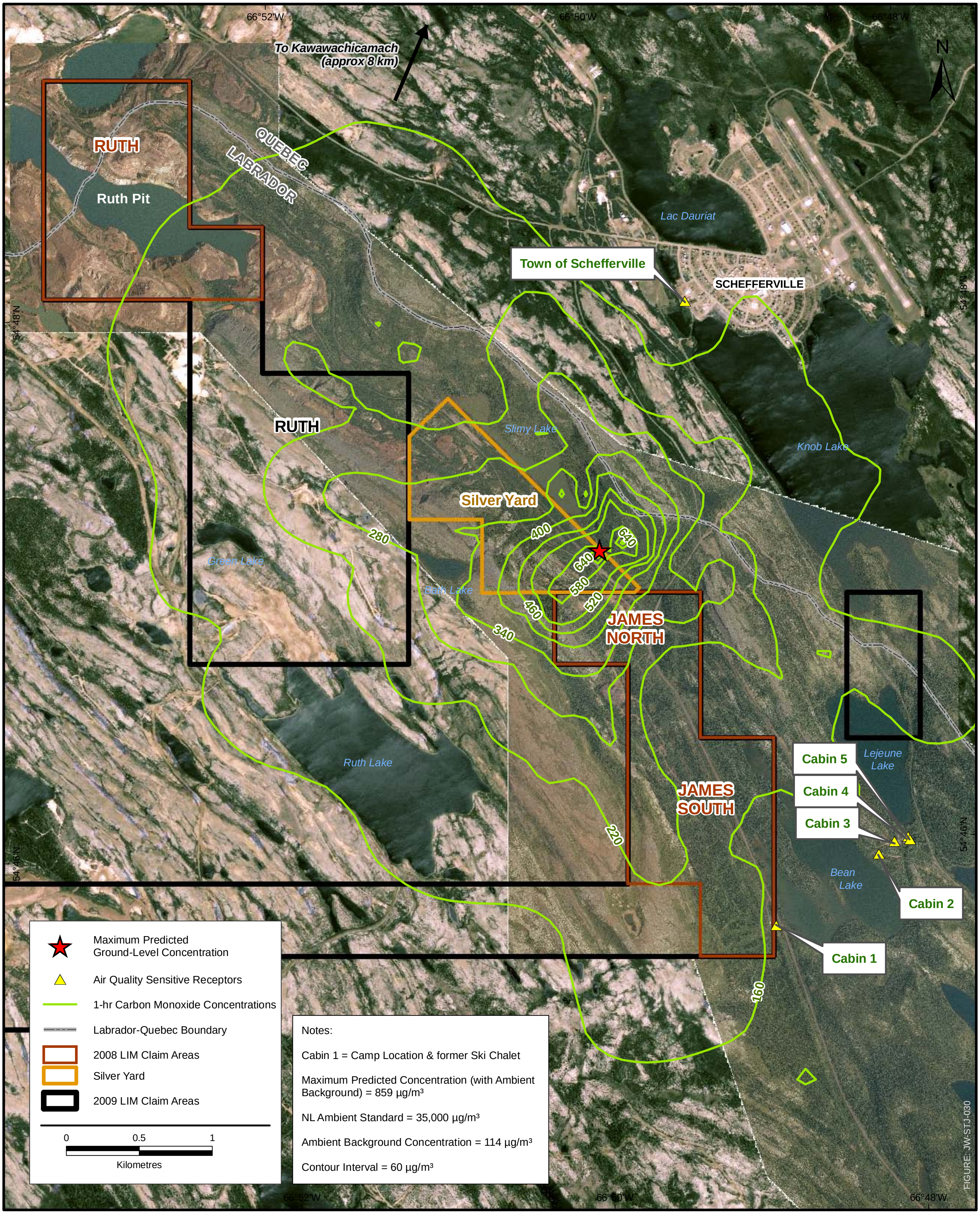
FIGURE NO:

E-7

Maximum Predicted Annual Nitrogen Dioxide Ground-level Concentrations

DRAFT DATE: 08/12/2008

REVISION DATE: 12/8/2009



Notes:

Cabin 1 = Camp Location & former Ski Chalet

Maximum Predicted Concentration (with Ambient Background) = 859 µg/m³

NL Ambient Standard = 35,000 µg/m³

Ambient Background Concentration = 114 µg/m³

Contour Interval = 60 µg/m³

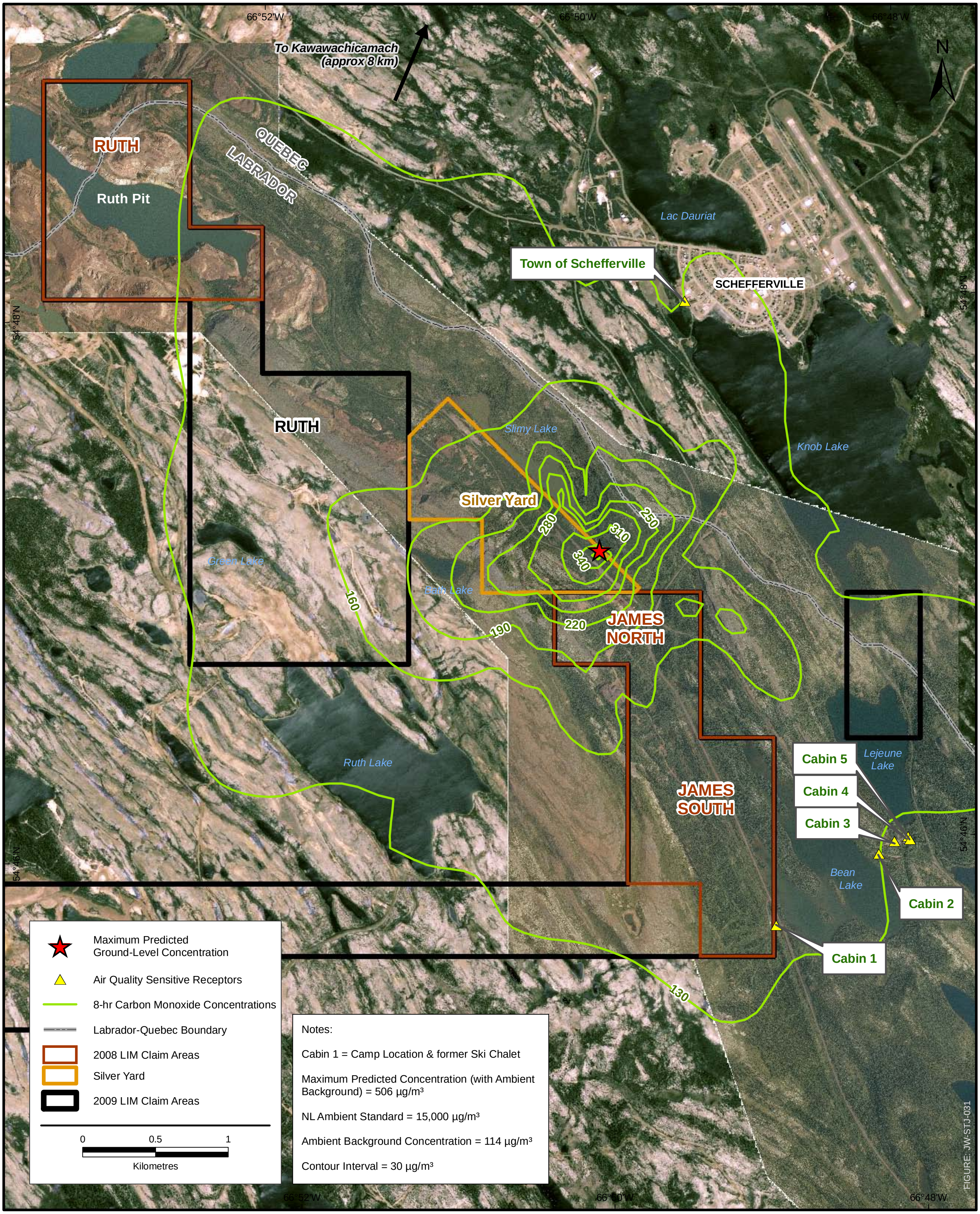
FIGURE NO:

E-8

Maximum Predicted 1-hr Carbon Monoxide Ground-level Concentrations

DRAFT DATE: 08/12/2008

REVISION DATE: 12/8/2009



Notes:

Cabin 1 = Camp Location & former Ski Chalet

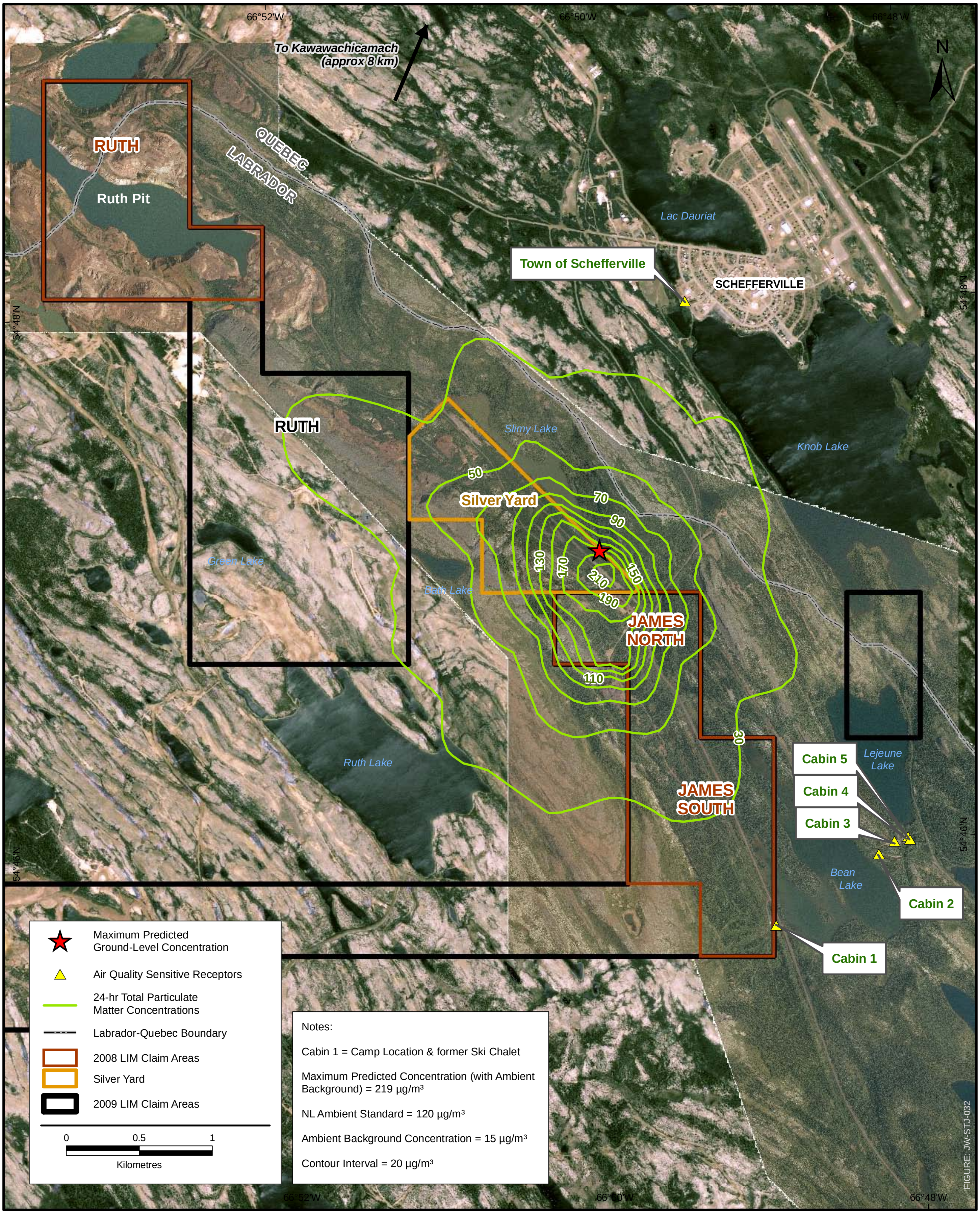
Maximum Predicted Concentration (with Ambient Background) = 506 µg/m³

NL Ambient Standard = 15,000 µg/m³

Ambient Background Concentration = 114 µg/m³

Contour Interval = 30 µg/m³

FIGURE NO:		DRAFT DATE:
E-9	**Maximum Predicted 8-hr Carbon Monoxide Ground-level Concentrations**	08/12/2008
		REVISION DATE:
		12/8/2009



Notes:

Cabin 1 = Camp Location & former Ski Chalet

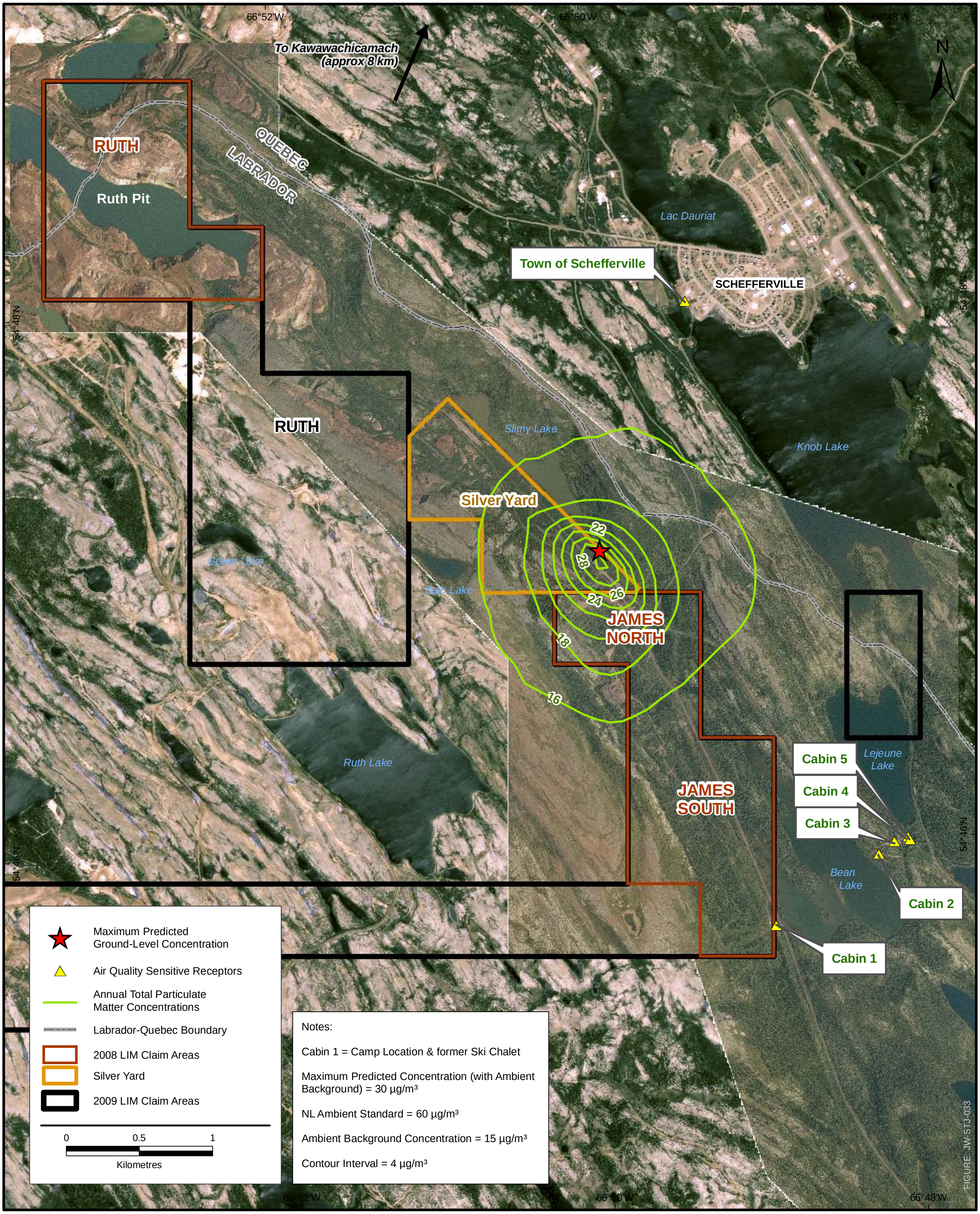
Maximum Predicted Concentration (with Ambient Background) = 219 µg/m³

NL Ambient Standard = 120 µg/m³

Ambient Background Concentration = 15 µg/m³

Contour Interval = 20 µg/m³

FIGURE NO: **E-10**	**Maximum Predicted 24-hr Total Particulate matter Ground-level Concentrations**	DRAFT DATE: 08/12/2008 REVISION DATE: 12/8/2009



Notes:

Cabin 1 = Camp Location & former Ski Chalet

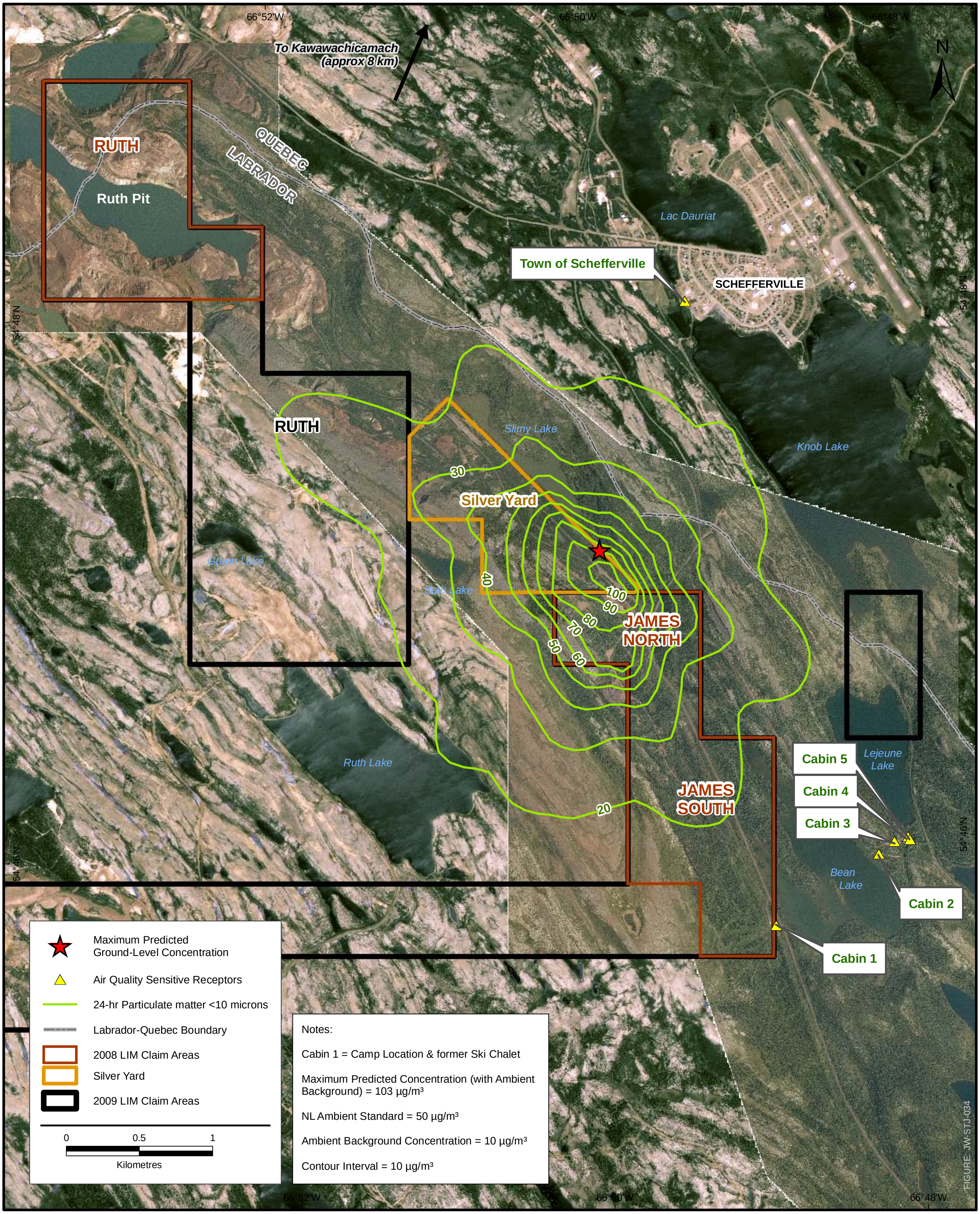
Maximum Predicted Concentration (with Ambient Background) = 30 µg/m³

NL Ambient Standard = 60 µg/m³

Ambient Background Concentration = 15 µg/m³

Contour Interval = 4 µg/m³

FIGURE NO: **E-11**	**Maximum Predicted Annual Total Particulate matter Ground-level Concentrations**	DRAFT DATE: 08/12/2008 REVISION DATE: 12/8/2009



Notes:

Cabin 1 = Camp Location & former Ski Chalet

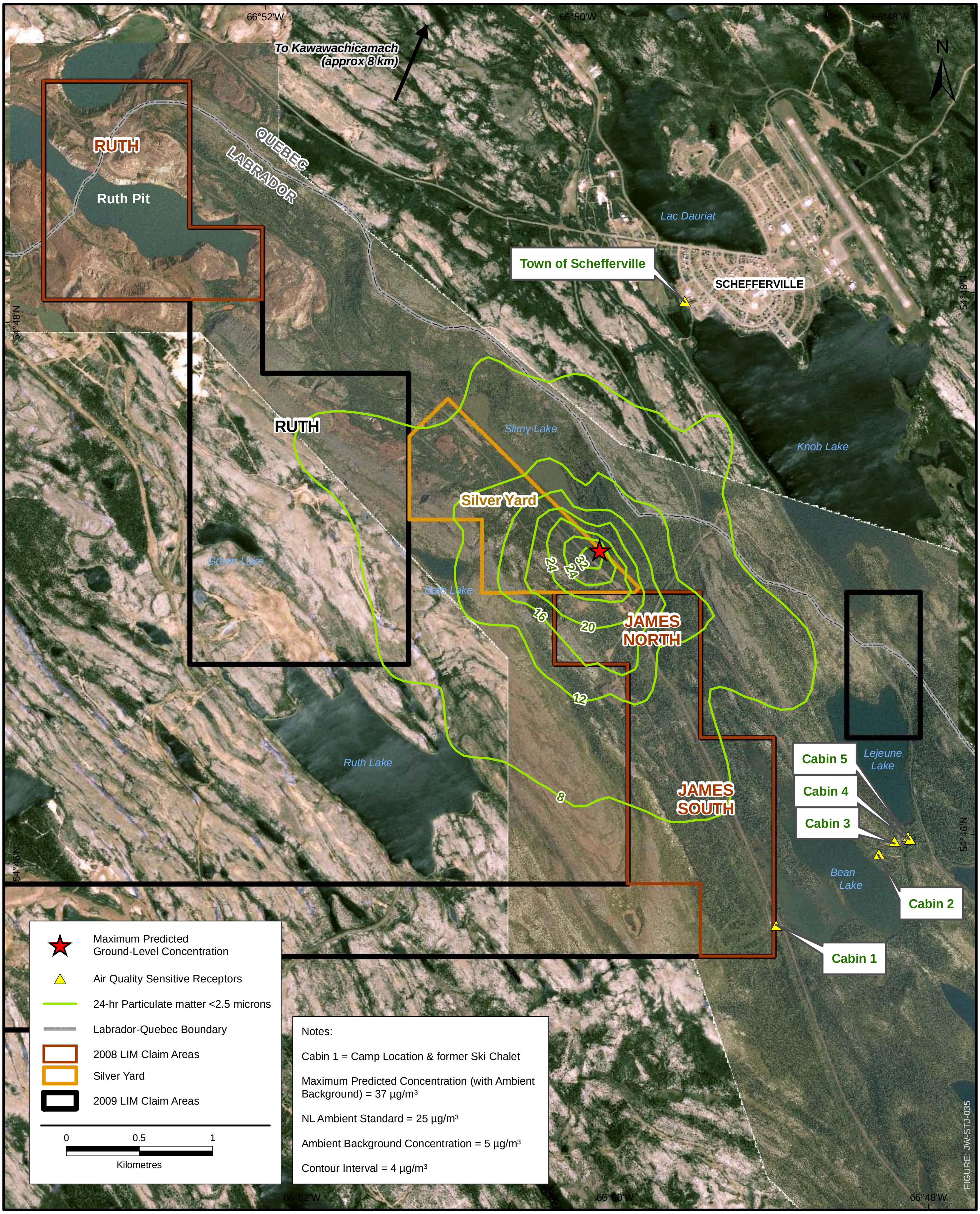
Maximum Predicted Concentration (with Ambient Background) = 103 µg/m³

NL Ambient Standard = 50 µg/m³

Ambient Background Concentration = 10 µg/m³

Contour Interval = 10 µg/m³

FIGURE NO:		DRAFT DATE:
E-12	**Maximum Predicted 24-hr Ground-level Concentrations Particulate matter less than 10 microns**	08/12/2008
		REVISION DATE: 12/8/2009



Notes:

Cabin 1 = Camp Location & former Ski Chalet

Maximum Predicted Concentration (with Ambient Background) = 37 µg/m³

NL Ambient Standard = 25 µg/m³

Ambient Background Concentration = 5 µg/m³

Contour Interval = 4 µg/m³

FIGURE NO:

E-13

Maximum Predicted 24-hr Ground-level Concentrations
Particulate matter less than 2.5 microns

DRAFT DATE: 08/12/2008

REVISION DATE: 12/8/2009

ATTACHMENT F

Maximum Predicted Concentrations at Sensitive Receptor Locations

Table F-1- Summary of Maximum Predicted Ground-Level Concentrations at Schefferville - (639939.60, 6074715.34)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with Background ($\mu g/m^3$)	Percent of Criteria (%)
NO_2	1 hr	400	3.8	75.9	80	20%
	24 hr	200	3.8	17.4	21	11%
	ann	100	3.8	0.7	5	5%
SO_2	1 hr	900	5	19.4	24	3%
	3 hr	600	5	14.1	19	3%
	24 hr	300	5	4.5	10	3%
	ann	60	5	0.2	5	9%
TSP	1 hr	-	15	40.0	55	n/a
	24 hr	120	15	8.7	24	20%
	ann	60	15	0.3	15	26%
PM_{10}	1 hr	-	10	25.6	36	n/a
	24 hr	50	10	5.4	15	31%
$PM_{2.5}$	1 hr	-	5	6.7	12	n/a
	24 hr	25	5	1.5	7	26%
CO	1 hr	35,000	114	33.2	147	0%
	8 hr	15,000	114	16.2	130	1%

Jacques Whitford

Table F-2- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 1- (640.569, 6070.471)

Air Contaminant	Averaging Period	Regulatory Standard (μg/m^3)	Estimated Background Concentration (μg/m^3)	Maximum Predicted Concentration (μg/m^3)	Predicted Concentration with Background (μg/m^3)	Percent of Criteria (%)
NO_2	1 hr	400	3.8	77.0	81	20%
	24 hr	200	3.8	20.9	25	12%
	ann	100	3.8	0.3	4	4%
SO_2	1 hr	900	5	19.7	25	3%
	3 hr	600	5	15.2	20	3%
	24 hr	300	5	5.5	10	3%
	ann	60	5	0.1	5	8%
TSP	1 hr	-	15	31.8	47	n/a
	24 hr	120	15	7.4	22	19%
	ann	60	15	0.1	15	25%
PM_{10}	1 hr	-	10	24.4	34	n/a
	24 hr	50	10	7.4	17	35%
$PM_{2.5}$	1 hr	-	5	6.7	12	n/a
	24 hr	25	5	1.7	7	27%
CO	1 hr	35,000	114	33.7	148	0%
	8 hr	15,000	114	16.1	130	1%

Jacques
Whitford

Table F-3- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 2 - (641.271, 6070.926)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with Background ($\mu g/m^3$)	Percent of Criteria (%)
NO_2	1 hr	400	3.8	85.0	89	22%
	24 hr	200	3.8	17.6	21	11%
	ann	100	3.8	0.4	4	4%
SO_2	1 hr	900	5	25.6	31	3%
	3 hr	600	5	21.0	26	4%
	24 hr	300	5	4.5	10	3%
	ann	60	5	0.1	5	9%
TSP	1 hr	-	15	27.6	43	n/a
	24 hr	120	15	6.9	22	18%
	ann	60	15	0.2	15	25%
PM_{10}	1 hr	-	10	18.7	29	n/a
	24 hr	50	10	6.9	17	34%
$PM_{2.5}$	1 hr	-	5	6.8	12	n/a
	24 hr	25	5	1.5	7	26%
CO	1 hr	35,000	114	43.7	158	0%
	8 hr	15,000	114	16.4	130	1%

Table F-4- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 3 - (641.376, 6071.014)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with Background ($\mu g/m^3$)	Percent of Criteria (%)
NO_2	1 hr	400	3.8	83.5	87	22%
	24 hr	200	3.8	16.1	20	10%
	ann	100	3.8	0.4	4	4%
SO_2	1 hr	900	5	23.8	29	3%
	3 hr	600	5	20.1	25	4%
	24 hr	300	5	4.2	9	3%
	ann	60	5	0.1	5	9%
TSP	1 hr	-	15	27.1	42	n/a
	24 hr	120	15	6.5	22	18%
	ann	60	15	0.2	15	25%
PM_{10}	1 hr	-	10	20.6	31	n/a
	24 hr	50	10	4.9	15	30%
$PM_{2.5}$	1 hr	-	5	6.4	11	n/a
	24 hr	25	5	1.5	6	26%
CO	1 hr	35,000	114	40.6	155	0%
	8 hr	15,000	114	15.3	129	1%

Table F-5- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 4 - (641.471, 6071.047)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with	Percent of Criteria (%)
NO_2	1 hr	400	3.8	82.3	86	22%
	24 hr	200	3.8	15.3	19	10%
	ann	100	3.8	0.4	4	4%
SO_2	1 hr	900	5	22.2	27	3%
	3 hr	600	5	19.0	24	4%
	24 hr	300	5	4.0	9	3%
	ann	60	5	0.1	5	9%
TSP	1 hr	-	15	24.0	39	n/a
	24 hr	120	15	6.0	21	17%
	ann	60	15	0.2	15	25%
PM_{10}	1 hr	-	10	18.3	28	n/a
	24 hr	50	10	4.5	15	29%
$PM_{2.5}$	1 hr	-	5	6.0	11	n/a
	24 hr	25	5	1.4	6	26%
CO	1 hr	35,000	114	37.9	152	0%
	8 hr	15,000	114	14.5	128	1%

Table F-6- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 5 - (641.484, 6071.026)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with	Percent of Criteria (%)
NO_2	1 hr	400	3.8	82.4	86	22%
	24 hr	200	3.8	15.3	19	10%
	ann	100	3.8	0.4	4	4%
SO_2	1 hr	900	5	22.3	27	3%
	3 hr	600	5	19.1	24	4%
	24 hr	300	5	4.0	9	3%
	ann	60	5	0.1	5	9%
TSP	1 hr	-	15	23.9	39	n/a
	24 hr	120	15	5.9	21	17%
	ann	60	15	0.2	15	25%
PM_{10}	1 hr	-	10	18.3	28	n/a
	24 hr	50	10	4.5	15	29%
$PM_{2.5}$	1 hr	-	5	6.0	11	n/a
	24 hr	25	5	1.4	6	26%
CO	1 hr	35,000	114	38.1	152	0%
	8 hr	15,000	114	14.3	128	1%

Table F-7- Summary of Maximum Predicted Ground-Level Concentrations at Cabin 6 - (642.233, 6068.097)

Air Contaminant	Averaging Period	Regulatory Standard (μg/m^3)	Estimated Background Concentration (μg/m^3)	Maximum Predicted Concentration (μg/m^3)	Predicted Concentration with Background (μg/m^3)	Percent of Criteria (%)
NO_2	1 hr	400	3.8	37.4	41	10%
	24 hr	200	3.8	6.6	10	5%
	ann	100	3.8	0.1	4	4%
SO_2	1 hr	900	5	9.6	15	2%
	3 hr	600	5	6.4	11	2%
	24 hr	300	5	1.8	7	2%
	ann	60	5	0.03	5	8%
TSP	1 hr	-	15	11.9	27	n/a
	24 hr	120	15	2.0	17	14%
	ann	60	15	0.04	15	25%
PM_{10}	1 hr	-	10	8.9	19	n/a
	24 hr	50	10	1.6	12	23%
$PM_{2.5}$	1 hr	-	5	3.0	8	n/a
	24 hr	25	5	0.5	6	22%
CO	1 hr	35,000	114	16.4	130	0%
	8 hr	15,000	114	6.7	121	1%

Table F-8- Summary of Maximum Predicted Ground-Level Concentrations at Recreational Camp - (642.789, 6068.313)

Air Contaminant	Averaging Period	Regulatory Standard ($\mu g/m^3$)	Estimated Background Concentration ($\mu g/m^3$)	Maximum Predicted Concentration ($\mu g/m^3$)	Predicted Concentration with Background ($\mu g/m^3$)	Percent of Criteria (%)
NO_2	1 hr	400	3.8	26.7	30	8%
	24 hr	200	3.8	6.0	10	5%
	ann	100	3.8	0.1	4	4%
SO_2	1 hr	900	5	7.0	12	1%
	3 hr	600	5	5.8	11	2%
	24 hr	300	5	1.6	7	2%
	ann	60	5	0.03	5	8%
TSP	1 hr	-	15	9.0	24	n/a
	24 hr	120	15	1.7	17	14%
	ann	60	15	0.04	15	25%
PM_{10}	1 hr	-	10	7.0	17	n/a
	24 hr	50	10	1.4	11	23%
$PM_{2.5}$	1 hr	-	5	2.2	7	n/a
	24 hr	25	5	0.5	5	22%
CO	1 hr	35,000	114	11.7	126	0%
	8 hr	15,000	114	4.6	119	1%

APPENDIX I

Water Quality (Groundwater and Surface Water)

Table 1
Water Analytical Results - Inorganics
Redmond Property, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	**Units**	**CWQG FWAL**	**GCDWQ**	**RDL+**	**RP1**			**RP2**					**RP3**				**RP4**						**RP5**	
Sampling Date					4/1/2008	6/6/2008	9/16/2008	4/24/2007	9/23/2007	4/1/2008	6/6/2008	9/13/2008	4/24/2007	9/23/2007	6/6/2008	9/13/2008	9/15/2008	4/24/2007	9/23/2007	4/1/2008	4/1/2008	6/6/2008	3/31/2008	9/15/2008
INORGANICS																								
Total Alkalinity (Total as CaCO3)	mg/L	NG	NG	5	38	39	39	ND	ND	<10	<10	<10	87	15	87	84	87	180	63	120	110	73	71	94
Dissolved Chloride (Cl)	mg/L	NG	NG	1	3	2	<2	ND	ND	<2	<2	<2	1	ND	<2	<2	<2	ND	ND	<2	<2	<2	<2	<2
Colour	TCU	NG	≤15*	5	<1	2	1	ND	ND	<1	6	5	**39**	**15**	2	11	6	ND	7	**28**	**30**	5	1	7
Total Dissolved Solids	mg/L	NG	NG	10	60	70	110	12	NA	<20	<20	50	340	NA	110	130	130	190	NA	100	100	90	70	140
Hardness (CaCO3)	mg/L	NG	NG	1	67	55	50	3	8	18	9	9	120	50	102	95	100	180	72	137	123	85	110	106
Nitrate + Nitrite	mg/L	NG	NG	0.05	0.5	0.4	0.3	0.17	0.09	0.4	0.3	0.3	0.07	ND	0.3	0.2	0.2	ND	0.15	<0.2	<0.2	0.2	0.4	0.3
Nitrite (N)	mg/L	0.06	NG	0.01	<0.1	<0.1	0.3	ND	0.34	<0.1	<0.1	<0.1	ND	ND	<0.1	<0.1	<0.1	ND		<0.1	<0.1	<0.1	<0.1	<0.1
Nitrogen (Ammonia Nitrogen)	mg/L	NG	NG	0.05	<0.05	<0.05	0.08	ND	0.07	0.05	<0.05	0.09	0.6	ND	<0.05	0.14	0.10	0.09	0.07	0.12	0.12	<0.05	<0.05	0.13
Dissolved Organic Carbon (C)	mg/L	NG	NG	0.5	<1	<1	<1	0.6	0.5	<1	<1	<1	6.5	4.3	<1	<1	2	1.2	1.3	1	<1	1	<1	<1
Total Organic Carbon (C)	mg/L	NG	NG	0.5	NA	3	<1	0.8	0.8	NA	1	<1	10	3.7	19	2	2	3.7	1.2	NA	NA	17	NA	<1
Orthophosphate (P)	mg/L	NG	NG	0.01	<0.003	0.003	<0.003	ND	ND	<0.003	<0.003	<0.003	ND	ND	0.004	0.003	<0.003	ND	ND	<0.003	<0.003	0.003	0.004	0.003
pH	pH	6.5 - 9	6.5 - 8.5	N/A	7.92	7.84	7.89	**6.46**	6.51	6.87	6.9	6.93	7.52	7.23	8.09	8.04	8.17	7.57	7.79	7.68	7.7	8.04	8.09	8.03
Reactive Silica (SiO2)	mg/L	NG	NG	0.5	3.9	3.8	3.1	0.8	1.7	2.2	1.8	1.8	4	0.7	6.3	5.2	4.6	19	3.3	14	11.9	4	6.4	6.5
Dissolved Sulphate (SO4)	mg/L	NG	NG	2	9	9	9	ND	3	5	4	3	42	30	10	4	4	2	3	3	3	4	7	10
Turbidity	NTU	NG	NG	0.1	0.17	0.75	0.34	2.4	1.8	0.35	2.2	1.7	3.9	0.6	0.31	0.57	0.42	21	0.2	4.7	5.4	0.21	0.17	1.2
Conductivity	uS/cm	NG	NG	1	111	99.6	98	11	18	21.6	16.5	15.2	260	96	185	159	167	320	120	207	208	147	151	196
Bromide	mg/L	NG	NG	0.1	<0.1	<0.1	0.08	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoride	mg/L	NG	1.5	0.1	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1	<0.1
RCAP CALCULATIONS																								
Nitrate (N)	mg/L	NG	45	N/A	0.5	0.4	0.03	NC	NA	0.4	0.3	0.3	8.16	NA	0.3	0.2	0.2	7.71	NA	<0.1	<0.1	0.2	0.4	0.3
Anion Sum	me/L	NG	NG	N/A	0.9	0.9	0.9	0.01	0.09	0.1	0.1	<0.1	2.64	0.92	1.7	1.5	1.5	3.63	1.34	2	1.9	1.3	1.4	1.8
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	38	39	39	ND	ND	<10	<10	<10	87	15	86	83	86	179	63	119	109	72	70	93
Calculated TDS	mg/L	NG	≤500*	1	50	55	51	3	9	13	8	8	145	57	96	86	89	191	69	120	109	76	88	102
Carb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	<10	<10	<10	ND	ND	<10	<10	<10	ND	ND	<10	<10	<10	ND	ND	<10	<10	<10	<10	<10
Cation - Anion Balance	%	NG	NG	N/A	19.5	Low EC	Low EC	NA	NA	Low EC	Low EC	Low EC	NA	NA	10.2	12.2	13.0	NA	NA	14.8	13.6	12.9	24.2	9.4
Cation Sum	me/L	NG	NG	N/A	1.4	1.2	1.0	0.08	0.17	0.4	0.2	0.2	2.62	1.04	2.1	1.9	2.0	3.67	1.46	2.7	2.5	1.7	2.2	2.2
Conductivity % Difference	%	NG	NG	N/A	6.9	5.4	-2.1	NA	NA	30	5.6	12.1	NA	NA	-4.5	0.2	-0.4	NA	NA	5.3	-4.5	-3.2	12.8	-5.2
Computed Conductivity	uS/cm	NG	NG	N/A	119	105	95.9	NA	NA	29.2	17.4	17.2	NA	NA	177	159	166	NA	NA	218	199	142	172	186
Ion Balance (% Difference)	%	NG	NG	N/A	148	Low EC	Low EC	77.8	30.8	Low EC	Low EC	Low EC	0.38	6.12	123	128	130	0.55	4.29	135	132	130	164	121
Langelier Index (@ 20C)	N/A	NG	NG	N/A	-0.7	-0.9	-0.8	NC	NC	-6.2	-6.5	-6.5	-0.393	-1.89	0	-0.1	0.0	0.107	-0.58	-0.1	-0.2	-0.2	0	0.0
Langelier Index (@ 4C)	N/A	NG	NG	N/A	NA	NA	NA	NC	NC	NA	NA	NA	-0.644	-2.15	NA	NA	NA	-0.143	-0.832	NA	NA	NA	NA	NA
Saturation pH (@ 20C)	N/A	NG	NG	N/A	8.59	8.69	8.74	NC	NC	13	13.4	13.4	7.91	9.12	8.13	8.15	8.13	7.46	8.37	7.82	7.91	8.23	8.1	8.08
Saturation pH (@ 4C)	N/A	NG	NG	N/A	NA	NA	NA	NC	NC	NA	NA	NA	8.16	9.38	NA	NA	NA	7.71	8.62	NA	NA	NA	NA	NA

All results expressed as indicated

RDL+ - Analytical Reportable Detection Limit

CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)

GCDWQ = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334	Exceeds CWQG FWAL Standards
334	Exceeds GCDWQ Standards

ND = Not detected
NC = Non-calculable
NG = No Guideline
NA = Not Analysed
N/A = Not Applicable

Table 2
Surface Water Analytical Results - Metals
Redmond Property, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	Units	Criteria 1	Criteria 2	RDL+	RP1			RP2					RP3				RP4						RP5	
Sampling Date		CWQG FWAL	GCDWQ		1-Apr-08	6-Jun-08	15-Sep-08	24-Apr-07	23-Sep-07	1-Apr-08	6-Jun-08	13-Sep-08	24-Apr-07	23-Sep-07	6-Jun-08	13-Sep-08	24-Apr-07	23-Sep-07	1-Apr-08	1-Apr-08	6-Jun-08	15-Sep-08	31-Mar-08	15-Sep-08
Total Metals																								
Total Aluminum (Al)	ug/L	5-100	100	10	<10	70	<10	32	NA	<10	20	20	42	NA	<10	<10	16	NA	<10	<10	<10	<10	50	0.02
Total Antimony (Sb)	ug/L	NG	6**	2	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	ND	NA	<5	<5	<5	<5	<5	<5
Total Arsenic (As)	ug/L	5	10	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L	NG	1000	5	<10	<10	<10	ND	NA	<10	<10	<10	11	NA	<10	<10	ND	NA	<10	<10	<10	<10	<10	<10
Total Beryllium (Be)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Bismuth (Bi)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Boron (B)	ug/L	NG	5000**	5	<50	<50	<50	ND	NA	<50	<50	<50	ND	NA	<50	<50	ND	NA	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	0.017	5	0.3	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L	NG	NG	100	14600	11000	9800	1200	1600	4100	2000	2300	33000	10000	19400	18700	47000	14000	29200	26000	17700	19000	25100	20300
Total Chromium (Cr)	ug/L	NG	50	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Cobalt (Co)	ug/L	NG	NG	1	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	2-4	≤1000*	2	<1	<1	<1	ND	ND	<1	<1	<1	ND	ND	<1	<1	ND	ND	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	≤300*	50	<50	180	<50	ND	30	<50	140	<50	**3300**	100	120	320	**5800**	70	**2290**	**1720**	120	120	<50	240
Total Lead (Pb)	ug/L	1-7	10	0.5	<1	<1	<1	ND	NA	<1		<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Magnesium (Mg)	ug/L	NG	NG	100	7300	6700	6100	600	900	1800	900	900	16000	5900	12900	11700	23000	8700	15600	14100	9.9	12800	11400	13500
Total Manganese (Mn)	ug/L	NG	≤50	2	3	13	12	10	ND	5	7	3	**780**	10	42	74	**160**	ND	**91**	**81**	14	3	**57**	**111**
Total Mercury (Hg)	ug/L	NG	1	0.01	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Molybdenum (Mo)	ug/L	73	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25-150	NG	2	<2	<2	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	ND	NA	<2	<2	<2	<2	<2	<2
Total Phosphorus (P)	ug/L	NG	NG	100	<50	<30	<50	ND	NA	<50	<30	<50	ND	NA	<30	<50	ND	NA	<50	<50	<30	<50	<50	<50
Total Potassium (K)	ug/L	NG	NG	100	<1000	<1000	<1000	200	100	<1000	<1000	<1000	900	300	<1000	<1000	1100	300	<1000	<1000	<1	<1000	<1000	<1000
Total Selenium (Se)	ug/L	1	10	2	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	ND	NA	<5	<5	<5	<5	<5	<5
Total Silicon (Si)	ug/L	NG	NG	100	1800	1800	1500	NA	NA	1200	1000	900	NA	NA	2500	2400	NA	NA	6200	5700	1600	2200	3000	3100
Total Silver (Ag)	ug/L	NG	NG	0.5	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Sodium (Na)	ug/L	NG	≤200000*	100	1400	1200	1200	300	100	<500	<500	<500	600	500	600	<500	800	400	<500	<500	<500	<500	600	600
Total Strontium (Sr)	ug/L	NG	NG	5	9	9	7	ND	NA	5	3	3	19	NA	12	9	12	NA	18	12	9	9	13	11
Total Thallium (Tl)	ug/L	0.8	NG	0.1	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	ND	NA	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total Tin (Sn)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Titanium (Ti)	ug/L	NG	NG	2	<2	3	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	ND	NA	<2	<2	<2	<2	<2	<2
Tungsten (W)-Total	ug/L	NG	NG	10	<10	<10	<10	NA	NA	<10	<10	<10	NA	NA	<10	<10	NA	NA	<10	<10	<10	<10	<10	<10
Total Uranium (U)	ug/L	NG	20**	0.1	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	0.4	NA	<5	<5	<5	<5	<5	<5
Total Vanadium (V)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	30	≤5000*	5	26	<3	<3	29	ND	20	<3	5	11	ND	3	<3	16	ND	28	5	3	<3	**153**	7
Zirconium (Zr)-Total	ug/L	NG	NG	4	<4	<4	<0.004	NA	NA	<4	<4	<0.004	NA	NA	<4	<0.004	NA	NA	<4	<4	<4	<4	<4	<4
Dissolved Metals																								
Dissolved Aluminum (Al)	ug/L	NG	NG	10	<10	<10	<10	ND	NA	<10	<10	<10	20	NA	<10	<10	ND	NA	<10	<10	<10	<10	<10	<10
Dissolved Antimony (Sb)	ug/L	NG	NG	2	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	ND	NA	<5	<5	<5	<5	<5	<5
Dissolved Arsenic (As)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Barium (Ba)	ug/L	NG	NG	5	<10	<10	<10	ND	NA	<10	<10	<10	10	NA	<10	<10	ND	NA	<10	<10	<10	<10	<10	<10
Dissolved Beryllium (Be)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Bismuth (Bi)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Boron (B)	ug/L	NG	NG	5	<50	<50	<50	ND	NA	<50	<50	<50	ND	NA	<50	<50	ND	NA	<50	<50	<50	<50	<50	<50
Dissolved Cadmium (Cd)	ug/L	NG	NG	0.3	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L	NG	NG	500	11200	10200	10400	NA	NA	2100	1600	1500	NA	NA	20500	18100	NA	NA	26300	25000	16700	19300	16000	20600
Dissolved Chromium (Cr)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Cobalt (Co)	ug/L	NG	NG	1	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Iron (Fe)	ug/L	NG	NG	50	<50	<50	<50	ND	NA	<50	<50	<50	**1800**	NA	<50	<50	220	NA	<50	<50	<50	<50	<50	<50
Dissolved Lead (Pb)	ug/L	NG	NG	0.5	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Magnesium (Mg)	ug/L	NG	NG	500	7200	6300	6100	NA	NA	120	900	1000	NA	NA	13000	10700	NA	NA	15000	14100	10100	11200	10700	12100
Dissolved Manganese (Mn)	ug/L	NG	NG	2	<1	6	<1	8	NA	2	6	<1	680	NA	42	60	120	NA	84	76	0.01	2	6	108
Mercury Dissolved (Hg)	ug/L	NG	NG	0.1	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Molybdenum (Mo)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Nickel (Ni)	ug/L	NG	NG	2	<2	<2	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	ND	NA	<2	<2	<2	<2	<2	<2
Dissolved Phosphorus (P)	ug/L	NG	NG	50	<50	<50	<50	NA	NA	<50	<50	<50	NA	NA	<50	<50	NA	NA	<50	<50	<50	<50	<50	<50
Dissolved Potassium (K)	ug/L	NG	NG	1000	<1000	<1000	<1000	NA	NA	<1000	<1000	<1000	NA	NA	<1000	<1000	NA	NA	<1000	<1000	<1000	<1000	<1000	<1000
Dissolved Selenium (Se)	ug/L	NG	NG	2	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	ND	NA	<5	<5	<5	<5	<5	<5
Dissolved Silicon (Si)	ug/L	NG	NG	100	1800	1800	1600	NA	NA	1000	800	800	NA	NA	2900	2800	NA	NA	6500	5500	1900	2400	3000	3400
Dissolved Silver (Ag)	ug/L	NG	NG	0.5	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	NG	NG	500	1300	1100	1200	NA	NA	<500	<500	<500	NA	NA	600	<500	NA	NA	<500	<500	<500	<500	500	600
Dissolved Strontium (Sr)	ug/L	NG	NG	5	7	7	7	ND	NA	3	3	3	18	NA	0.011	9	11	NA	12	11	9	9	7	11
Dissolved Thallium (Tl)	ug/L	NG	NG	0.1	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	ND	NA	<0.3	<0.0003	<0.0003	<0.3	<0.3	<0.3
Dissolved Tin (Sn)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	<1	<1	<1	<1	<1	<1
Dissolved Titanium (Ti)	ug/L	NG	NG	2	<2	<2	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	ND	NA	<2	<2	<2	<2	<2	<2
Dissolved Tungsten (W)	ug/L	NG	NG	10	<10	<10	<10	NA	NA	<10	<10	<10	NA	NA	<10	<10	NA	NA	<10	<10	<10	<10	<10	<10
Dissolved Uranium (U)	ug/L	NG	NG	0.1	<5	<5	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	0.4	NA	<5	<5	<5	<5	<5	<5
Dissolved Vanadium (V)	ug/L	NG	NG	2	<1	<1	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	ND	NA	3	<1	<1	<1	1	<1
Dissolved Zinc (Zn)	ug/L	NG	NG	5	<6	6	<3	20	NA	3	7	<3	ND	NA	5	<3	5	NA	<3	<3	3	4	<3	3
Dissolved Zirconium (Zr)		NG	NG	4	<4	<4	<4	NA	NA	<4	<4	<4	NA	NA	<4	<4	NA	NA	<4	<4	<4	<4	<4	<4

All results expressed as indicated

RDL+ - Analytical Reportable Detection Limit

CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)

GCDWQ = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334	Exceeds CCME FWAL Standards
334	Exceeds GCDWQ Standards
ND = Not detected	N/A = Not Applicable
NA = Not Analyzed	
NG = No Guidelines	
* Aesthetic Objective	** Interim Maximum Acceptable Concentration

Table 3
Water Analytical Results - Inorganics
James Property, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	Units	CCME FWAL	CCME DW	RDL+	JP1			JP2			JP3		JP4					JP5				JP6	
Sampling Date					*4/26/2007*	*9/23/2007*	*9/13/2008*	*4/26/2007*	*9/23/2007*	*9/13/2008*	*4/26/2007*	*9/13/2008*	*4/26/2007*	*9/23/2007*	*3/31/2008*	*6/9/2008*	*9/13/2008*	*4/26/2007*	*9/23/2007*	*3/31/2008*	9/14/2008	*6/9/2008*	*9/13/2008*
INORGANICS																							
Total Alkalinity (Total as CaCO3)	mg/L	NG	NG	5	76	71	73	73	74	74	81	23	10	11	14	<10	10	69	75	<10	70	13	22
Dissolved Chloride (Cl)	mg/L	NG	NG	1	1	ND	<2	1	ND	<2	1	<2	ND	ND	<2	<2	<2	ND	ND	<2	<2	<2	<2
Colour	TCU	NG	≤15*	5	ND	ND	5	ND	ND	4	ND	6	ND	ND	<1	<1	4	ND	ND	1	4	2	<1
Total Dissolved Solids	mg/L	NG	NG	10	88	NA	420	90	NA	80	89	90	39	NA	<20	<20	<20	91	NA	70	120	30	30
Hardness (CaCO3)	mg/L	NG	NG	1	77	81	83	75	89	88	87	31	14	12	23	11	13	78	86	110	73	19	28
Nitrate + Nitrite	mg/L	NG	NG	0.05	0.27	0.09	0.2	0.24	0.27	0.2	0.24	<0.2	0.24	0.24	0.2	0.3	0.2	0.33	0.27	0.4	0.2	0.2	0.2
Nitrite (N)	mg/L	0.06	NG	0.01	ND	NA	<0.1	ND	NA	<0.1	ND	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1
Nitrogen (Ammonia Nitrogen)	mg/L	NG	NG	0.05	ND	0.06	0.06	ND	0.07	0.07	ND	0.05	ND	0.06	<0.05	<0.05	0.06	ND	0.07	<0.05	0.09	0.06	<0.05
Dissolved Organic Carbon (C)	mg/L	NG	NG	0.5	ND	ND	<1	ND	ND	2	0.6	<1	0.7	ND	<1	<1	1	ND	ND	<1	<1	<1	1
Total Organic Carbon (C)	mg/L	NG	NG	0.5	ND	0.5	<1	0.5	ND	3	0.5	<1	ND	ND	NA	<1	<1	0.9	ND	NA	<1	NA	<1
Orthophosphate (P)	mg/L	NG	NG	0.01	ND	ND	0.003	ND	ND	0.003	ND	<0.003	ND	ND	<0.003	0.003	<0.003	ND	ND	0.004	<0.003	<0.003	0.004
pH	pH	6.5 - 9	6.5 - 8.5	N/A	7.98	7.9	8.11	8.17	7.93	8.13	8.44	7.47	7.09	6.81	7.22	6.91	6.97	7.99	7.88	8.09	7.98	7.54	7.12
Reactive Silica (SiO2)	mg/L	NG	NG	0.5	5.9	4.7	6.8	5.4	5.4	7.1	5.6	5.9	4.9	4.2	5.1	4.1	5.9	5.4	5.3	6.4	6.5	3.9	6.4
Dissolved Sulphate (SO4)	mg/L	NG	NG	2	6	5	7	6	6	7	6	2	ND	ND	<2	2	<2	6	6	7	7	2	4
Turbidity	NTU	NG	NG	0.1	0.3	0.5	0.49	0.2	0.7	0.46	ND	0.31	ND	0.2	0.12	0.14	0.14	0.4	1.2	0.17	0.72	0.12	0.10
Conductivity	uS/cm	NG	NG	1	160	140	146	150	150	144	170	42.4	29	23	25.2	23	23.9	160	150	151	141	36.5	48.5
Bromide	mg/L	NG	NG	0.1	NA	NA	<0.1	NA	NA	<0.1	NA	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1
Fluoride	mg/L	NG	1.5	0.1	NA	NA	<0.1	NA	NA	<0.1	NA	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1
RCAP CALCULATIONS																							
Nitrate (N)	mg/L	NG	45	N/A	0.27	NA	0.2	0.24	NA	0.2	0.24	0.1	0.24	NA	0.2	0.3	0.2	0.33	NA	0.4	0.2	0.2	0.2
Anion Sum	me/L	NG	NG	N/A	1.7	1.54	1.4	1.63	1.61	1.4	1.79	0.4	0.22	0.23	0.2	<0.1	0.2	1.53	1.64	1.4	1.3	0.3	0.5
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	75	70	72	71	73	73	79	23	10	11	14	<10	<10	68	74	70	69	13	22
Calculated TDS	mg/L	NG	≤500*	1	86	80	78	82	86	81	91	26	17	16	17	7	11	81	86	88	73	17	27
Carb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	ND	ND	<10	ND	ND	<10	2	<10	ND	ND	<10	<10	<10	ND	ND	<10	<10	<10	<10
Cation - Anion Balance	%	NG	NG	N/A	NA	NA	9.7	NA	NA	12.6	NA	Low EC	NA	NA	Low EC	Low EC	Low EC	NA	NA	24.2	5.2	Low EC	Low EC
Cation Sum	me/L	NG	NG	N/A	1.57	1.65	1.7	1.53	1.82	1.8	1.76	0.6	0.29	0.25	0.5	0.2	0.3	1.59	1.75	2.2	1.5	0.4	0.6
Conductivity % Difference	%	NG	NG	N/A	NA	NA	-0.5	NA	NA	5.4	NA	21.0	NA	NA	33.2	-33.9	-5.8	NA	NA	12.8	-5.8	-6.2	7.4
Computed Conductivity	uS/cm	NG	NG	N/A	NA	NA	145	NA	NA	152	NA	52.4	NA	NA	35.2	16.3	22.6	NA	NA	172	133	34.3	52.2
Ion Balance (% Difference)	%	NG	NG	N/A	3.98	3.45	122	3.16	6.12	129	0.85	Low EC	13.7	4.17	Low EC	Low EC	Low EC	1.92	3.24	164	111	Low EC	Low EC
Langelier Index (@ 20C)	N/A	NG	NG	N/A	-0.245	-0.381	-0.2	-0.085	-0.295	-0.1	0.28	-1.6	-2.74	-3.06	-2.1	-6.5	-2.9	-0.269	-0.354	0	-0.4	-2	-2.1
Langelier Index (@ 4C)	N/A	NG	NG	N/A	-0.496	-0.633	NA	-0.336	-0.546	NA	0.029	NA	-2.99	-3.31	NA	NA	NA	-0.52	-0.605	NA	NA	NA	NA
Saturation pH (@ 20C)	N/A	NG	NG	N/A	8.23	8.28	8.28	8.26	8.23	8.23	8.16	9.09	9.83	9.78	9.37	13.4	9.87	8.26	8.23	8.1	8.36	9.59	9.23
Saturation pH (@ 4C)	N/A	NG	NG	N/A	8.48	8.53	NA	8.51	8.48	NA	8.41	NA	10.1	10.1	NA	NA	NA	8.51	8.49	NA	NA	NA	NA

All results expressed as indicated

RDL+ - Analytical Reportable Detection Limit

CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)

GCDWQ DW = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334	Exceeds CWQG FWAL Standards
334	Exceeds GCDWQ Standards

ND = Not detected

NC = Non-calculable

NG = No Guideline

NA = Not Analysed

N/A = Not Applicable

Table 4
Surface Water Analytical Results - Metals
James Property, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	Units	Criteria 1	Criteria 2	RDL+	JP1			JP2			JP3		JP4					JP5				JP6	
Sampling Date		CCME FWAL	CCME DW		*26-Apr-07*	*9/23/2007*	*9/13/2008*	*26-Apr-07*	*9/23/2007*	*9/13/2008*	*26-Apr-07*	*9/13/2008*	*26-Apr-07*	*9/23/2007*	*31-Mar-08*	*9-Jun-08*	*9/13/2008*	*26-Apr-07*	*9/23/2007*	*31-Mar-08*	*14-Sep-08*	*9-Jun-08*	*9/13/2008*
Total Metals																							
Total Aluminum (Al)	ug/L	5-100	100	10	ND	NA	<10	ND	NA	<10	ND	20	ND	NA	20	<10	<10	ND	NA	50	<10	<10	<10
Total Antimony (Sb)	ug/L	NG	6**	2	ND	NA	<5	ND	NA	<5	ND	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	<5	<5
Total Arsenic (As)	ug/L	5	10	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Barium (Ba)	ug/L	NG	1000	5	ND	NA	<10	ND	NA	<10	ND	<10	ND	NA	<10	<10	<10	ND	NA	<10	<10	<10	<10
Total Beryllium (Be)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Bismuth (Bi)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Boron (B)	ug/L	NG	5000**	5	ND	NA	<50	ND	NA	<50	ND	<50	ND	NA	<50	<50	<50	ND	NA	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	0.017	5	0.3	ND	NA	<0.1	ND	NA	<0.1	ND	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L	NG	NG	100	17000	16000	15900	17000	18000	17600	19000	7000	2900	2400	5900	2000	2500	17000	17000	25100	15000	3800	5300
Total Chromium (Cr)	ug/L	NG	50	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Cobalt (Co)	ug/L	NG	NG	1	ND	NA	<0.5	ND	NA	<0.5	ND	<0.5	ND	NA	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	2-4	≤1000*	2	ND	ND	<1	ND	ND	<1	ND	<1	ND	ND	<1	<1	<1	ND	ND	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	≤300*	50	ND	40	80	ND	30	80	ND	110	ND	ND	<50	<50	50	ND	30	<50	110	<50	<50
Total Lead (Pb)	ug/L	1-7	10	0.5	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Magnesium (Mg)	ug/L	NG	NG	100	11000	9900	10600	11000	11000	10800	12000	3200	1900	1600	1900	1400	1700	11000	11000	11400	10200	2400	3700
Total Manganese (Mn)	ug/L	NG	≤50	2	10	ND	21	7	NA	13	ND	36	8	ND	15	4	16	21	10	**57**	20	9	2
Total Mercury (Hg)	ug/L	NG	1	0.01	ND	NA	<0.1	ND	NA	<0.1	ND	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1
Total Molybdenum (Mo)	ug/L	73	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25-150	NG	2	ND	NA	<2	ND	NA	<2	ND	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	<2	<2
Total Phosphorus (P)	ug/L	NG	NG	100	ND	NA	<50	ND	NA	<50	ND	<50	ND	NA	<50	30	<50	ND	NA	<50	<50	30	<50
Total Potassium (K)	ug/L	NG	NG	100	500	400	<1000	500	500	<1000	400	<1000	200	100	<1000	<1000	<1000	500	400	<1000	<1000	<1000	<1000
Total Selenium (Se)	ug/L	1	10	2	ND	NA	<5	ND	NA	<5	ND	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	<5	<5
Total Silicon (Si)	ug/L	NG	NG	100	NA	NA	3200	NA	NA	3300	NA	2800	NA	NA	2400	2000	2800	NA	NA	3000	3100	1800	3000
Total Silver (Ag)	ug/L	NG	NG	0.5	ND	NA	0.6	ND	NA	0.8	ND	0.8	ND	NA	<0.1	<0.1	0.7	ND	NA	<0.1	<0.1	<0.0001	0.9
Total Sodium (Na)	ug/L	NG	≤200000*	100	500	600	<500	600	400	<500	500	<500	200	ND	<500	<500	<500	600	400	600	<500	<500	<500
Total Strontium (Sr)	ug/L	NG	NG	5	7	NA	7	7	NA	9	7	4	ND	NA	4	2	2	7	NA	13	8	3	2
Total Thallium (Tl)	ug/L	0.8	NG	0.1	ND	NA	<0.3	ND	NA	<0.3	ND	<0.3	ND	NA	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	<0.3	<0.3
Total Tin (Sn)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Titanium (Ti)	ug/L	NG	NG	2	ND	NA	<2	ND	NA	<2	ND	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	<2	<2
Tungsten (W)-Total	ug/L	NG	NG	10	NA	NA	<10	NA	NA	<10	NA	<10	NA	NA	<10	<10	<10	NA	NA	<10	<10	<10	<10
Total Uranium (U)	ug/L	NG	20**	0.1	0.2	NA	<5	0.2	NA	<5	0.2	<5	ND	NA	<5	<5	<5	0.1	NA	<5	<5	<5	<5
Total Vanadium (V)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	30	≤5000*	5	6	ND	7	8	ND	21	5	34	ND	ND	**41**	<3	<3	5	ND	**153**	<3	<3	7
Zirconium (Zr)-Total	ug/L	NG	NG	4	NA	NA	<4	NA	NA	<4	NA	<4	NA	NA	<4	<4	<4	NA	NA	<4	<4	<4	<4
Dissolved Metals																							
Dissolved Aluminum (Al)	ug/L	5-100	100	10	ND	NA	<10	ND	NA	<10	ND	<10	ND	NA	<10	<10	<10	ND	NA	<10	<10	<10	<10
Dissolved Antimony (Sb)	ug/L	NG	NG	2	ND	NA	<5	ND	NA	<5	ND	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	<5	<5
Dissolved Arsenic (As)	ug/L	5	25	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Barium (Ba)	ug/L	NG	1000	5	ND	NA	<10	ND	NA	<10	ND	<10	ND	NA	<10	<10	<10	ND	NA	<10	<10	<10	<10
Dissolved Beryllium (Be)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Bismuth (Bi)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Boron (B)	ug/L	NG	5000	5	ND	NA	<50	ND	NA	<50	ND	<50	ND	NA	<50	<50	<50	ND	NA	<50	<50	<50	<50
Dissolved Cadmium (Cd)	ug/L	0.017	5	0.3	ND	NA	<0.1	ND	NA	<0.1	ND	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L	NG	NG	500	NA	NA	14200	NA	NA	15100	NA	4100	NA	NA	2800	1900	2300	NA	NA	16000	13700	3800	4200
Dissolved Chromium (Cr)	ug/L	NG	50	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Cobalt (Co)	ug/L	NG	NG	1	ND	NA	<0.5	ND	NA	<0.5	ND	<0.5	ND	NA	<0.5	<0.5	<0.5	ND	NA	<0.5	<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	2.4	<1000	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Iron (Fe)	ug/L	300	<300	50	ND	NA	<50	ND	NA	<50	ND	<50	ND	NA	<50	<50	<50	ND	NA	<50	<50	<50	<50
Dissolved Lead (Pb)	ug/L	1-7	10	0.5	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Magnesium (Mg)	ug/L	NG	NG	500	NA	NA	10100	NA	NA	11400	NA	3100	NA	NA	1800	1300	1700	NA	NA	10700	9400	2600	3500
Dissolved Manganese (Mn)	ug/L	NG	NG	2	3	NA	<1	ND	NA	<1	ND	22	6	NA	<1	3	8	17	NA	6	<1	3	1
Mercury Dissolved (Hg)	ug/L		0.001	0.1	NA	NA	<0.1	NA	NA	<0.1	NA	<0.1	NA	NA	<0.1	<0.1	<0.1	NA	NA	<0.1	<0.1	<0.1	<0.1
Dissolved Molybdenum (Mo)	ug/L	73	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Nickel (Ni)	ug/L	25-150	NG	2	ND	NA	<2	ND	NA	<2	ND	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	<2	<2
Dissolved Phosphorus (P)	ug/L		NG	50	NA	NA	<50	NA	NA	<50	NA	<50	NA	NA	<50	<50	<50	NA	NA	<50	<50	<50	<50
Dissolved Potassium (K)	ug/L	NG	NG	1000	NA	NA	<1000	NA	NA	<1000	NA	<1000	NA	NA	<1000	<1000	<1000	NA	NA	<1000	<1000	<1000	<1000
Dissolved Selenium (Se)	ug/L	1	10	2	ND	NA	<5	ND	NA	<5	ND	<5	ND	NA	<5	<5	<5	ND	NA	<5	<5	<5	<5
Dissolved Silicon (Si)	ug/L	NG	NG	100	NA	NA	3700	NA	NA	3500	NA	2700	NA	NA	2400	1900	2800	NA	NA	3000	3100	1800	3100
Dissolved Silver (Ag)	ug/L	NG	NG	0.5	ND	NA	<0.1	ND	NA	<0.1	ND	<0.1	ND	NA	<0.1	<0.1	<0.1	ND	NA	<0.1	<0.1	<0.0001	<0.1
Dissolved Sodium (Na)	ug/L		<200	500	NA	NA	<500	NA	NA	<500	NA	<500	NA	NA	<500	<500	<500	NA	NA	500	<500	<500	<500
Dissolved Strontium (Sr)	ug/L	NG	NG	5	7	NA	7	6	NA	7	7	2	ND	NA	3	3	2	7	NA	7	8	2	2
Dissolved Thallium (Tl)	ug/L	0.8	NG	0.1	ND	NA	<0.3	ND	NA	<0.3	ND	<0.3	ND	NA	<0.3	<0.3	<0.3	ND	NA	<0.3	<0.3	<0.3	<0.3
Dissolved Tin (Sn)	ug/L	NG	NG	2	ND	NA	<1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	<1	<1	<1	<1
Dissolved Titanium (Ti)	ug/L	NG	NG	2	ND	NA	<2	ND	NA	<2	ND	<2	ND	NA	<2	<2	<2	ND	NA	<2	<2	<2	<2
Dissolved Tungsten (W)	ug/L	NG	NG	10	NA	NA	<10	NA	NA	<10	NA	<10	NA	NA	<10	<10	<10	NA	NA	<10	<10	<10	<10
Dissolved Uranium (U)	ug/L	NG	NG	0.1	0.2	NA	<5	0.2	NA	<5	0.2	<5	ND	NA	<5	<5	<5	0.2	NA	<5	<5	<5	<5
Dissolved Vanadium (V)	ug/L	NG	NG	2	ND	NA	1	ND	NA	<1	ND	<1	ND	NA	<1	<1	<1	ND	NA	1	<1	<1	<1
Dissolved Zinc (Zn)	ug/L	30	<5000	5	ND	NA	3	ND	NA	<3	ND	<3	ND	NA	<3	4	<3	ND	NA	<3	<3	<3	3
Dissolved Zirconium (Zr)		NG	NG	4	NA	NA	<4	NA	NA	<4	NA	<4	NA	NA	<4	<4	<4	NA	NA	<4	<4	<4	<4

All results expressed as indicated

RDL+ - Analytical Reportable Detection Limit

CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)

GCDWQ DW = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334	Exceeds CWQG FWAL Standards
334	Exceeds GCDWQ Standards
ND = Not detected	N/A = Not Applicable
NA = Not Analyzed	NG = No Guideline
* Aesthetic Objective	** Interim Maximum Acceptable Concentration

Table 5
Water Analytical Results - Inorganics
Offsite Property Samples, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	**Units**	**CWQG FWAL**	**GCWDG**	**RDL+**	**Spring**			**Slimy L.**		**Bean L. Outlet**		**Bean L.**		**Ruth Outet**			**Ruth Pit**
Sampling Date					3/31/2008	7/6/2008	9/15/2008	7/6/2008	9/15/2008	6/6/2008	*9/14/2008*	4/3/2008	*9/13/2008*	4/1/2008	6/10/2008	9/14/2008	9/14/2008
INORGANICS																	
Total Alkalinity (Total as CaCO3)	mg/L	NG	NG	5	78	75	67	66	71	63	74	57	70	59	55	55	53
Dissolved Chloride (Cl)	mg/L	NG	NG	1	<2	<2	<2	7	<2	<2	<2	<2	7	<2	2	<2	<2
Colour	TCU	NG	≤15*	5	<1	2	15	4	5	3	4	2	5	<1	4	2	3
Total Dissolved Solids	mg/L	NG	NG	10	70	90	120	80	120	80	110	50	120	50	30	110	100
Hardness (CaCO3)	mg/L	NG	NG	1	140	108	80	74	74	73	71	82	69	76	66	66	65
Nitrate + Nitrite	mg/L	NG	NG	0.05	0.4	0.4	0.2	0.3	0.2	0.2	<0.2	0.5	<0.2	0.3	0.3	0.2	0.2
Nitrite (N)	mg/L	0.06	NG	0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Nitrogen (Ammonia Nitrogen)	mg/L	NG	NG	0.05	<0.05	0.07	0.10	0.06	0.07	0.07	0.08	<0.05	0.07	0.06	<0.05	0.07	0.18
Dissolved Organic Carbon (C)	mg/L	NG	NG	0.5	<1	<1	<1	<1	<1	6.3	<1	<1	1	<1	<1	<1	<1
Total Organic Carbon (C)	mg/L	NG	NG	0.5	NA	<1	6	<1	<1	8	<1	NA	<1	NA	<1	2	<1
Orthophosphate (P)	mg/L	NG	NG	0.01	0.01	0.005	<0.003	0.004	0.003	<0.003	<0.003	<0.003	<0.003	0.003	0.005	<0.003	<0.003
pH	pH	6.5 - 9	6.5 - 8.5	N/A	8.13	8.09	8.05	8.01	8.06	7.99	8.10	7.73	8.05	7.97	8.04	8.06	8.05
Reactive Silica (SiO2)	mg/L	NG	NG	0.5	7	6.2	6.1	4.8	6.6	5.8	6.5	6.3	6.2	6.2	5.5	5.0	5.2
Dissolved Sulphate (SO4)	mg/L	NG	NG	2	7	7	7	7	7	6	6	7	6	7	7	6	6
Turbidity	NTU	NG	NG	0.1	<0.1	0.28	3.8	0.69	0.85	0.42	0.58	0.52	0.59	0.19	1.9	0.44	0.62
Conductivity	uS/cm	NG	NG	1	160	154	137	145	144	134	139	127	136	131	119	117	118
Bromide	mg/L	NG	NG	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Fluoride	mg/L	NG	1.5	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
RCAP CALCULATIONS																	
Nitrate (N)	mg/L	NG	45	N/A	0.4	0.4	0.2	0.3	0.2	0.02	<0.1	0.4	<0.1	0.3	0.3	0.2	0.2
Anion Sum	me/L	NG	NG	N/A	1.5	1.4	1.3	1.5	1.3	1.2	1.4	1.1	1.5	1.1	1.1	1.1	1
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	77	74	66	65	70	2	73	57	69	58	55	54	52
Calculated TDS	mg/L	NG	≤500*	1	104	90	74	79	74	68	73	70	77	69	65	61	60
Carb. Alkalinity (calc. as CaCO3)	mg/L	NG	NG	1	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Cation - Anion Balance	%	NG	NG	N/A	31.4	20.7	12.5	1.1	4.9	10.9	2.8	19	-3.6	15.1	8.1	12.2	13.2
Cation Sum	me/L	NG	NG	N/A	2.8	2.2	1.6	1.5	1.5	1.5	1.4	1.6	1.4	1.6	1.3	1.3	1.3
Conductivity % Difference	%	NG	NG	N/A	24.9	11.1	1.8	0.8	-6.8	-4.8	1.4	6	1.4	-0.2	2.2	-0.5	-3.1
Computed Conductivity	uS/cm	NG	NG	N/A	205	172	139	146	135	128	132	135	140	131	122	116	114
Ion Balance (% Difference)	%	NG	NG	N/A	191	152	129	102	110	124	106	147	93.1	136	118	128	130
Langelier Index (@ 20C)	N/A	NG	NG	N/A	0.2	0	-0.3	-0.3	-0.3	-0.4	-0.2	-0.6	-0.3	-0.4	-0.5	-0.4	-0.5
Langelier Index (@ 4C)	N/A	NG	NG	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
Saturation pH (@ 20C)	N/A	NG	NG	N/A	7.92	8.06	8.34	8.32	8.35	8.38	8.33	8.34	8.38	8.38	8.49	8.49	8.51
Saturation pH (@ 4C)	N/A	NG	NG	N/A	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA

All results expressed as indicated

RDL+ - Analytical Reportable Detection Limit

CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)

GCDWQ = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334	Exceeds CWQG FWAL Standards
334	Exceeds GCDWQ Standards

ND = Not detected

NC = Non-calculable

NG = No Guideline

NA = Not Analysed

N/A = Not Applicable

Table 6
Surface Water Analytical Results - Metals
Offsite Property Samples, Labrador Iron Mines, Schefferville Project, Labrador

Parameter	Units	Criteria 1	Criteria 2	RDL+	Spring			Slimy L.		Bean L. Outlet		Bean L.		Ruth Outlet			Ruth Pit
Sampling Date		CWGQ FWAL	GCDWQ		*31-Mar-08*	*06-Jul-08*	*15-Sep-08*	*06-Jul-08*	*15-Sep-08*	*6-Jun-08*	*14-Sep-08*	*3-Apr-08*	*13-Sep-08*	*1-Apr-08*	*10-Jun-08*	*14-Sep-08*	*14-Sep-08*
Total Metals																	
Total Aluminum (Al)	ug/L	5-100	100	10	**160**	20	100	20	<10	<10	<10	30	<10	<10	30	<10	<10
Total Antimony (Sb)	ug/L	NG	6**	2	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Arsenic (As)	ug/L	5	10	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Barium (Ba)	ug/L	NG	1000	5	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Beryllium (Be)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Bismuth (Bi)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Boron (B)	ug/L	NG	5000**	5	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Total Cadmium (Cd)	ug/L	0.017	5	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Calcium (Ca)	ug/L	NG	NG	100	36000	26200	14900	15800	15000	14400	14800	17700	14800	15400	12600	12500	12500
Total Chromium (Cr)	ug/L	NG	50	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Cobalt (Co)	ug/L	NG	NG	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Total Copper (Cu)	ug/L	2-4	≤1000*	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Iron (Fe)	ug/L	300	≤300*	50	60	<50	170	<50	100	110	100	70	160	<50	60	<50	<50
Total Lead (Pb)	ug/L	1-7	10	0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Magnesium (Mg)	ug/L	NG	NG	100	12100	10300	10500	8500	10200	9100	10200	9300	10300	9100	8300	8400	8100
Total Manganese (Mn)	ug/L	NG	≤50	2	**54**	14	42	33	24	17	17	**51**	28	3	2	1	1
Total Mercury (Hg)	ug/L	NG	1	0.01	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Total Molybdenum (Mo)	ug/L	73	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Nickel (Ni)	ug/L	25-150	NG	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Total Phosphorus (P)	ug/L	NG	NG	100	<50	<50	<50	<50	<50	40	<50	<50	<50	<50	30	<50	<50
Total Potassium (K)	ug/L	NG	NG	100	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Total Selenium (Se)	ug/L	1	10	2	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Silicon (Si)	ug/L	NG	NG	100	3100	2900	2800	2000	3100	2500	3100	2900	2900	2700	2600	2700	2400
Total Silver (Ag)	ug/L	NG	NG	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.0001	<0.1	<0.1
Total Sodium (Na)	ug/L	NG	≤200000*	100	600	<500	500	<500	<500	<500	<500	<500	<500	700	600	600	600
Total Strontium (Sr)	ug/L	NG	NG	5	19	13	8	8	8	8	8	9	9	8	7	8	8
Total Thallium (Tl)	ug/L	0.8	NG	0.1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Total Tin (Sn)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Titanium (Ti)	ug/L	NG	NG	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Tungsten (W)-Total	ug/L	NG	NG	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Total Uranium (U)	ug/L	NG	20**	0.1	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Total Vanadium (V)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Total Zinc (Zn)	ug/L	30	≤5000*	5	**230**	85	<3	54	<3	<3	<3	**76**	<3	8	<3	<3	<3
Zirconium (Zr)-Total	ug/L	NG	NG	4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4
Dissolved Metals																	
Dissolved Aluminum (Al)	ug/L	NG	NG	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Dissolved Antimony (Sb)	ug/L	NG	NG	2	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved Arsenic (As)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Barium (Ba)	ug/L	NG	NG	5	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Dissolved Beryllium (Be)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Bismuth (Bi)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Boron (B)	ug/L	NG	NG	5	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Dissolved Cadmium (Cd)	ug/L	NG	NG	0.3	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Calcium (Ca)	ug/L	NG	NG	500	18600	15700	14600	13800	13800	14600	13600	13900	12900	13800	12.2	11400	12200
Dissolved Chromium (Cr)	ug/L	NG	NG	2	<1	2	<1	2	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Cobalt (Co)	ug/L	NG	NG	1	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
Dissolved Copper (Cu)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Iron (Fe)	ug/L	NG	NG	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Dissolved Lead (Pb)	ug/L	NG	NG	0.5	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Magnesium (Mg)	ug/L	NG	NG	500	11700	9500	9600	8100	9500	9000	9100	9100	8900	9000	8300	8000	8000
Dissolved Manganese (Mn)	ug/L	NG	NG	2	<1	<1	4	<1	<1	<1	<1	36	<1	<1	<1	<1	<1
Mercury Dissolved (Hg)	ug/L	NG	NG	0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Molybdenum (Mo)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Nickel (Ni)	ug/L	NG	NG	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Phosphorus (P)	ug/L	NG	NG	50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50	<50
Dissolved Potassium (K)	ug/L	NG	NG	1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000	<1000
Dissolved Selenium (Se)	ug/L	NG	NG	2	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved Silicon (Si)	ug/L	NG	NG	100	3300	2900	2800	2200	3100	2700	3100	2900	2800	2900	2600	2500	2500
Dissolved Silver (Ag)	ug/L	NG	NG	0.5	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Dissolved Sodium (Na)	ug/L	NG	NG	500	500	<500	500	<500	<500	<500	<500	500	<500	700	<500	600	600
Dissolved Strontium (Sr)	ug/L	NG	NG	5	7	6	8	7	8	8	8	7	8	87	7	7	7
Dissolved Thallium (Tl)	ug/L	NG	NG	0.1	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3	<0.3
Dissolved Tin (Sn)	ug/L	NG	NG	2	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Titanium (Ti)	ug/L	NG	NG	2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2	<2
Dissolved Tungsten (W)	ug/L	NG	NG	10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10	<10
Dissolved Uranium (U)	ug/L	NG	NG	0.1	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Dissolved Vanadium (V)	ug/L	NG	NG	2	1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1
Dissolved Zinc (Zn)	ug/L	NG	NG	5	<3	<3	<3	<3	<3	8	5	<3	4	<3	3	<3	<3
Dissolved Zirconium (Zr)		NG	NG	4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4	<4

All results expressed as indicated

RDL+ - Analytical Reportable Detection Limit

CWQG, FWAL = CCME Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (2006 Update)

GCDWQ = CCME Canadian Water Quality Guidelines for Drinking Water Quality

334	Exceeds CWQG FWAL Standards
334	Exceeds GCDWQ Standards
ND = Not detected	N/A = Not Applicable
NA = Not Analyzed	NG = No Guidance
* Aesthetic Objective	** Interim Maximum Acceptable Concentration

APPENDIX J

Hydrological Field Study Methods

Hydrological Field Survey Methods

WESA conducted a field survey at the Project site to monitor stream flow. Methods used by WESA to monitor stream flow at the Project site in 2008 are described.

Water Balance Approach

James Creek and Bean Lake are the focal points for the water balance assessment of the James Property since these are the closest surface waters features and because shallow groundwater from the site flows to the east/southeast, toward the lake. The approach taken with respect to the water balance involved measuring surface water flow into and out of the lake, estimating groundwater discharge to the lake, and incorporating evaporation data from available meteorological data sources.

Methodology

Methodologies and data sources used in determining the surface water inputs to the water balance are described in this section.

Surface Water

Velocity-Area Method of Discharge Calculation

The Velocity-Area Method of calculating stream discharge (Q) estimates Q as the product of flow velocity (V) and cross-sectional area (A):

$$Q=(V)(A)$$

In order to calculate the discharge of a channel, the channel cross-section must first be divided into several subsections. A tag line was set up perpendicular to the flow direction at each pre-selected gauging station to ensure accurate measurements of each subsection width. The stream depth was measured at these specific intervals across the stream, which allowed a stream profile to be constructed. From this profile, the cross-sectional area of the stream at the gauging site was determined. The average velocity of the cross-section was measured using the FP101 Global Flow Probe. The methodology outlined in the probe manual (Global Water, 2004) was utilized whereby the probe is moved in a serpentine pattern across the stream cross-section yielding a single average flow velocity. This average velocity was then multiplied by the cross-sectional area to determine stream discharge.

Continuous Stream Depth Measurement

Water level dataloggers were installed at five locations (SG-1, 2, 4, 5, and 8) on June 7, 2008. One additional datalogger was installed at SG-4 on July 7, 2008 to measure barometric pressure. Solinst® Levelogger® Gold Model 3001 and Barologger Gold dataloggers were used. These loggers are equipped with the datalogger, battery, pressure transducer, and temperature sensor. All loggers were programmed to record real-time data every 15 minutes which could be downloaded from the loggers using direct read cables.

Loggers at SG-1, 2, and 8 were installed in natural stream cross-sections using a length of 1.5-inch diameter ABS pipe extended horizontally from one bank to the other, perpendicular to the direction of flow. This pipe not only anchored the Levelogger, but also served as the tag line used for cross-section measurements. A second length of ABS pipe was bolted vertically to the horizontal piece such that it extended down to the streambed. This vertical ABS pipe had holes drilled through it to allow water to pass into and through the pipe in order for the water depth inside the ABS to reflect the water level of the stream. The vertical ABS acted as a sort of "stilling-well" in which the Levelogger was contained. The Levelogger was secured inside the vertical ABS by attaching the direct read cable to it with zip-ties. The direct read cable was attached to the Levelogger and run along the ABS pipe (secured using zip-ties) to the shore where the other end remained on a spool to allow for easier downloading of the Levelogger. Figures 1 and 2 show leveloggers set up in a stream.

Figure 1 SG2 Stream Gauge Levelogger Looking Southeast

Figure 2 SG1 Stream Gauge Levellogger

Sites SG-4 and 5 required Leveloggers to be mounted in culverts using threaded steel rods. A hole was drilled in the top of the culvert through which the steel rod was inserted until it came in contact with the bottom of the culvert (Figure 3).

Figure 3 SG4 Levellogger Looking West

Precipitation

Precipitation was estimated using the meteorological data collected at the Schefferville Airport weather station from May to November 2008. This weather station is located approximately 4 km from the site. Weather patterns in the area can be extremely localized; consequently, the precipitation data for the Schefferville airport do not necessarily reflect the precipitation at Bean Lake on a day-to-day basis. However, it is assumed that over the course of a season, the precipitation at Schefferville would be a reasonable approximation of the amount of rainfall at Bean Lake, given the proximity of the site to the weather station and the similar elevations of each. Furthermore, a comparison of the James Property stream gauge data with the Schefferville precipitation data shows a qualitative correlation between higher levels of precipitation at Schefferville, and higher water levels in the monitored streams (Figures 4 to 7).

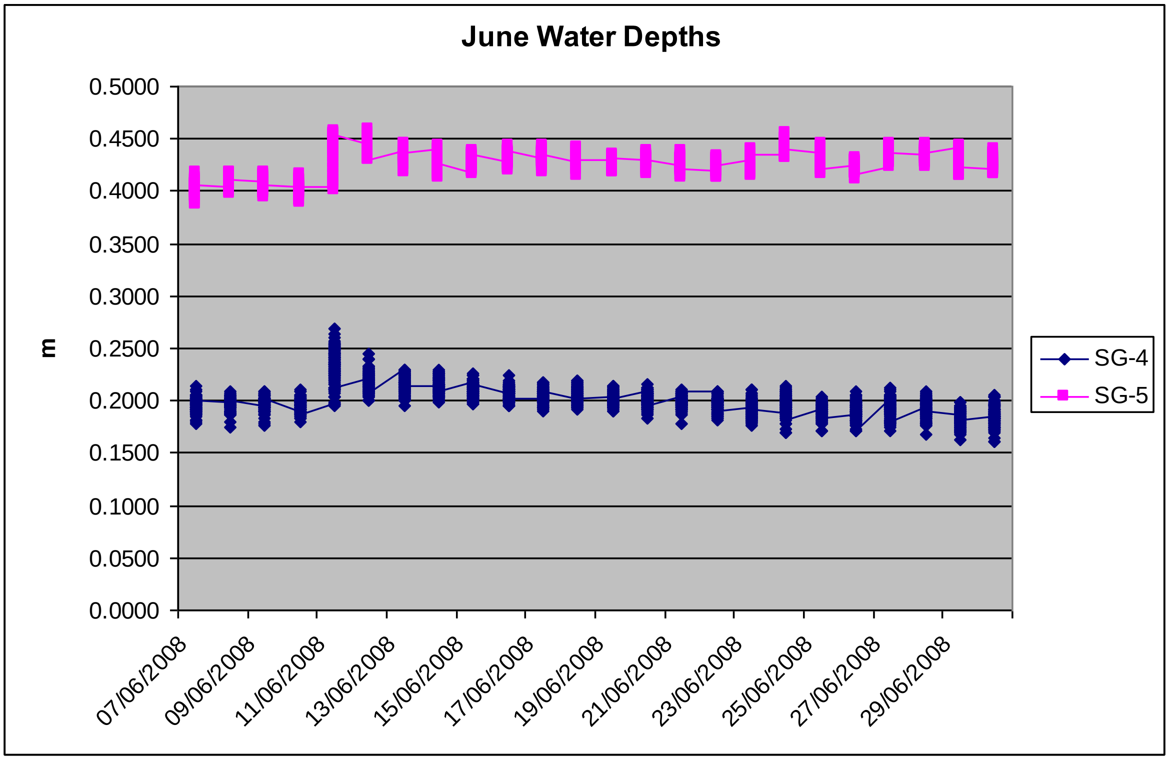


Figure 4 **Stream Gauge Data, June 7 to 29**

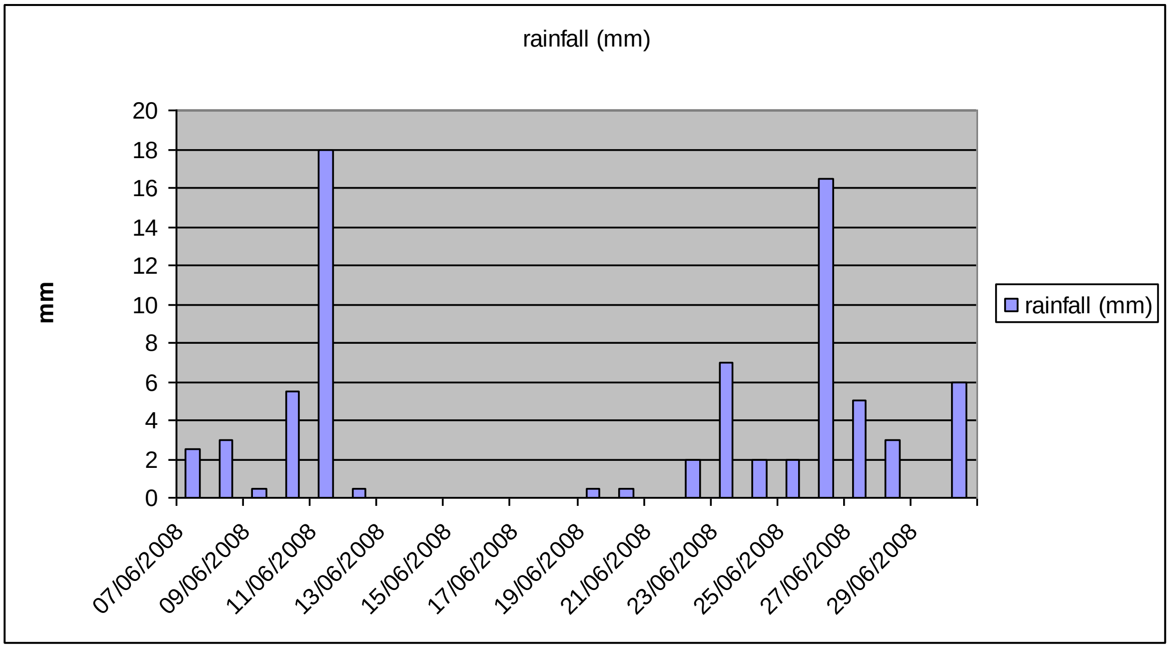


Figure 5 Rainfall Data, June 7 to 29

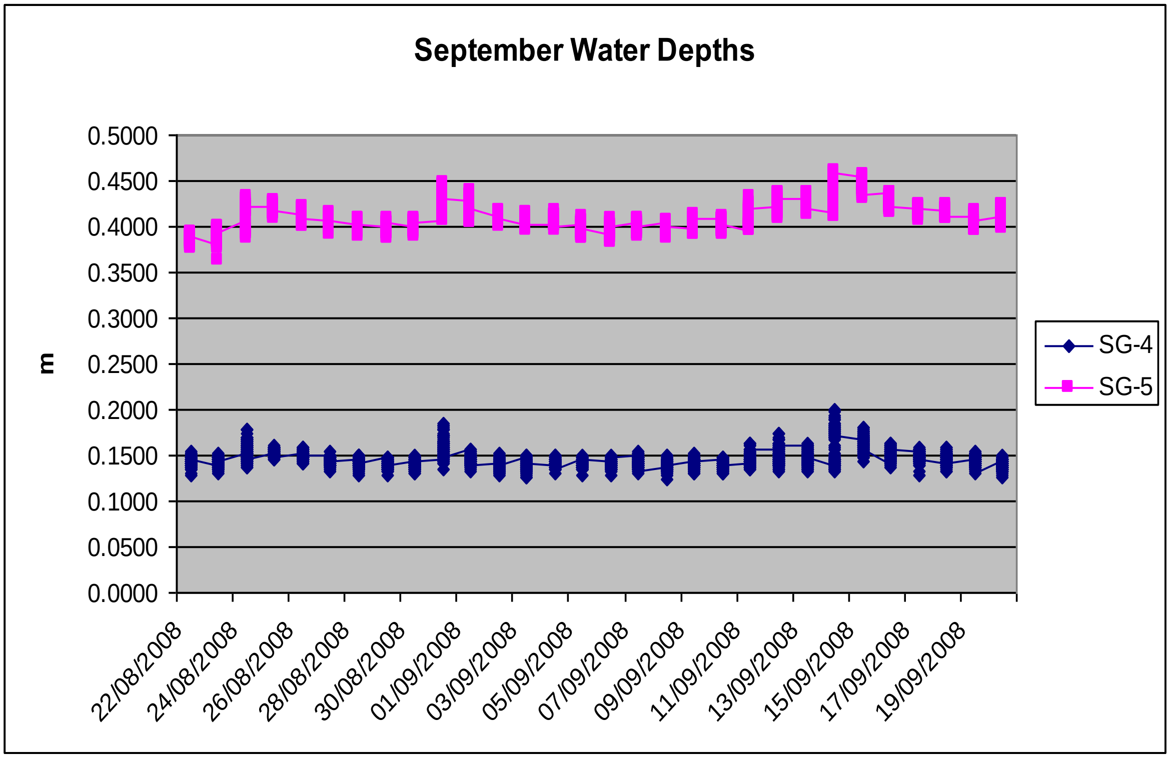


Figure 6 Stream Gauge Data, August 22 to September 19

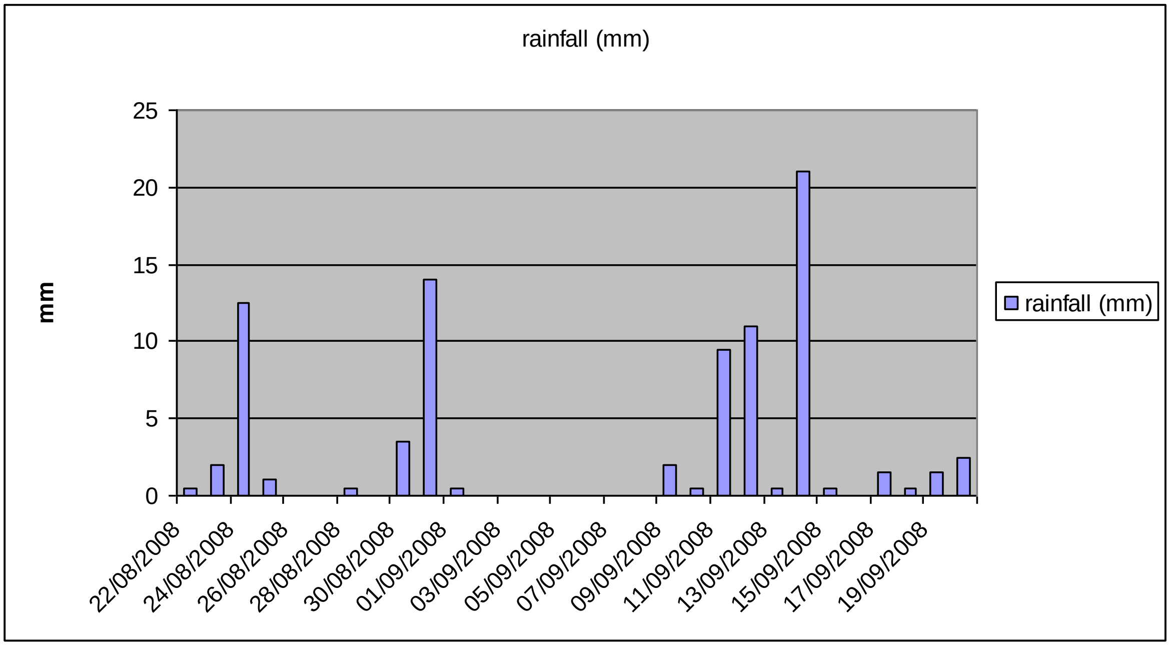


Figure 7 Rainfall Data, August 22 to September 19

Stream Gauges (James)

The stream gauges collected water level readings every 15 minutes. Water level readings were corrected for barometric pressure.

The locations of the stream gauges are described as follows:

SG-1: The northern of two springs in the proposed mine area (James North Spring). The stream gauge was installed in a stream about 3.3 m wide, with a depth of approximately 30 cm at its deepest point.

SG-2: The southern spring in the proposed mine area (James South Spring). This small stream is approximately 90 cm wide, with a depth of about 20 cm.

SG-4: The combined drainage of the two springs (unnamed tributary), just before it enters Bean Lake, passes through a culvert (formerly a 24" round culvert, now deformed such that the sides in the lower portion form a V-shape).

SG-8: The main inflow to Bean Lake (at the north end of the lake) is James Creek, a stream approximately 2.9 m wide and 30 cm deep.

SG-5: The outflow from Bean Lake passes through a 12 ft corrugated steel culvert.

The combined inflows to Bean Lake (surface and groundwater) and the combined outflows (surface water flow and evaporation) are presented in Figures 9 and 10.

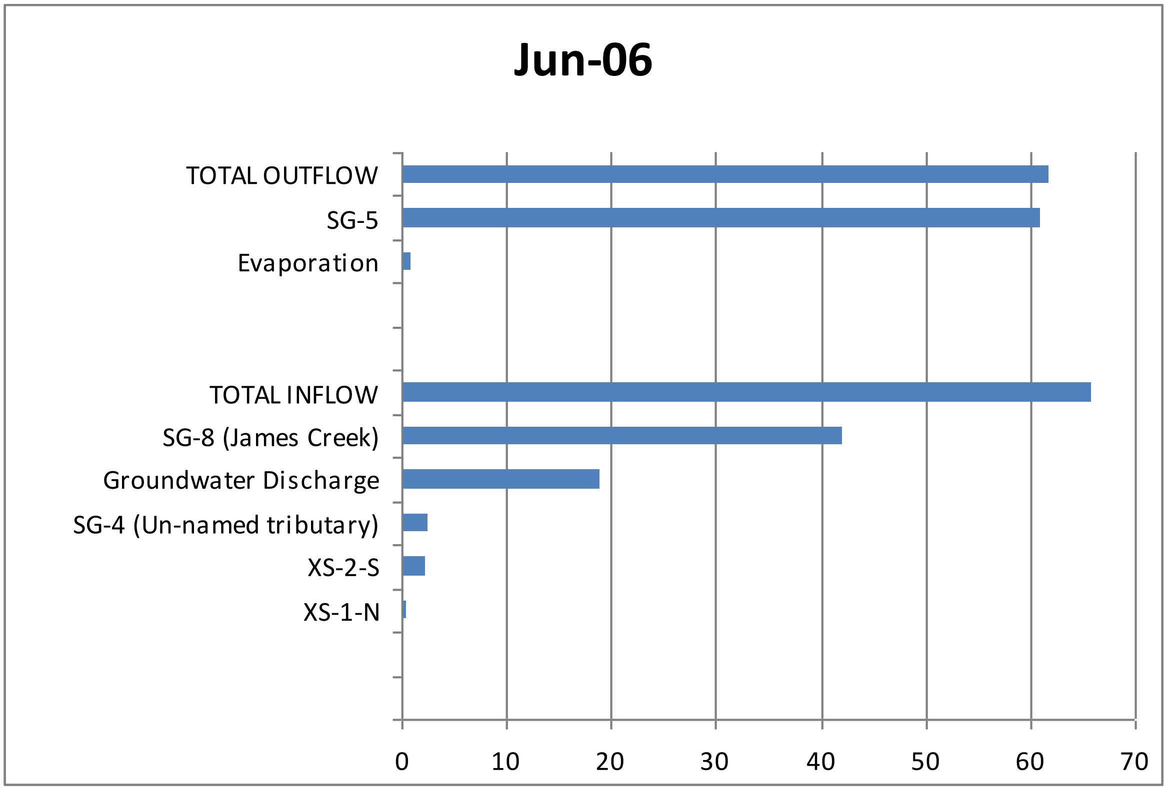


Figure 9 **Components of the Water Balance for June 6**

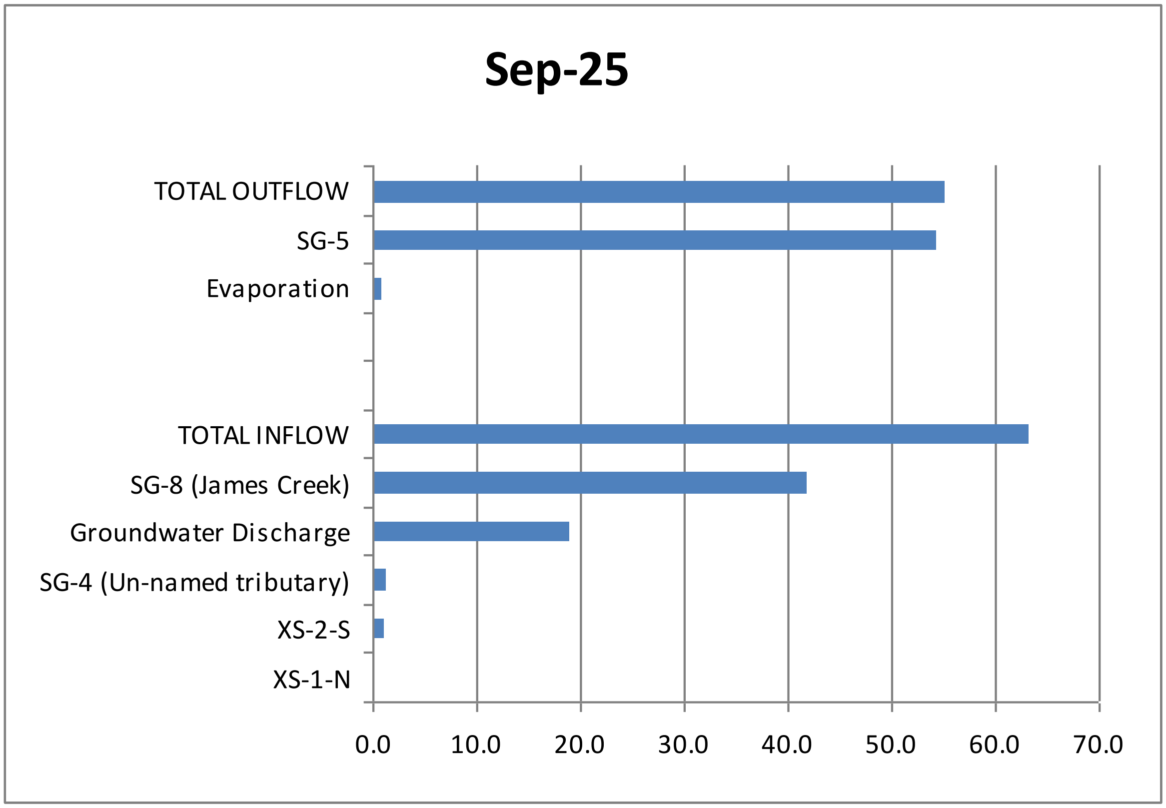


Figure 10 Components of the Water Balance for September 25

Comparison of Measured flow rates - for Theoretical Rates – James Creek and Bean Lake Watershed

Theoretical maximum runoff (R) estimates for the James Creek/Bean Lake watershed can be made by determining inputs to the watershed from precipitation (P) and subtracting the potential evapotranspiration (ET) based on the area of the watershed and published P and ET rates for the area. This approach assumes that any infiltration that occurs eventually discharges back to surface further along in the system.

The area of the watershed is estimated to be 1305 hectares. Precipitation data obtained from Environment Canada for the area for the period of 1949 to 2007 indicates average annual precipitation of 775 mm. A potential ET rate for the area of 375 mm was obtained from the Newfoundland and Labrador Water Atlas. Using these values yields an average annual runoff value of 5222504 m^3. This works out to 28230 m^3/day using a six month period as a basis and 14308 m^3/day over a twelve month period. These maximum theoretical values are considerably lower than the stream flow rates that were measured in James Creek from June to October 2008 if the measured flow rates are extrapolated over a full year.

The most likely explanation for this is that the stream flow measurements over the spring/summer/fall of 2008 represent well above average flow conditions and the flow rates drop substantially during the winter months. Longer term full season monitoring would be required to determine if this is the case.

Stream Gauges (Redmond)

The locations of the stream gauges are described as follows:

SG-3: Installed on June 6, removed on September 25. The stream gauge was installed in a stream about 2.5 m wide, with a depth of approximately 35 cm at its deepest point (Figure 11).

SG-7: Installed on July 30, removed on September 25. The gauge measured the combined drainage in the former railway turnaround north of the existing Redmond 2 pit and proposed Redmond 2B pit (Figure 12).

Figure 11 Stream Location SG3 Looking South

Figure 12 Stream Gauge Location SG7 Looking South

APPENDIX K

Vegetation Species List and Photographs

VASCULAR PLANT SPECIES LIST

Labrador Iron Mines Vegetation Assessment

SCIENTIFIC NAME	COMMON NAME	FAMILY
Achillea millefolium	Common Yarrow	ASTERACEAE
Alnus viridis ssp. crispa	Green Alder	BETULACEAE
Amelanchier arborea	Common Serviceberry	ROSACEAE
Andromeda sp.	Bog Rosemary	ERICACEAE
Aster sp.	Aster	ASTERACEAE
Betula glandulosa	Dwarf Birch	BETULACEAE
Betula papyrifera	Paper Birch	BETULACEAE
Betula pumila	Swamp Birch	BETULACEAE
Carex aquatilis	Water Sedge	CYPERACEAE
Carex sp.	… Sedge	CYPERACEAE
Chamaedaphne calyculata	Leatherleaf	ERICACEAE
Cornus canadensis	Bunchberry	CORNACEAE
Deschampsia flexuosa	Common Hairgrass	POACEAE
Empetrum sp.	Crowberry	ERICACEAE
Epilobium angustifolium	Fireweed	ONAGRACEAE
Epilobium sp.		ONAGRACEAE
Eriophorum sp.	Cottonrass	CYPERACEAE
Fragaria sp.	Strawberry	ROSACEAE
Geranium macrorrhizum	Bigroot cranesbill	GERANIACEAE
Heracleum sp.	Hogweed	APIACEA
Juncus sp.	Rush	JUNCACEAE
Larix laricina	Tamarack	PINACEAE
Ledum groenlandicum	Common Labrador Tea	ERICACEAE
Lonicera involucrata	Twinberry Honeysuckle	CAPRIFOLIACEAE
Lycopodium sp.	Clubmoss	LYCOPODIACEAE
Menyanthes trifoliata	Buckbean	MENYANTHACEAE
Picea glauca	White Spruce	PINACEAE
Picea mariana	Black Spruce	PINACEAE
Potentilla palustris	Silverweed	ROSACEAE
Pyrola sp.		PYROLACEAE
	Orchid	ORCHIDACEAE
Ribes glandulosum	Skunk Currant	GROSSULARIACEAE
Rubus chamaemorus	Cloudberry	ROSACEAE
Rubus idaeus	Raspberry	ROSACEAE
Salix arctophila	Arctic Willow	SALICACEAE
Salix bebbiana	Bebb's Willow	SALICACEAE
Salix reticulata	Net-leaved Willow	SALICACEAE
Salix sp.	Willow	SALICACEAE
Salix vestita	Rock Willow	SALICACEAE
Vaccinium angustifolium	Late Lowbush Blueberry	ERICACEAE
Vaccinium macrocarpon	Large Cranberry	ERICACEAE
Vaccinium uliginosum	Bog Bilberry	ERICACEAE
MOSSES		
Aulacomnium palustre	Ribbed Bog Moss	Aulacomniaceae
Dicranum spp.		Dicranaceae
Hylocomium splendens	Stair-Step Moss	Hylocomiaceae
Marchantia polymorpha	Green-Tongue Liverwort	Marchantiaceae
Mnium spp.	Mniums	Mniaceae
Pleurozium schreberi	Schreber's Moss	Hylocomiaceae
Polytrichum commune	Common Hair Cap Moss	Polytrichaceae
Polytrichum juniperinum	Juniper Moss	Polytrichaceae
Ptilium crista-castrensis	Plume Moss	Hypnaceae
Sphagnum angustifolium	Poor-Fen Peat Moss	Sphagnaceae
Sphagnum fuscum	Common Brown Peat Moss	Sphagnaceae
Sphagnum warnstorfii	Warnstorf's Peat Moss	Sphagnaceae
LICHENS		
Cladina rangiferina	Reindeer Lichen	Cladoniaceae
Cladina stellaris	Coral Lichen	Cladoniaceae
Cladonia cenotea	Powdered Funnel Cladonia	Cladoniaceae
Cladonia chlorophaea	False Pixie Cup	Cladoniaceae
Cladonia coniocraea	Powder Horn Lichen	Cladoniaceae
Cladonia cristatella	British Soldiers	Cladoniaceae

J-1 – Shrub/spruce over glacial till,

J-2 – Spruce/shrub over glacial till

J-3 – Sedge/open water Fen

J-4 – Mixed woods (birch/spruce) over gravel

J-5 – Alder stand over gravel

J-6 – Closed sedge/moss fen over slightly decomposed peat

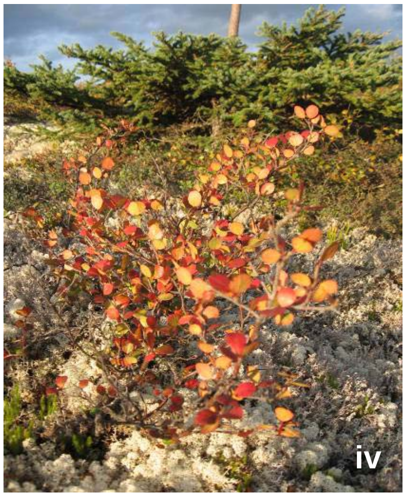
J-7 – Spruce/moss stand over glacial till

J-8 – Spruce/shrub over glacial till

i) Crowberry

ii) Bunchberry

iii) Clubmoss



iv) Dwarf Birch

v) False Pixie Cup

vi) Bearberry

vii) British Soldiers

viii) Bog bilberry

ix) Pyrola sp

x) Bog laurel

SY-1 – Shrub/spruce over till

SY-2 – Alder stand over exposed till,

SY-3 – Shrub/herb over till

Red-1- Open lichen/shrub over bedrock

Red 2 - Open lichen/shrub/moss over bedrock

Red-3 – Deciduous shrub/herb over glacial till

Red-4 – Closed sedge/moss fen,

Red-5 – Spruce/tamarack/shrub over glacial till

Red-6 – Spruce/shrub over glacial till

Red-7 – Closed sedge/willow fen

Red-8 – Closed ribbed fen - hummocks

Red-9 – Closed ribbed fen - sedge/open water

APPENDIX L

Bird Species Observed During Survey

Avifauna Species List

Table 1 Avifauna Observations for the James Property (James Mine North and James Mine South)

Ring-neck Duck (*Aythya collaris*) – G5

Preferred Habitat: Habitat consists of small (<4 ha) wetlands with some surrounding woody vegetation, often in heavily forest areas; shallow swamps, marshes and bogs with emergent vegetation. May also be found near reedy lakes or rivers; during migration also rivers, larger lakes, and ponds with marshy edges.

Observation: Probable breeding – Pair observed in breeding season in suitable habitat.

Osprey (*Pandion haliaetus*) – G5

Preferred Habitat: Habitat consists of lakes, rivers. Species nests in trees near water's edge or on large rocks. Species will use artificial structures as well such as transmission lines.

Observation: Confirmed breeding – Adult carrying food for young.

Bald Eagle (*Haliaeetus leucocephalus*) – G4

Preferred Habitat: Habitat requires large continuous area of deciduous or mixed woods around large lakes, and rivers. Requires an area of 255 ha for nesting, shelter, feeding, and roosting. Species prefers open woods with 30 to 50% canopy cover, nests in tall trees 50 to 200m from shore. Species requires tall, dead, partially dead trees within 400 m of nest for perching.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Short-billed Dowitcher (*Limnodromus griseus*) – G5

Preferred Habitat: Habitat consists of mudflats, estuaries, shallow marshes, pools, ponds, flooded fields and sandy beaches. Species prefers shallow salt water with soft muddy bottoms, but will visit various wetlands during migration. Species nests in grassy or mossy tundra and wet meadows, in muskeg.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Herring Gull (*Larus argentatus*) – G5

Preferred Habitat: Habitat consists of undisturbed open, rocky islands, peninsulas or cliffs along lakes or rivers. May also be found on sand dunes or headlands with various types of shores and islands.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Northern Flicker (*Colaptes auratus*) –

Preferred Habitat: Habitat consists of open deciduous, coniferous or mixed woodlands; forest edges; suburbs, farm woodlots and wetlands. May also use dead or dying trees with a diameter at breast height (dbh) >30 cm. This species is adaptable and is not dependent on forest size.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Yellow-bellied Flycatcher (*Empidonax flaviventris*) – G5

Preferred Habitat: Habitat consists of coniferous forest of pine and spruce with dense shrubs. Species may also br found in shrubby swamps with spruce, and alder. Can be found in low, wet swampy thickets bordering ponds, streams, bogs, and talus slopes.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Gray Jay (*Perisoreus Canadensis*) – G5

Preferred Habitat: Habitat consists of coniferous, mixed wood forests; forest openings, and bogs. Species is highly territorial, common in Labrador.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults

Common Raven (*Corvus corax*) – G5

Preferred Habitat: Habitat consists of relatively undisturbed habitat of boreal or mixed forest. May nest on steep cliffs or in tall trees, uses and builds onto same nest in consecutive years.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Boreal Chickadee (*Poecile hudsonicus*) – G5

Preferred Habitat: Habitat consists of conifers (spruce), wooded swamps, bogs, and thickets. Species nests in natural cavities, woodpecker holes, or their own excavation in decaying wood. Species territory is about 1-2 ha of woodland.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Winter Wren (*Troglodytes troglodytes*) – G5

Preferred Habitat: Habitat consists of coniferous forest with hemlock-pine communities; cedar swamps; spruce bogs and deep woods with dense undergrowth. May also be found near downed wood close to forest streams. Species nests in cavities of uprooted trees, old stumps, and brush piles, also nests in soft trees with dbh >10 cm. Species appears to need at least 30 ha of forest and is considered an interior species.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Ruby-crowned Kinglet* (*Regulus calendula*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed woodlands with stands of fir, spruce, tamarack or pine, evergreen stands in a variety of habitats. As well as, coniferous open or edge areas with thickets of brush, and bogs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Gray-cheeked Thrush (*Catharus minimus*) – G5, S3S4

Preferred Habitat: Habitat consists of moist northern woodlands and riparian areas up to Arctic tundra.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Swainson's Thrush* (*Catharus ustulatus*) – G5

Preferred Habitat: Habitat consists of coniferous forest interiors (spruce, fir), with deciduous shrubs. May also be found in low, damp woods near water and riverbanks. The species may also be observed in young or mature stands and will also use mixed woods.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Hermit Thrush (*Catharus guttatus*) – G5

Preferred Habitat: Habitat consists of boreal forest or Great Lakes-St. Lawrence forest zones. Consisting of rocky, dry, jack pine forests, as well as dry sandy coniferous or deciduous woods with dense young undergrowth. Species may also be found in spruce bogs, borders of wooded swamps and damp forest, and brushy pasture. Species appears to need at least 100 ha of forest in south.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Tennessee Warbler (*Vermivora peregrine*) – G5

Preferred Habitat: Habitat consists of brushy, semi-open land including grassy openings in coniferous, deciduous or mixed woods with dense shrubs and scattered clumps of young deciduous trees. Species can also be found in treed fens or boggy areas, dry pine plantations and beach ridges.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Orange-crowned Warbler (*Vermivora celata*) – G5

Preferred Habitat: Habitat consists of open deciduous or mixed woods with shrub undergrowth as well as second growth in clearings or burns, brushy thickets and tall stands of shrubbery

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Nashville Warbler (*Vermivora ruficapilla*) – G5

Preferred Habitat: Habitat consists of wet, open coniferous, deciduous or mixed woods of young secondary growth. May also be found in cedar, spruce swamps; dry or moist overgrown pastures and old field with scattered trees and shrubs and edges. Species nests in depressions in ground under dead, dry bracken fern.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Yellow Warbler (*Dendroica petechia*) – G5

Preferred Habitat: Habitat: Habitat consists of open areas with dense scrub, shrubby wetland areas; stream and river banks or lakeshores with scattered small trees or dense shrubbery. May also be found in farmlands, orchards or suburban yards.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Wilson’s Warbler (*Wilsonia pusilla*) – G5

Preferred Habitat: Habitat consists of boggy areas with cedar, tamarack or spruce. As well as swampy, brushy lands, streamside thickets and tangles. Species may also be found in wet, wooded high shrubs or low deciduous trees.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Fox Sparrow* (*Passerella iliaca*) – G5

Preferred Habitat: Habitat consists of thickets and edges of coniferous, mixed, or second-growth forests or chaparral.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Lincoln's Sparrow (*Melospiza lincolnii*) – G5

Preferred Habitat: Habitat consists of muskegs, bogs, swamps; regenerated stands following cutting or fires and hedgerows. Species may also be found in spruce forests with clearings; willow, alder thickets; low brushy growth with openings of grass or sedge, and edges of lakes, rivers.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

White-throated Sparrow* (*Zonotrichia albicollis*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed, semi-open forests with jack pine or spruce, balsam fir, aspen, and white birch. May also be found in old cut-overs or burns with forest regeneration and slash piles, brushy clearings, and borders of bogs. Species nests on the ground in brush piles or under logs.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

White-crowned Sparrow (*Zonotrichia leucophrys*) – G5

Preferred Habitat: Species breeds in shrub growth in open areas such as woodland edge, forest burns, willow clumps on tundra, and stream edges. Species nests on ground; may winter in southern Ontario

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

White-wing Crossbill* (*Loxia leucoptera*)

Preferred Habitat: Habitat consists of boreal forest with tamarack, spruce, fir or hemlock.

Observation: Probable breeding – Pair observed in their breeding season in suitable habitat.

American Robin (*Turdus migratorius*) – G5

Preferred Habitat: Habitat consists of residential areas, lawns, gardens, ornamental trees, shrubberies. May also be found in forest edges and openings, burns, cut-over areas, as well as fens, bogs; lake or river shores.

Observation: Confirmed breeding – Recently fledged young or downy young.

Yellow-rumped Warbler* (*Dendroica coronata*) – G5

Preferred Habitat: Habitat consists of dry coniferous or mixed forests dominated by fir, spruce, pine, hemlock or cedar with scattered openings from logging, fire or abandoned fields. May also be found in evergreen plantations; young coniferous growth at woodland edges as well as wetter habitat of black spruce or tamarack. Species is adaptable and opportunistic.

Observation: Confirmed breeding – Adult carrying food for young.

Blackpoll Warbler (*Dendroica striata*) – G5

Preferred Habitat: Habitat consists of coniferous forests during breeding season, and during migration found chiefly in tall trees.

Observation: Confirmed breeding – Adult carrying food for young.

Northern Waterthrush* (*Seiurus noveboracensis*) – G5

Preferred Habitat: Habitat consists of cool, shady, wet ground with open shallow pools of water; shrubby tangles, and fallen logs. May also be found in wooded swamps, bogs, creek, stream banks or swampy lakeshores. Species nests in banks, upturned tree roots or under mossy logs or stumps.

Observation: Confirmed breeding – Adult carrying food for young.

Dark-eye Junco* (*Junco hyemalis*) – G5

Preferred Habitat: Habitat consists of coniferous woodlands with aspen, birch and clearings; young jack pine stands; burned areas, and forest edges. Species may also be found in borders of streams or clearings. Nests in depression on ground, under roots, rocks or logs. Winters in conifers, hedgerows or brushy field borders.

Observation: Confirmed breeding – Adult carrying food for young.

Alder Flycatcher (*Empidonax alnorum*) – G5

Preferred Habitat: Habitat consists of open areas with alder, willow thickets bordering lakes or streams; low damp thickets in or near bogs, and swamps or marshes. Species prefers alders, willows, elders or sumacs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

* represents species most frequently observed within the site

Table 2 Avifauna Results for Silver Yards Property

Green-winged Teal (*Anas crecca*) – G5

Preferred Habitat: Habitat consists of marshes, rivers, lakes or ponds, and shorelines. Species nests in upland areas, dense stands of grass or brush from 36- 100 m from wetland edge. Species nests occasionally found far from water.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Osprey (*Pandion haliaetus*) – G5

Preferred Habitat: Habitat consists of lakes, rivers. Species nests in trees near water's edge or on large rocks. Species will use artificial structures such as transmission lines.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Spotted Sandpiper (*Actitis macularia*) – G5

Preferred Habitat: Habitat consists of a variety of habitat types near water. Species often forages on floating logs

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Alder Flycatcher (*Empidonax alnorum*) – G5

Preferred Habitat: Habitat consists of open areas with alder, willow thickets bordering lakes or streams; low damp thickets in or near bogs, and swamps or marshes. Species prefers alders, willows, elders or sumacs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Gray Jay (*Perisoreus Canadensis*) – G5

Preferred Habitat: Habitat consists of coniferous, mixed wood forests; forest openings, and bogs. Species is highly territorial, common in Labrador.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Common Raven* (*Corvus corax*) – G5

Preferred Habitat: Habitat consists of relatively undisturbed habitat of boreal or mixed forest. May nest on steep cliffs or in tall trees, uses and builds onto same nest in consecutive years.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Ruby-crowned Kinglet* (*Regulus calendula*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed woodlands with stands of fir, spruce, tamarack or pine, evergreen stands in a variety of habitats. As well as, coniferous open or edge areas with thickets of brush, and bogs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Gray-cheeked Thrush (*Catharus minimus*) – G5, S3S4

Preferred Habitat: Habitat consists of moist northern woodlands and riparian areas up to Arctic tundra.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Swainson's Thrush* (*Catharus ustulatus*) – G5

Preferred Habitat: Habitat consists of coniferous forest interiors (spruce, fir), with deciduous shrubs. May also be found in low, damp woods near water and riverbanks. The species may also be observed in young or mature stands and will also use mixed woods.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Hermit Thrush (*Catharus guttatus*) – G5

Preferred Habitat: Habitat consists of boreal forest or Great Lakes-St. Lawrence forest zones. Consisting of rocky, dry, jack pine forests, as well as dry sandy coniferous or deciduous woods with dense young undergrowth. Species may also be found in spruce bogs, borders of wooded swamps and damp forest, and brushy pasture. Species appears to need at least 100 ha of forest in south.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Tennessee Warbler (*Vermivora peregrine*) – G5

Preferred Habitat: Habitat consists of brushy, semi-open land including grassy openings in coniferous, deciduous or mixed woods with dense shrubs and scattered clumps of young deciduous trees. Species can also be found in treed fens or boggy areas, dry pine plantations and beach ridges.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Orange-crowned Warbler (*Vermivora celata*) – G5

Preferred Habitat: Habitat consists of open deciduous or mixed woods with shrub undergrowth as well as second growth in clearings or burns, brushy thickets and tall stands of shrubbery

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Yellow Warbler (*Dendroica petechia*) – G5

Preferred Habitat: Habitat: Habitat consists of open areas with dense scrub, shrubby wetland areas; stream and river banks or lakeshores with scattered small trees or dense shrubbery. May also be found in farmlands, orchards or suburban yards.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Yellow-rumped Warbler (*Dendroica coronata*) – G5

Preferred Habitat: Habitat consists of dry coniferous or mixed forests dominated by fir, spruce, pine, hemlock or cedar with scattered openings from logging, fire or abandoned fields. May also be found in evergreen plantations; young coniferous growth at woodland edges as well as wetter habitat of black spruce or tamarack. Species is adaptable and opportunistic.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Blackpoll Warbler (*Dendroica striata*) – G5

Preferred Habitat: Habitat consists of coniferous forests during breeding season, and during migration found chiefly in tall trees.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Northern Waterthrush* (*Seiurus noveboracensis*) – G5

Preferred Habitat: Habitat consists of cool, shady, wet ground with open shallow pools of water; shrubby tangles, and fallen logs. May also be found in wooded swamps, bogs, creek, stream banks or swampy lakeshores. Species nests in banks, upturned tree roots or under mossy logs or stumps.

Observation: Confirmed breeding – Adult carrying food for young.

Wilson's Warbler (*Wilsonia pusilla*) – G5

Preferred Habitat: Habitat consists of boggy areas with cedar, tamarack or spruce. As well as swampy, brushy lands, streamside thickets and tangles. Species may also be found in wet, wooded high shrubs or low deciduous trees.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Fox Sparrow* (*Passerella iliaca*) – G5

Preferred Habitat: Habitat consists of thickets and edges of coniferous, mixed, or second-growth forests or chaparral.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Lincoln's Sparrow (*Melospiza lincolnii*) – G5

Preferred Habitat: Habitat consists of muskegs, bogs, swamps; regenerated stands following cutting or fires and hedgerows. Species may also be found in spruce forests with clearings; willow, alder thickets; low brushy growth with openings of grass or sedge, and edges of lakes, rivers.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

White-throated Sparrow* (*Zonotrichia albicollis*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed, semi-open forests with jack pine or spruce, balsam fir, aspen, and white birch. May also be found in old cut-overs or burns with forest regeneration and slash piles, brushy clearings, and borders of bogs. Species nests on the ground in brush piles or under logs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

White-crowned Sparrow * (*Zonotrichia leucophrys*) – G5

Preferred Habitat: Species breeds in shrub growth in open areas such as woodland edge, forest burns, willow clumps on tundra, and stream edges. Species nests on ground; may winter in southern Ontario

Observation: Confirmed breeding – Recently fledge young or downy young.

Dark-eye Junco* (*Junco hyemalis*) – G5

Preferred Habitat: Habitat consists of coniferous woodlands with aspen, birch and clearings; young jack pine stands; burned areas, and forest edges. Species may also be found in borders of streams or clearings. Nests in depression on ground, under roots, rocks or logs. Winters in conifers, hedgerows or brushy field borders.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

White-wing Crossbill (*Loxia leucoptera*) – G5

Preferred Habitat: Habitat consists of boreal forest with tamarack, spruce, fir or hemlock.

Observation: Probable breeding – Pair observed in their breeding season in suitable habitat.

Common Redpoll* (*Carduelis flammea*) – G5

Preferred Habitat: Habitat consists of low shrub tundra or barren-lands with patches of spruce, tamarack, alder, and willow thickets. Species winters near alder, birches in snow-covered weedy fields and frequents feeders.

Observation: Confirmed breeding – Recently fledge young or downy young.

Pine Siskin (*Carduelis pinus*) – G5

Preferred Habitat: Habitat consists of coniferous, mixed woods; coniferous plantations; alder thickets, as well as weed patches next to forests.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

- represents species most frequently observed within the site

Table 3 Avifauna Results for Redmond Property

Greater Scaup (*Aythya marila*) – G5

Preferred Habitat: Habitat consists of pond, marshes and lakes.

Observation: Probable – Pair observed in breeding season in suitable habitat.

Common Goldeneye (*Bucephala clangula*) – G5

Preferred Habitat: Habitat consists of wetlands, rivers or lakes with deep (~2 m) water; open lakes with nearby woodlands and marshy edges. May also be found in bulrush in water 1m deep Species breeding distribution depends on availability of trees >30 cm diameter at breast height (dbh).

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Osprey (*Pandion haliaetus*) – G5

Preferred Habitat: Habitat consists of lakes, rivers. Species nests in trees near water's edge or large rocks. Species will use artificial structures such as transmission lines.

Observation: Probable breeding – Nest building or excavation of nest hole.

Spruce Grouse (*Falcipennis Canadensis*) – G5

Preferred Habitat: Habitat consists of dense stands of conifers, young jack pine, upland black spruce forests on stream borders, tamarack swamps, cedar bogs, and muskegs. Species nests on ground under woody debris.

Observation: Confirmed breeding – recently fledge young or downy young.

Semipalmated Plover (*Charadrius semipalmatus*) – G5

Preferred Habitat: Breeding habitat consists of sandy or mossy tundra from Alaska to Newfoundland and Nova Scotia. Species winters on mudflats, salt marshes, and lakeshores along coastal California and the Carolinas south.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Greater Yellowlegs (*Tringa melanoleuca*) – G5

Preferred Habitat: Habitat consists of fens, bogs, sloughs, shallow ponds surrounded or interspersed with tree, shrub cover.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Solitary Sandpiper (*Tringa solitaria*) – G5

Preferred Habitat: Habitat consists of open, wet northern coniferous forest woodlands, wetlands, ponds, and lakes. Species nests in abandoned bird nests in trees.

Observation: Probable breeding – Nest building or excavation of nest hole.

Spotted Sandpiper (*Actitis macularia*) – G5

Preferred Habitat: Habitat consists of a variety of habitat types near water. Species often forages on floating logs

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Wilson's Snipe (*Gallinago gallinago*) – G5

Preferred Habitat: Habitat consists of freshwater marshes and swamps. Species often frequents open landscapes.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

American Three-toed woodpecker (*Picoides tridactylus*) – G5

Preferred Habitat: Habitat consists of moist, mature or old growth coniferous woodlands of cedar-balsam fir. Species may be found near burns with stands of dead timber, as well as riparian areas, bogs. Species is loosely colonial where nesting habitat is particularly suitable and food supply abundant, furthermore uses dead trees > 30 cm dbh, and needs extensive (□ 40 ha) of forest.

Observation: Probable breeding – Courtship or display between male and female or two males including courtship feeding and copulation.

Northern Flicker (*Colaptes auratus)* – G5

Preferred Habitat: Habitat consists of open deciduous, coniferous or mixed woodlands; forest edges; suburbs, farm woodlots and wetlands. May also use dead or dying trees with a diameter at breast height (dbh) >30 cm. This species is very adaptable and is not dependent on forest size.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Yellow-bellied Flycatcher (*Empidonax flaviventris*) – G5

Preferred Habitat: Habitat consists of coniferous forest of pine and spruce with dense shrubs. Species may also br found in shrubby swamps with spruce, and alder. Can be found in low, wet swampy thickets bordering ponds, streams, bogs, and talus slopes.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Alder Flycatcher (*Empidonax alnorum*) – G5

Preferred Habitat: Habitat consists of open areas with alder, willow thickets bordering lakes or streams; low damp thickets in or near bogs, and swamps or marshes. Species prefers alders, willows, elders or sumacs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Gray Jay* (*Perisoreus Canadensis*) – G5

Preferred Habitat: Habitat consists of coniferous, mixed wood forests; forest openings, and bogs. Species is highly territorial, common in Labrador.

Observation: Confirmed breeding – Recently fledged young or downy young.

Common Raven (*Corvus corax*) – G5

Preferred Habitat: Habitat consists of relatively undisturbed habitat of boreal or mixed forest. May nest on steep cliffs or in tall trees, uses and builds onto same nest in consecutive years.

Observation: Confirmed breeding – Recently fledge young or downy young.

Boreal Chickadee (*Poecile hudsonicus*) – G5

Preferred Habitat: Habitat consists of conifers (spruce), wooded swamps, bogs, and thickets. Species nests in natural cavities, woodpecker holes, or their own excavation in decaying wood. Species territory is about 1-2 ha of woodland.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Ruby-crowned Kinglet* (*Regulus calendula*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed woodlands with stands of fir, spruce, tamarack or pine, evergreen stands in a variety of habitats. As well as, coniferous open or edge areas with thickets of brush, and bogs.

Observation: Confirmed breeding – Recently fledge young or downy young.

Gray-cheeked Thrush (*Catharus minimus*) – G5, S3S4

Preferred Habitat: Habitat consists of moist northern woodlands and riparian areas up to Arctic tundra.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Swainson's Thrush* (*Catharus ustulatus*) – G5

Preferred Habitat: Habitat consists of coniferous forest interiors (spruce, fir), with deciduous shrubs. May also be found in low, damp woods near water and riverbanks. The species may also be observed in young or mature stands and will also use mixed woods.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Hermit Thrush (*Catharus guttatus*) – G5

Preferred Habitat: Habitat consists of boreal forest or Great Lakes-St. Lawrence forest zones. Consisting of rocky, dry, jack pine forests, as well as dry sandy coniferous or deciduous woods with dense young undergrowth. Species may also be found in spruce bogs, borders of wooded swamps and damp forest, and brushy pasture. Species appears to need at least 100 ha of forest in south.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

American Robin (*Turdus migratorius*) – G5

Preferred Habitat: Habitat consists of residential areas, lawns, gardens, ornamental trees, shrubberies. May also be found in forest edges and openings, burns, cut-over areas, as well as fens, bogs; lake or river shores.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

American Pipit (*Anthus rubescens*) – G5

Preferred Habitat: Habitat consists of Arctic and alpine tundra, beaches, barren fields, agricultural lands, and golf courses.

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Tennessee Warbler (*Vermivora peregrine*) – G5

Preferred Habitat: Habitat consists of brushy, semi-open land including grassy openings in coniferous, deciduous or mixed woods with dense shrubs and scattered clumps of young deciduous trees. Species can also be found in treed fens or boggy areas, dry pine plantations and beach ridges.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Orange-crowned Warbler (*Vermivora celata*) – G5

Preferred Habitat: Habitat consists of open deciduous or mixed woods with shrub undergrowth as well as second growth in clearings or burns, brushy thickets and tall stands of shrubbery.

Observation: Confirmed breeding – Adult carrying food for young**.**

Yellow Warbler (*Dendroica petechia*) – G5

Preferred Habitat: Habitat: Habitat consists of open areas with dense scrub, shrubby wetland areas; stream and river banks or lakeshores with scattered small trees or dense shrubbery. May also be found in farmlands, orchards or suburban yards.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Yellow-rumped Warbler* (*Dendroica coronata*) – G5

Preferred Habitat: Habitat consists of dry coniferous or mixed forests dominated by fir, spruce, pine, hemlock or cedar with scattered openings from logging, fire or abandoned fields. May also be found in evergreen plantations; young coniferous growth at woodland edges as well as wetter habitat of black spruce or tamarack. Species is adaptable and opportunistic.

Observation: Confirmed breeding – Adult carrying food for young.

Blackpoll Warbler (*Dendroica striata*) – G5

Preferred Habitat: Habitat consists of coniferous forests during breeding season, and during migration found chiefly in tall trees.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Northern Waterthrush (*Seiurus noveboracensis*) – G5

Preferred Habitat: Habitat consists of cool, shady, wet ground with open shallow pools of water; shrubby tangles, and fallen logs. May also be found in wooded swamps, bogs, creek, stream banks or swampy lakeshores. Species nests in banks, upturned tree roots or under mossy logs or stumps.

Observation: Probable breeding – Agitated behavior or anxiety calls of adults.

Wilson's Warbler (*Wilsonia pusilla*) – G5

Preferred Habitat: Habitat consists of boggy areas with cedar, tamarack or spruce. As well as swampy, brushy lands, streamside thickets and tangles. Species may also be found in wet, wooded high shrubs or low deciduous trees.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

American Tree Sparrow (*Spizella arborea*) – G5

Preferred Habitat: Habitat consists of open areas with scattered trees, brush; low-lying tundra with stands of shrubs, stunted trees, especially willow, birch, alder. During winter, species may be found in weedy, brushy fields, open country with groves of small trees, hedgerows, and marshes

Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

Fox Sparrow* (*Passerella iliaca*) – G5

Preferred Habitat: Habitat consists of thickets and edges of coniferous, mixed, or second-growth forests or chaparral.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

Lincoln's Sparrow* (*Melospiza lincolnii*) – G5

Preferred Habitat: Habitat consists of muskegs, bogs, swamps; regenerated stands following cutting or fires and hedgerows. Species may also be found in spruce forests with clearings; willow, alder thickets; low brushy growth with openings of grass or sedge, and edges of lakes, rivers.

Observation: Confirmed breeding – Adult carrying food for young.

White-throated Sparrow* (*Zonotrichia albicollis*) – G5

Preferred Habitat: Habitat consists of coniferous or mixed, semi-open forests with jack pine or spruce, balsam fir, aspen, and white birch. May also be found in old cut-overs or burns with forest regeneration and slash piles, brushy clearings, and borders of bogs. Species nests on the ground in brush piles or under logs.

Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.

White-crowned Sparrow (*Zonotrichia leucophrys*) – G5

Preferred Habitat: Species breeds in shrub growth in open areas such as woodland edge, forest burns, willow clumps on tundra, and stream edges. Species nests on

ground; may winter in southern Ontario Observation: Confirmed breeding – Recently fledge young or downy young.
Dark-eye Junco* (*Junco hyemalis*) – G5 Preferred Habitat: Habitat consists of coniferous woodlands with aspen, birch and clearings; young jack pine stands; burned areas, and forest edges. Species may also be found in borders of streams or clearings. Nests in depression on ground, under roots, rocks or logs. Winters in conifers, hedgerows or brushy field borders. Observation: Confirmed breeding – Recently fledge young or downy young.
Rusty Blackbird (Euphagus carolinus) – G5, Special Concern - COSEWIC Preferred Habitat: Habitat consists of openings in coniferous woodlands bordering bodies of water as well as tree- bordered marshes, beaver ponds, muskegs, bogs, and fens or wooded swamps. Species may also be found in stream borders with alder, willow; wooded islands on lakes. Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.
Pine Grosbeak (*Pinicola enucleator*) – G5 Preferred Habitat: Habitat consists of open coniferous forests with spruce or fir as well as forest edges, and clearings. Observation: Possible breeding – Signing male present or breeding calls heard in breeding season in suitable habitat.
White-wing Crossbill (*Loxia leucoptera*) – G5 Preferred Habitat: Habitat consists of boreal forest with tamarack, spruce, fir or hemlock. Observation: Probable breeding – Pair observed in their breeding season in suitable habitat.
Common Redpoll (*Carduelis flammea*) – G5 Preferred Habitat: Habitat consists of low shrub tundra or barren-lands with patches of spruce, tamarack, alder, and willow thickets. Species winters near alder, birches in snow-covered weedy fields and frequents feeders. Observation: Possible breeding – Species observed in breeding season in suitable nesting habitat.

* represents species most frequently observed within the site

Table 4 Avifauna Species Observed in the Project Area

SPECIES	JAMES	REDMOND	SILVER YARDS/ BURNT AND RUTH PITS
Green-winged Teal			1 / H
Ring-necked Duck	4 / P		
Greater Scaup		2 / P	
White-winged Scoter		1 / X	
Common Goldeneye		1 / H	
Osprey	1 / CF	1 / N	1 / H
Bald Eagle	1 / H		
Spruce Grouse		6 / FY	
Semipalmated Plover		2 / H	
Greater Yellowlegs		1 / H	
Solitary Sandpiper		2 / N	
Spotted Sandpiper		2 / A	2 / H
Short-billed Dowitcher	1 / H		
Wilson’s Snipe		1 / H	
Herring Gull	1 / H		65 / X
American Three-toed Woodpecker		1 / D	
Northern Flicker	1 / H	1 / H	
Yellow-bellied Flycatcher	1 / S	1 / S	
Alder Flycatcher	1 / S	1 / S	1 / S

Gray Jay	2 / A	3 / FY	1 / H
Common Raven	1 / H	3 / FY	3 / A
Boreal Chickadee	1 / H	1 / H	
Winter Wren	2 / S		
Ruby-crowned Kinglet	3 / S	3 / CF	2 / S
Gray-cheeked Thrush	1 / S	1 / S	3 / S
Swainson’s Thrush	3 / A	2 / S	2 / S
Hermit Thrush	1 / S	2 / S	1 / S
American Robin	2 / FY	2 / S	
American Pipit		1 / H	
Tennessee Warbler	1 / S	2 / A	1 / S
Orange-crowned Warbler	1 / S	1 / CF	1 / H
Nashville Warbler	1 / S		
Yellow Warbler	1 / S	1 / S	1 / S
Yellow-rumped Warbler	3 / CF	6 / CF	4 / S
Blackpoll Warbler	5 / CF	2 / A	2 / S
Northern Waterthrush	3 / CF	2 / A	4 / CF
Wilson’s Warbler	2 / S	1 / S	2 / S
American Tree Sparrow		1 / H	
Fox Sparrow	3 / S	3 / S	2 / S
Lincoln’s Sparrow	2 / A	5 / CF	2 / S
White-throated Sparrow	6 / A	1 / S	2 / S

White-crowned Sparrow	2 / S	7 / FY	3 / FY
Dark-eyed Junco	3 / CF	6 / FY	2 / H
Rusty Blackbird		1 / S	
Pine Grosbeak		1 / S	
White-winged Crossbill	19 / P	45 / P	26 / P
Common Redpoll		2 / H	3 / FY
Pine Siskin			1 / H
Species Totals	**31**	**40**	**26**

APPENDIX M

Breeding and Migratory Birds of the Study Area

Table 1 Breeding and Migratory Birds of Labrador Iron Mines Study Area

Common Name	Scientific Name	Status*		Breeding**	Migratory	Other	
		Species at Risk (national)	Species at Risk (provincial)	Observed (O) or Possible (P)	Possible	Year-round or Over-wintering	Rare/ Unlikely to occur
Common Loon	*Gavia immer*			O			
Red-throated loon	*Gavia stellata*			O			
American Bittern	*Botaurus lentiginosus*			P			
Great Blue Heron	*Ardea herodias*				P		
Canada Goose	*Branta canadensis*			O			
Wood Duck	*Aix sponsa*				P		
Green-winged Teal	*Anas crecca*			O			
Ring-necked Duck	*Aythya collaris*			O			
American Black Duck	*Anas rubripes*			O			
Mallard	*Anas platyrhynchos*			P			
Northern Pintail	*Anas acuta*			P			
Northern Shoveler	*Anas clypeata*				P		
Blue-winged Teal	*Anas discors*				P		
Gadwall	*Anas strepera*						X
American Wigeon	*Anas americana*				P		
Greater Scaup	*Aythya marila*			O			
Lesser Scaup	*Aythya affinis*			P			
Harlequin Duck	*Histrionicus histrionicus*		Vulnerable	P			
Long-tailed Duck	*Clangula hyemalis*			P			
Surf Scoter	*Melanitta perspicillata*			P			
White-winged Scoter	*Melanitta fusca*			O			
Black Scoter	*Melanitta nigra*			P			
Common Goldeneye	*Bucephala clangula*			O			
Barrow's Goldeneye	*Bucephala islandica*	SC	Vulnerable	P			
Hooded Merganser	*Lophodytes cucullatus*			P			
Common Merganser	*Mergus merganser*			O			
Red-breasted Merganser	*Mergus serrator*			O			
Osprey	*Pandion haliaetus*			O			
Sharp-shinned Hawk	*Accipiter striatus*			P			
Northern Harrier	*Circus cyaneus*			P			
Bald Eagle	*Haliaeetus leucocephalus*			O			
Golden Eagle	*Aquila chrysaetos*			P			
Northern Goshawk	*Accipiter gentilis*			P			
Red-tailed Hawk	*Buteo jamaicensis*			P			
Rough-legged Hawk	*Buteo lagopus*			P			
American Kestrel	*Falco sparverius*			P			
Merlin	*Falco columbarius*			P			
Peregrine Falcon	*Falco peregrinus*	SC	Vulnerable		P		
Gyrfalcon	*Falco rusticolus*						X
Ruffed Grouse	*Bonasa umbellus*			P		year-round	
Spruce Grouse	*Falcipennis canadensis*			O		year-round	
Willow Ptarmigan	*Lagopus lagopus*			O		year-round	
Rock Ptarmigan	*Lagopus mutus*			P		year-round	
Black-bellied Plover	*Pluvialis squatarola*				P		

Common Name	Scientific Name	Status*		Breeding**	Migratory	Other	
		Species at Risk (national)	Species at Risk (provincial)	Observed (O) or Possible (P)	Possible	Year-round or Over-wintering	Rare/ Unlikely to occur
American Golden Plover	*Pluvialis dominica*				P		
Killdeer	*Charadrius vociferus*						X
Semipalmated Plover	*Charadrius semiplamatus*			O			
Greater Yellowlegs	*Tringa melanoleuca*			O			
Solitary Sandpiper	*Tringa solitaria*			O			
Spotted Sandpiper	*Actitis macularia*			O			
Ruddy Turnstone	*Arenaria interpres*						X
Sanderling	*Calidris alba*						X
Red Knot	*Calidris canutus*	END	Endangered				X
Dunlin	*Calidris alpina*				P		
White-rumped Sandpiper	*Calidris fuscicollis*				P		
Semipalmated Sandpiper	*Calidris pusilla*				P		
Least Sandpiper	*Calidris minutilla*			O			
Short-billed Dowitcher	*Limnodromus griseus*			O			
Wilson's Snipe	*Gallinago delicata*			O			
American Woodcock	*Scolopax minor*						X
Red-necked Phalarope	*Phalaropus lobatus*			P			
Black-legged Kittiwake	*Rissa tridactyla*						X
Sabine's Gull	*Xema sabini*						X
Herring Gull	*Larus argentatus*			O			
Iceland Gull	*Larus glaucoides*						X
Great Black-backed Gull	*Larus marinus*						X
Lesser Black-backed Gull	*Larus fuscus*						X
Glaucous Gull	*Larus hyperboreus*						X
Common Tern	*Sterna hirundo*			P			
Arctic Tern	*Sterna paradisaea*			P			
Mourning Dove	*Zenaida macroura*				P		
Great Horned Owl	*Bubo virginianus*			P		year-round	
Great Gray Owl	*Strix nebulosa*						X
Snowy Owl	*Bubo scandiaca*				P	over-winter	
Northern Hawk Owl	*Surnia ulula*			P		year-round	
Short-eared Owl	*Asio flammeus*	SC	Vulnerable	P			
Boreal Owl	*Aegolius funereus*			P		year-round	
Chimney Swift	*Chaetura pelagica*	THR	Threatened				X
Common Nighthawk	*Chordeiles minor*	THR	Threatened	P			
Belted Kingfisher	*Ceryle alcyon*			P			
Yellow-bellied Sapsucker	*Sphyrapicus varius*			P			
Hairy Woodpecker	*Picoides villosus*			P		year-round	
Three-toed Woodpecker	*Picoides tridactylus*			O		year-round	
Black-backed Woodpecker	*Picoides arcticus*			P		year-round	
Northern Flicker	*Colaptes auratus*			O			
Olive-sided Flycatcher	*Contopus cooperi*	THR		P			
Yellow-bellied Flycatcher	*Empidonax flaviventris*			O			
Alder Flycatcher	*Empidonax alnorum*			O			
Eastern Kingbird	*Tyrannus tyrannus*						X
Horned Lark	*Eremophila alpestris*			O			

Common Name	Scientific Name	Status*		Breeding**	Migratory	Other	
		Species at Risk (national)	Species at Risk (provincial)	Observed (O) or Possible (P)	Possible	Year-round or Over-wintering	Rare/ Unlikely to occur
Tree Swallow	*Tachycineta bicolor*			O			
Bank Swallow	*Riparia riparia*			P			
Gray Jay	*Perisoreus canadensis*			O		year-round	
American Crow	*Corvus brachyrhynchos*			P			
Common Raven	*Corvus corax*			O		year-round	
Boreal Chickadee	*Poecile hudsonica*			O		year-round	
Red-breasted Nuthatch	*Sitta canadensis*			P		Year-round	
Winter Wren	*Troglodytes troglodytes*			O			
Golden-crowned Kinglet	*Regulus satrapa*			P			
Ruby-crowned Kinglet	*Regulus calendula*			O			
Gray-cheeked Thrush	*Catharus minimus*		Vulnerable	O			
Swainson's Thrush	*Catharus ustulatus*			O			
Hermit Thrush	*Catharus guttatus*			O			
American Robin	*Turdus migratorius*			O			
American Pipit	*Anthus rubescens*			O	P		
Bohemian Waxwing	*Bombycilla garrulus*			P		year-round	
Cedar Waxwing	*Bombycilla cedrorum*						X
Philadelphia Vireo	*Vireo philadelphicus*			P			
Northern Shrike	*Lanius excubitor*			P			
European Starling	*Sturnus vulgaris*						X
Tennessee Warbler	*Vermivora peregrina*			O			
Orange-crowned Warbler	*Vermivora celata*			O			
Nashville Warbler	*Vermivora ruficapilla*			O			
Yellow Warbler	*Dendroica petechia*			O			
Black-throated Green Warbler	*Dendroica virens*			P			
Yellow-rumped Warbler	*Dendroica coronata*			O			
Palm Warbler	*Dendroica palmarum*			P			
Blackpoll Warbler	*Dendroica striata*			O			
Common Yellowthroat	*Geothlypis trichas*						X
Northern Waterthrush	*Seiurus noveboracensis*			O			
Wilson's Warbler	*Wilsonia pusilla*			O			
American Tree Sparrow	*Spizella arborea*			O			
Savannah Sparrow	*Passerculus sandwichensis*			P			
Lincoln's Sparrow	*Melospiza lincolnii*			O			
Swamp Sparrow	*Melospiza georgiana*			P			
Fox Sparrow	*Passerella iliaca*			O			
White-throated Sparrow	*Zonotrichia albicollis*			O			
White-crowned Sparrow	*Zonotrichia leucophrys*			O			
Dark-eyed Junco	*Junco hyemalis*			O			
Snow Bunting	*Plectrophenax nivalis*				P		
Lapland Longspur	*Calcarius lapponicus*				P		
Rusty Blackbird	*Euphagus carolinus*	SC	Vulnerable	O			
Hoary Redpoll	*Carduelis hornemanni*					over-winter	
Common Redpoll	*Carduelis flammea*			O		year-round	
Purple Finch	*Carpodacus purpureus*						X
Pine Grosbeak	*Pinicola enucleator*			O			

Common Name	Scientific Name	Status*		Breeding**	Migratory	Other	
		Species at Risk (national)	Species at Risk (provincial)	Observed (O) or Possible (P)	Possible	Year-round or Over-wintering	Rare/ Unlikely to occur
Pine Siskin	*Carduelis pinus*			O			
White-winged Crossbill	*Loxia leucoptera*			O		year-round	
Number of Species: 138							
Number of national Species at Risk: 8							
Number of provincial Species at Risk: 9							
*National Species at Risk are those listed by COSEWIC = Committee on the Status of Endangered Wildlife in Canada							
Provincial Species at Risk are those listed by Newfoundland and Labrador Regulation 57/02,							
Endangered Species List Regulations under the Endangered Species Act							
END = Endangered, THR = Threatened, SC = Special Concern							
**Observed (O): Observed during point-count surveys conducted July 2008							
**Possible (P): Though not observed during point counts, study area falls within or just north of their range of occurrence							
Data on 'Possible' species range of occurrence taken from range maps illustrated in:							
Sibley, D.A. 2003. The Sibley Field Guide to Birds of Eastern North America. Chanticleer Press, Inc. New York.							

APPENDIX N

Fish Habitat Assessment Report,

James Property Unnamed Tributary

Labrador Iron Mines Limited

Fish Habitat Assessment Report – James Property Unnamed Tributary

Prepared by:

Earth Tech doing business as AECOM
702 – 101 Frederick Street, Floor 7, The Galleria, Kitchener, ON, Canada N2H 6R2
T 519.570.4886 F 519.570.3379 www.aecom.com

Date:

December 2008

AECOM

AECOM
702 – 101 Frederick Street, Floor 7, The Galleria, Kitchener, ON, Canada   N2H 6R2
T 519.570.4886   F 519.570.3379   www.aecom.com

December 6, 2008 Project Number:101931

Ms. Linda Wrong
Labrador Iron Mines Limited
220 Bay Street, Suite 700
Toronto, Ontario   M5J 2W4

Dear Ms. Wrong:

Re: Fish Habitat Assessment Report – James Property, Unnamed Tributary

Please find enclosed a Fish Habitat Assessment Report, prepared by AECOM, with hydrological support from WESA for the Unnamed Tributary located on the James Property. This assessment report contains extracted information from the Environmental Impact Statement currently being prepared on behalf of Labrador Iron Mines Ltd. for the West Central Labrador Iron Ore Project.

The conditions documented herein represent the existing fish habitat before the start of ore extraction at the James Property. Discussions on the potential impacts from mining operations and the proposed mitigation measures to offset any potential harmful alteration, disturbance or destruction (HADD) are discussed.

If you should have any questions with regards to this report, please feel free to contact us.

Sincerely,
Earth Tech doing business as AECOM

Derek Parks

Derek Parks, B.Sc (Hon), M.Sc.
Senior Aquatic Ecologist
derek.parks@aecom

Encl.
cc: Byron O'Connor, WESA

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
0	Derek Parks	November 28, 2008	Issued to Client for comments
1	Derek Parks	December 5, 2008	Revised report issued to Client for comments
2	Derek Parks	December 8, 2008	Final Report distributed to DFO
3	Derek Parks	December 19, 2008	Revisions to WESA 2008 Report (Appendix A)
4	Derek Parks	August 11, 2009	Revisions to Project Description

Signature Page

Report Prepared By:	Report Reviewed By:
Derek Parks	
Derek Parks, B.Sc. (Hon), M.Sc. Senior Aquatic Ecologist	Dean Fitzgerald, Ph. D. Senior Environmental Ecologist

Table of Contents

List of Figures

List of Tables

Appendices

A. WESA 2008. James Property Hydrology and Water Balance, (Section 4.1.4) of the Environmental Impact Statement for Labrador Iron Mines Ltd. pp.19.

B. Appendix Site Photographs

1. Introduction

Labrador Iron Mines (LIM) plans to reactivate the mining of iron ore deposits in this location of western Labrador, an area of past intensive mining activities. Haematite iron ores will be mined from a number of known deposits where similar activities have previously taken place. Mining activities will be conducted in a sequential manner using conventional open pit mining methods. According to the Newfoundland and Labrador Mining Act (1999), a mill means " a facility in which a substance containing minerals may be concentrated by physical or chemical process or otherwise treated, except by simple washing or crushing. As the proposed beneficiation at the Silver Yard will be conducted using semi-mobile washer and crusher, the use of a mill is not required. Once the rock is mined, washed, crushed and sorted (beneficiated), it will be loaded onto rail cars, at the Silver Yards, located to the North of the James property in Labrador, for shipment south. No chemicals will be used in the beneficiation. The Silver Yards was historically operated as a rock storage, marshalling and loading yard by IOC and, although the former rail spur line was removed, the rail bed is still present in this area and is in good condition. As a result, the project will also included the re-establishment of the spur line rail along this existing rail bed.

The mines will produce lump and sinter ores for direct shipping to end users. As the deposit is a high-grade ore, no further processing aside from the proposed crushing and washing to be carried out in Labrador will be conducted in Canada Mining will initially be at a combined rate of one to two million tones per year at three mine sites at an estimated daily production rate less than 3000t/day per mine location. Rock beneficiation at the Silver Yard will occur during an estimated seven to eight month (approximately 250 days) working season and correspond to camp operations undertaken to complete the required excavation and processing. This process will take advantage of the existing infrastructure, such as the railway line between Schefferville and Sept-Iles, roads and electrical power and, as a result, no development work is proposed within the Province of Quebec. Although some local upgrading of roads and of the railway may be necessary, no major improvements are anticipated and work will be conducted along the existing rail-beds at the Silver Yard.

There is a small coldwater tributary immediately adjacent to the proposed James Mine South Pit (Figure 2) and, although it is outside the pit footprint, proposed dewatering activities have the potential to impact water levels further downstream.. Discussions with the Department of Fisheries and Oceans (DFO) at meetings conducted in St. John's Newfoundland and Labrador in September 2007, February and June 2008 indicated that a fish habitat assessment report would be required to determine whether a *Section 35(2) Harmful Alteration, Disturbance and Destruction* (HADD) *Authorization* would be required for the proposed mining operation. Two components for this fish habitat assessment report include; the actual physical fish habitat present and the role of groundwater contributions to the Unnamed Tributary (this report) as well as a water balance and hydrology report prepared by WESA (2008).(Appendix A). AECOM has been active on the sites, conducting environmental baseline work since 2005, and was retained by Labrador Iron Mines (LIM) to work cooperatively with WESA to complete this fish habitat assessment report for the James Property and provide potential mitigation/compensation strategies for DFO approval.

2. Study Team

The fish habitat assessment study team was lead by Mr. Derek Parks, with logistic support provided by Mr. David Praskey for the physical habitat mapping. Mr. Byron O'Connor (WESA) oversaw the hydrological and hydrogeological programs and provided the hydrological and water balance information for the Unnamed Tributary summarized within this document. Brief biographies are provided below:

Derek Parks, B.Sc. (Hon), M.Sc.

Mr Derek Parks is currently employed as a senior aquatic specialist within AECOM, and has been actively working on behalf of Labrador Iron Mines Ltd. in the Schefferville Area for the past three years. Mr. Parks has more than ten years of experience in fisheries and fish habitat, water-quality; environmental effects monitoring, bioengineering and habitat assessment and enhancement. He also has experience in the use of GIS to evaluate a range of fisheries issues. His previous employment includes AMEC Earth and Environmental, the Ontario Ministry of Natural Resources, the Township of Goulbourn and Niblett and Associates. He is also certified by MNR in the use of electrofishers and the Southern Ontario Rapid Stream Assessment Protocol and has extensive experience with a wide range of environmental studies. With a strong technical and academic background in fisheries resources, Mr Parks has applied this knowledge to plan, design and monitor a variety of projects to meet the needs of the client. He acted as a liaison for the client between regulatory agencies such as; Department of Fisheries and Ocean, Ontario Ministry of Natural Resources, and several Conservation Authorities, to provide the required information to be submitted to the appropriate agency. Once approvals have been granted, Mr. Parks has carried out over 15 monitoring programs to confirm work proposed and compensation and mitigation measures used were successful in protecting fish and fish habitat.

David Praskey, B.Sc.

Mr. Praskey is an aquatic ecologist with AECOM's Ecological Services group in Kitchener, Ontario. He has over six years experience in the aquatic biology field including lake and stream fisheries and habitat assessments, Lake Ontario wetland fish sampling, aquatic habitat mapping, Ontario Benthos Biomonitoring Network sampling, BC stream classification, and aquatic biological toxicity testing. Mr. Praskey's fish sampling experience includes index trapnetting and gillnetting, backpack and boat electrofishing, as well as seine and fyke netting. He also has more than 20 years of safe boating experience and has operated various sized boats for several professional and volunteer projects. He also has experience preparing project and client reports.

Byron O'Connor, P.Eng.

Mr. O'Connor, is a Principal with WESA Inc. and licensed professional engineer in the Provinces of Ontario, New Brunswick, the Northwest Territories and Nunavut, and Newfoundland and Labrador. He has worked in the mineral exploration and environmental fields since 1987. His technical expertise is in mining, hydrology, hydrogeology, contaminated site assessments and remedial assessments of surface water, groundwater and soil. He has conducted site assessments at mine sites and industrial facilities across the Arctic, throughout Northern and Southern Ontario, New Brunswick, Prince Edward Island, in Labrador and Alberta. He has served as technical advisor on projects outside of Canada in Missouri, Delaware, Jamaica, Turks and Caicos, and St. Lucia. He is currently co-project project principal for a multi-site (15 sites) closure plan groundwater characterization study currently underway for a major mining company in the Sudbury area. His tailings experience includes installation and evaluation of data for inclinometers installed at Brunswick Mining and Smelting near Bathurst, NB, as well as groundwater studies at tailings facilities in Northern Ontario. He has appeared before the Environmental Assessment Board as a technical expert related to waste management systems expansion on several occasions. Mr. O'Connor has instructed groundwater and waste management courses and training sessions in Kingston and Sudbury, Ontario; Kuala Lumpur Malaysia, Kingston Jamaica, and St. Lucia (BWI).

3. Summary of Study Objectives

The study objective for this report is to provide DFO, in combination with the WESA Hydrology and Water Balance report, with sufficient information to determine whether a *Section 35(2) HADD Authorization* will be required for the proposed mining operations at the James Property. This report will outline the physical fish habitat that exists within the Unnamed Tributary on the James Property. The fish habitat assessment will define the existing aquatic habitats associated with the unnamed tributary, and identify historic alterations on the James Property. Anticipated impacts resulting from the proposed mining operations associated with the James North and James South Pits will also be assessed and discussed.

It is strongly believed that the information discussed within this report will enable DFO to make a determination, based on:

- The quantification of fish habitats, as defined by the DFO's McCarthy *et al.* 2007 DRAFT Interim Standard Methods Guide for the Classification and Quantification of Fish Habitat in Rivers of Newfoundland and Labrador, were completed,

- Provide sufficient information for a HADD determination by DFO, when read in conjunction with the WESA (2008) on hydrological interactions. (Appendix A)

- Mitigation measures to be implemented, to ensure no HADD occurs during the construction, operation and abandonment of the James North and South Pits.

4. Description of Study Area

4.1 General

The James Property is located in western Labrador, at a distance of about 5 km from Schefferville, Quebec (Figure 1). The James Property has previous mining-related impacts as a result of historical IOC operations in the area. The James Property is bound by a high rock ridge to the southwest and an existing road connecting Schefferville with the Menihek Hydro Dam to the northeast. The terrain is comprised of parallel ridges and valleys, sparsely forested, trending northwest to southeast.

This area has been approximately 50% disturbed due to past mining activities. Two pits are planned for the area, the James North and James South pits.

4.2 Unnamed Tributary

Within the James Property, a small first order tributary originates from two artesian sources (James North Spring and James South Spring) that are situated between the James North and James South Pits (James North Spring) and at the southern edge of the James South Pit (James Spring South) (Figure 2). This tributary is approximately 1000 metres in length and flows in a south easterly direction and discharges into Bean Lake. Another small spring (James South Spring) originates from the southern end of the James South ore body and flows north easterly to the unnamed tributary, approximately half way between the tributary's origin and Bean Lake

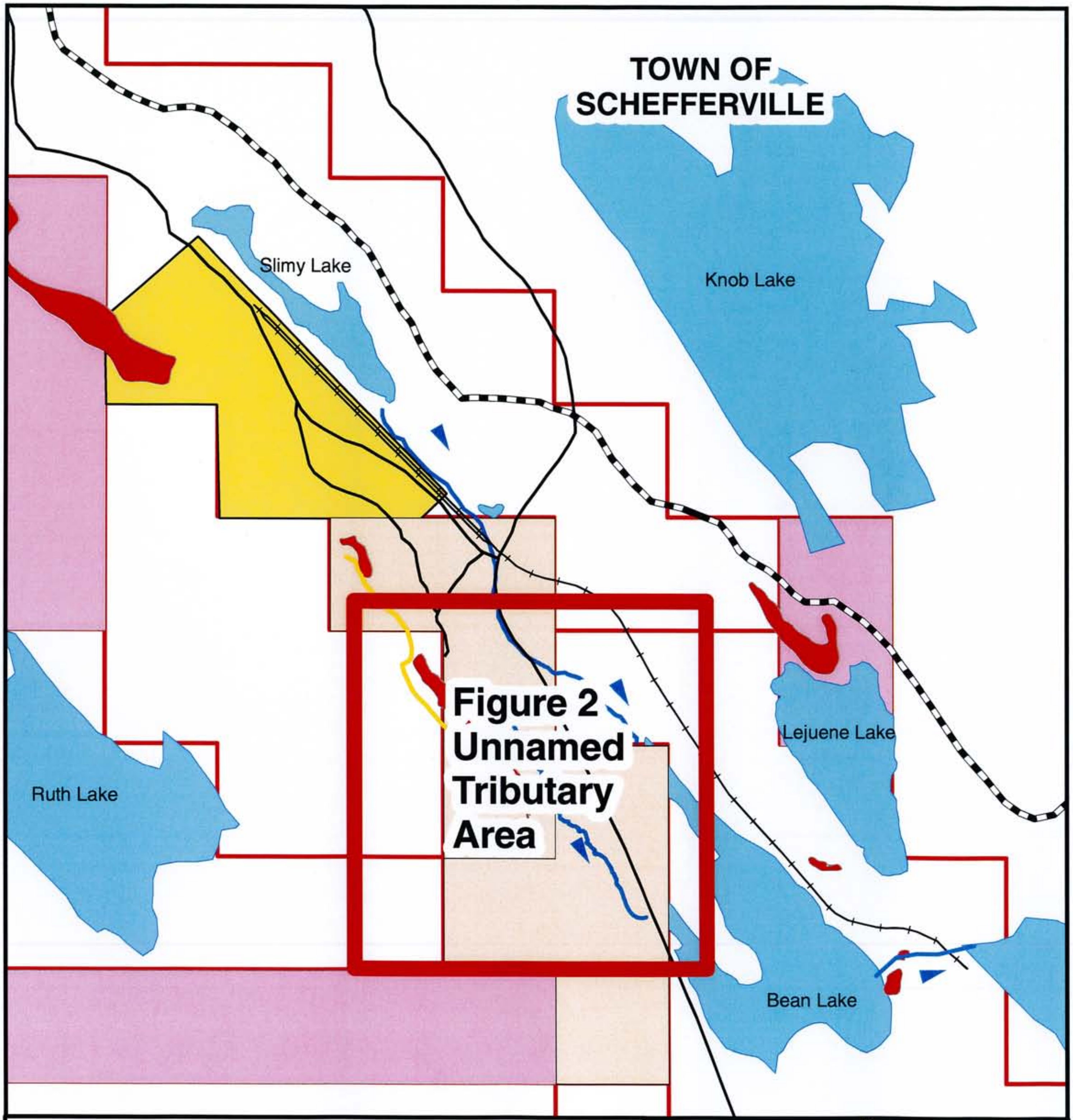


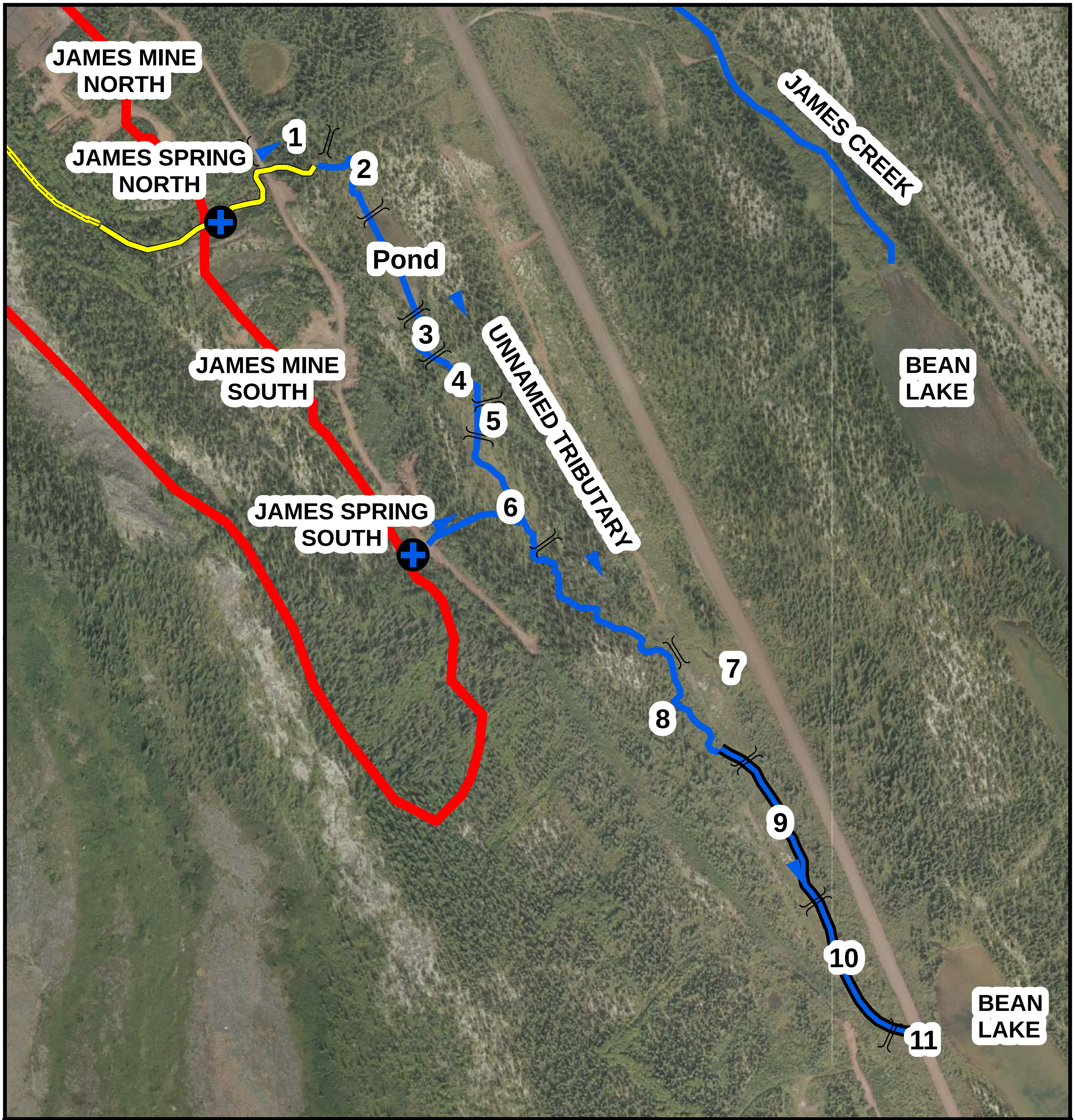
FIGURE 1

General Project Area
West Central Labrador Iron Ore Project

JANUARY 2009

Project #: 101931

AECOM



Legend

Habitat Classification

- Intermittent
- Permanent - No Fish
- Permanent - Fish Habitat
- Channelized - Fish habitat
- Water Flow Direction
- Habitat Reach Break (#) (Table 1)
- Maximum Pit Extent

FIGURE 2

Unnamed Tributary
James Property

DECEMBER 2008

Project #: 101931

AECOM

5. Methodology

5.1 Background

Information was sought from previous mining documents associated with the James Property. Provincial mapping data provided by the province indicated the origin of the unnamed tributary originated north of the James North Mine location. During winter baseline studies, conducted in late March 2007, spring locations were identified to assist in the summer physical habitat assessments. Seasonal environmental baseline studies ahve been conducted in the study area since 2005.

During the meeting with DFO staff in September 2007, and again in February and June 2008, DFO staff outlined that the fish habitat classification type values to be assessed were based on those described in Tables 4.2 (flow, current, depth and substrate parameters) and 4.2 (general habitat types) from the DRAFT Interim *Standard Methods Guide for Freshwater Fish and Fish Habitat Surveys in Newfoundland and Labrador: Rivers and Streams (2007)*.

5.2 Field Survey

5.2.1 September 2007

A physical habitat survey was conducted on September 21, 2007. Data collected included habitat type, mean wetted depth and width, substrate, % cover and type as well as additional comments including presence of redds, fish observations, etc. The stream was separated into reaches in the field when a typical reach break characteristic was observed. The lengths of the reaches were determined in a desk top exercise using ArcGIS.

Electrofishing was not conducted as young of year (YOY), juvenile and adult brook trout (*Salvelinus fontinalis*) were visually detected from the stream bank by the investigators during the September assessment located at the start of Reach 2 (Figure 2) and was outside of the timing window permitted by the DFO collection permit.

5.2.2 July 2008

On July 8, 2008, flow data were collected at 26 sites using a HydroQual flow meter. Velocity and depth measurements were recorded at distances of ¼, half and ¾ across the stream and a mean flow value of each was derived and follow the methodology outline in the guidance provided by DFO.

5.2.3 Winter 2007, 2008, and Spring 2008

Field sampling for the water quality program was completed in late March/early April 2007 and 2008. General habitat conditions for the tributary were noted during this field program.

6. Results

6.1 Physical Fish Habitat

6.1.1 General

The unnamed tributary consisted predominantly of flats and runs. Riffles and glides were also present but true pools were limited in number. One pool in Reach 8 had an approximated wetted width of 2 metres and maximum depth of 1.12 metres and occurred at an abrupt angular redirection of the stream.

The substrate in the riffles and runs was typically cobbles and gravels and in the flats, sand, silt and detritus dominated. In many flat sections however, gravels occurred under the fines and during the fall 2007 survey, redds that had been excavated down to the gravel were observed in some of these flat sections (Table 1).

Cover for fish in flat sections was dominated by undercut banks and overhanging grasses. In the runs, the dominant cover was typically overhanging alders and willows.

The smaller tributary that flows into the unnamed creek from the west was originally described as having a mean wetted width of 0.5 metres on the field sheets. This value was increased to 1 metre for calculations since the margins of the tributary were choked with watercress and therefore the actual wetted width was functionally a larger value than 0.5.

Available Habitat

The approximate areas of available spawning, rearing, migration and adult resident habitat types are 351 m^2, 1227 m^2, 0 m^2 and 5716 m^2, respectively (Table 1). We retained the use of glide as a habitat type from the BEAK 1980 and Sooley *et al* 1998, as the DRAFT classification does not identify slow moving water within a wide shallow channel with water velocities below <0.1 m/sec

Figures 3, 4 and 5 provide a representation of the fish habitat conditions noted during the study. Annotated text for each photograph can be found in Appendix B.

6.1.2 Other Observations

There appeared to be a significant decrease in the volumes of water flowing from the springs during the winter months. Sampling for the James North Spring indicated that flows were markedly reduced, as it took over one minute to fill a 1 litre bottle. Attempts to sample at pond locations along the tributary result in no water sample being collected, as the ponds were frozen solid to the substrate.

During the spring 2008 sampling program, it was noted the brook trout were actively swimming upstream from Bean Lake into the tributary. This observation was noted during the establishment of the hydrology monitoring station at the downstream perched culvert end along the road between the James and

Redmond Properties, as fish were jumping into the culvert during installation of water gauging devices (Figure 5, Photo H).

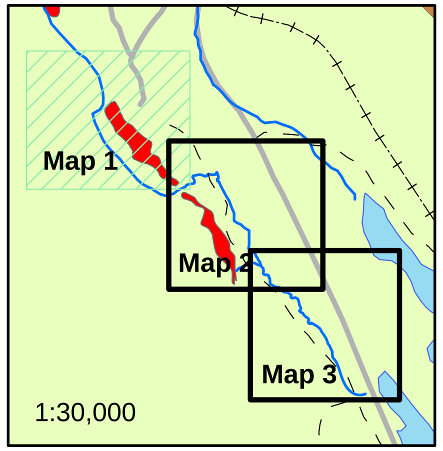
Table 1 Fish Habitat Classifications, Unnamed Tributary, James Property

	Reach Number																																				Total Habitat Area
	1			2			pond			3			4			5	6			James S. Spring			7			8			9			10			11			
Habitat Type	Riffle	Flat	Pool	Glide	Flat	Pool				Riffle	Run	Pool	Riffle	Flat	Pool	Glide	Riffle	Flat	Pool	Run	Riffle	Pool	Run	Glide	Pool	Riffle	Run	Pool	Riffle	Run	Pool	Riffle	Run	Flat	Riffle	Flat	Pool	
% Habitat				85	15					20	70	10	5	50	45	100		100		100			20	60	20	20	60	20	50	50			100		100			
Reach Length (m)				92						47			53			53	100			105			231			353			104			230			14			
Habitat Type Length (m)				78	14					9	33	4.7	3	27	24	53		100		105			46	139	46	70	212	70	52	52			230		14			
Mean Wetted Width (m)				2.3	2.9					0.8	1.3	1.7	0.8	6.2	3.4	2.8		3.2		1			1.6	4	7	1.7	2.2	3.8	3.2	2.4			1.8		2.5			
Mean Wetted Depth (m)				0.1	0.4			< 0.5		0	0.1	0.2	0.1	0.1	0.2	0.3		0.2					0.1	0.2	0.2	0.1	0.1	0.5	0.1	0.1			0.2		0.1			
Approximate Area (m^2)				179	40			3522		12	43	6	19	167	149	148		320		105			74	556	322	119	466	266	166	125			414		35			
Mean Velocity at Flow Station (m/s)[1]					0.1									0.1				0		0.4						0.3	0.4	0.1	0.4				0.3					
Mean depth at Flow Station (m)					0.2									0.2				0.2		0						0.1	0.1	0.3	0.1				0.1					
Discharge m³/s					0.1									0.1				0		0						0.1	0.1	0.1	0.1				0.1					
Spawning										12			19													119			166						35			**351**
Rearing											43									105			74				466			125			414					**1227**
Migration																																						**0**
Adult Resident				179	40			3522				6		167	149	148		320						556	322			266						41				**5716**
%Substrate	underground flow from road to start of Reach 2			80Sand 20Detritus	80sand 20detritus			10Detritus		80Gravels 20Cobbles	80Gravels 15Cobbles 5Sand	45Sand 45Gravels 10Detritus	100Gravels	95Detritus 4Gravels 1Boulder	100Gravels	100Detritus		100Detritus		70Gravels 20Cobbles 10Sand			100Detritus (over gravels/sand)	100Detritus (over gravels/sand)	100Detritus (over gravels/sand)	100Gravels	80Gravels 20Cobbles	80Gravels 20Detritus	80Gravels 20Cobbles	80Gravels 20Cobbles			50Gravels 50Sand		95Gravels 5Cobble			

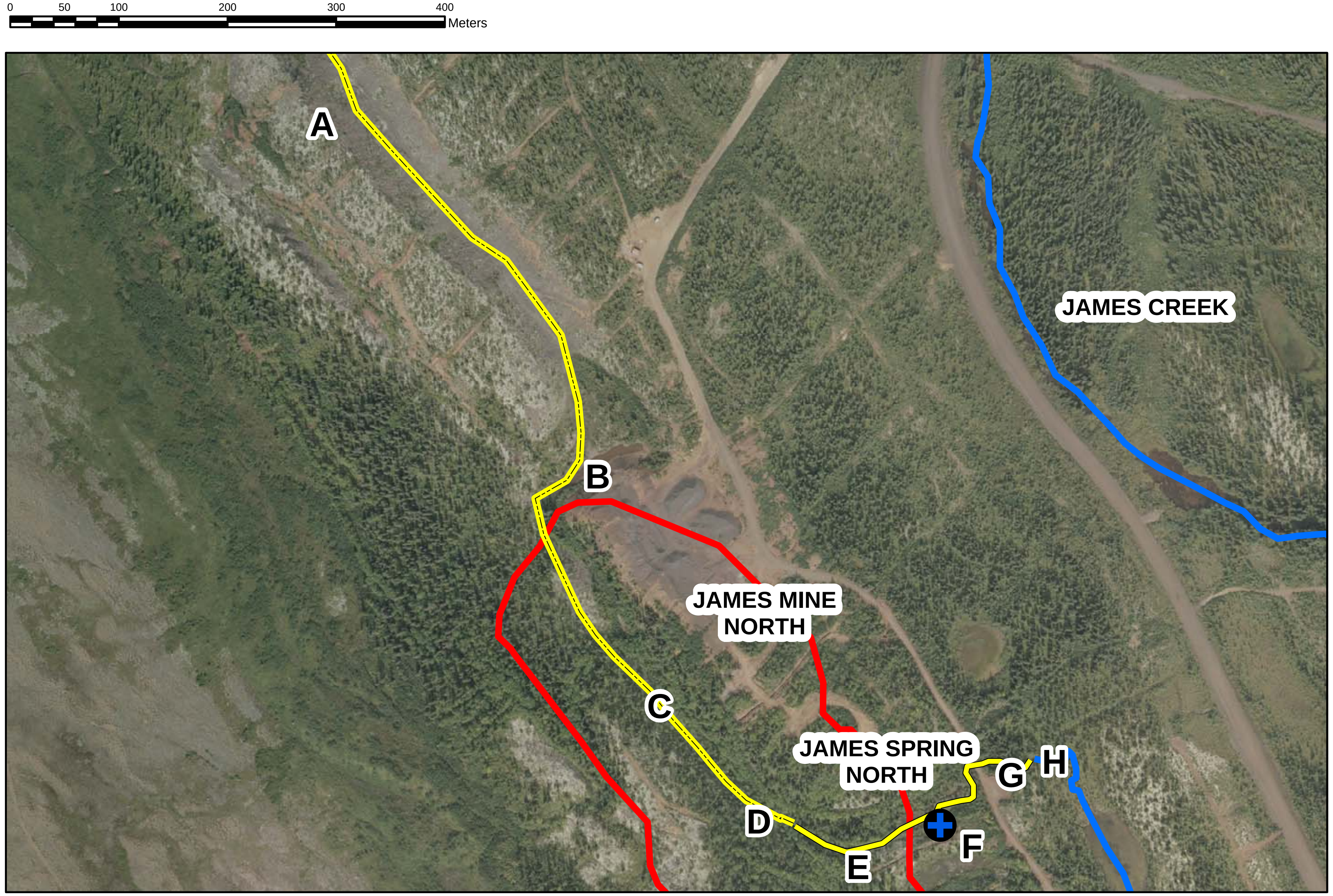
Habitat types based on DRAFT Interim Riverine Habitat Classifications of Newfoundland Labrador

[1] Flow data collected on July 8 2008; other physical habitat data collected on September 21 2007

MAP 1 OF 3



Key Map



JAMES PROPERTY

UNNAMED TRIBUTARY

Legend

Unnamed Tributary Classification

- Intermittent
- Permanent - No Fish
- Permanent - Fish Habitat
- Channelized - Fish Habitat
- Maximum Pit Extent

LIM

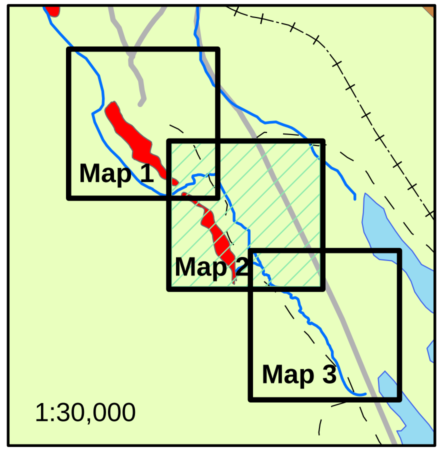
AECOM

FISH HABITAT CLASSIFICATION

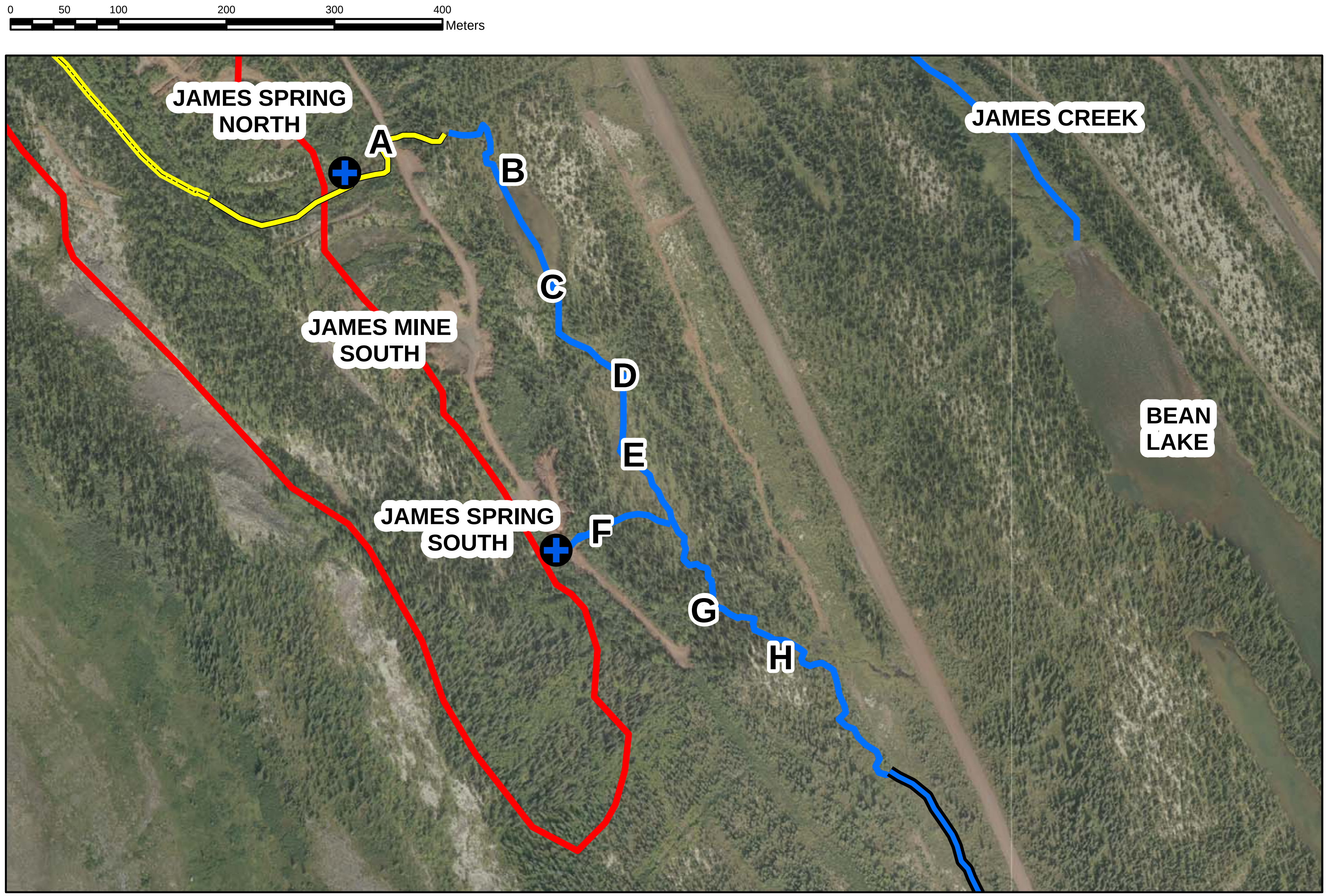
FIGURE 3

DATE:	DECEMBER 2008
PROJECT N0.:	101931

MAP 2 OF 3



Key Map



JAMES PROPERTY

UNNAMED TRIBUTARY

Legend

Unnamed Tributary Classification

- Intermittent
- Permanent - No Fish
- Permanent - Fish Habitat
- Channelized - Fish Habitat
- Maximum Pit Extent

LIM

AECOM

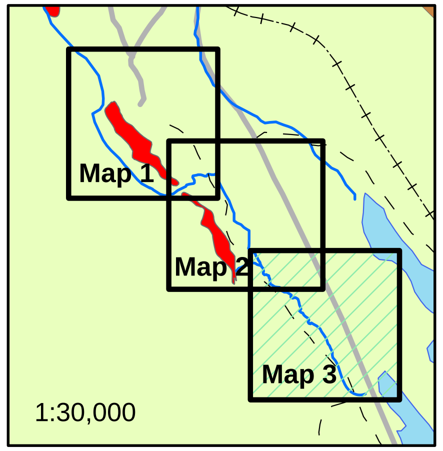
FISH HABITAT CLASSIFICATION

FIGURE 4

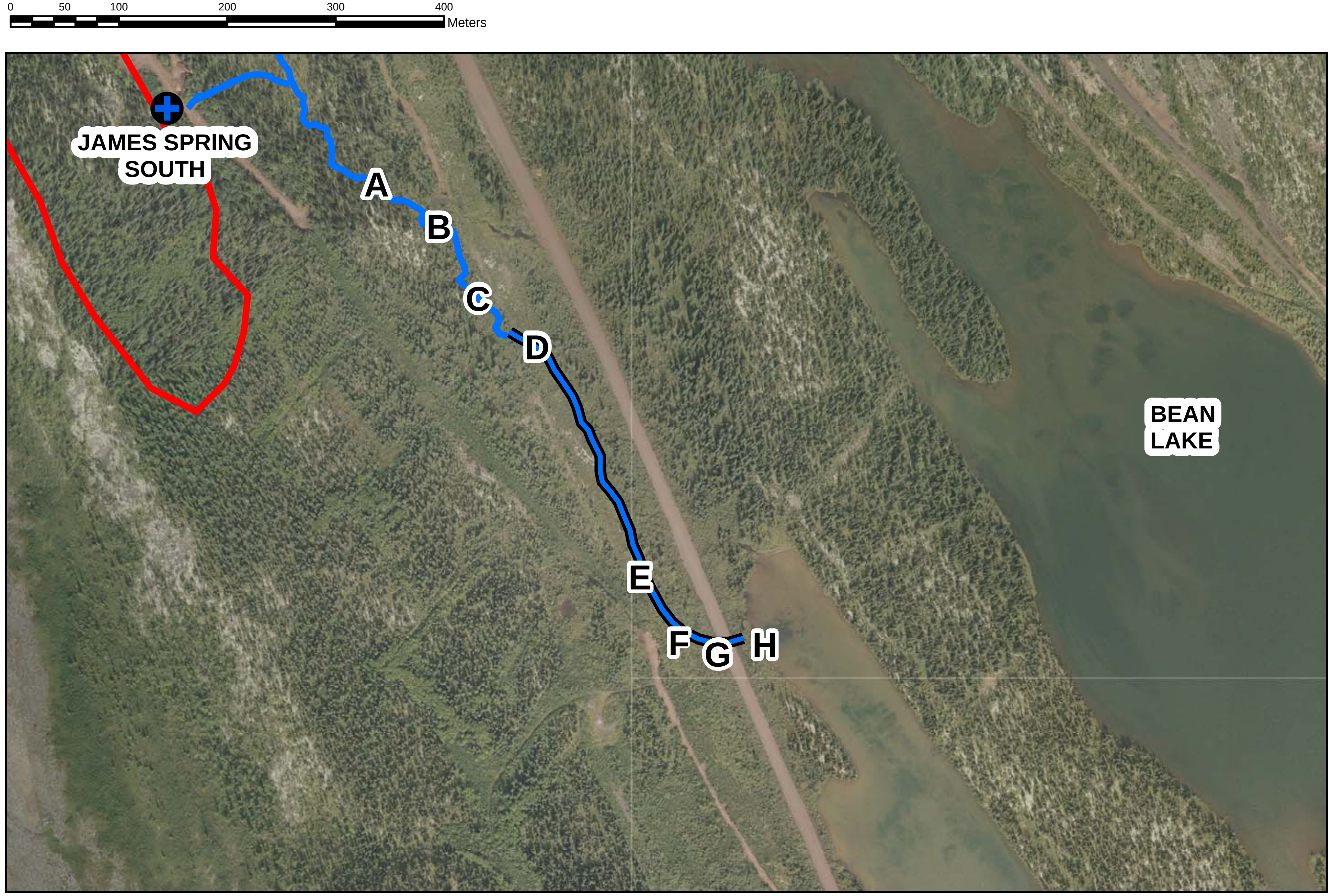
DATE: DECEMBER 2008

PROJECT N0.: 101931

MAP 3 OF 3



Key Map



JAMES PROPERTY

UNNAMED TRIBUTARY

Legend

Unnamed Tributary Classification

- 🟨 Permanent - No Fish
- 🟦 Permanent - Fish Habitat
- ▬ Channelized - Fish Habitat
- --- Intermittent
- 🟥 Maximum Pit Extent

AECOM

FISH HABITAT CLASSIFICATION

FIGURE 5

DATE: DECEMBER 2008

PROJECT N0.: 101931

7. Discussion

Historic information (Drake, 1981) indicated that Bean Lake had been impacted by past mining activities. Habitat assessments made for the Unnamed Tributary indicate that past modifications (channel straightening) has occurred with the lower sections of the tributary, but sediment deposition noted in other historic mine impacted stream environments were not noted.

7.1 James North and South Mine Operations

Based on preliminary information provided by the LIM's engineering team and supporting information collected by WESA (2008) regarding the groundwater interactions with the Unnamed Tributary, the James North and South Springs are expected to be influenced by dewatering activities to facilitate ore extraction from both of the proposed mine sites.

The James North Pit and James South Pits have an estimated operating life of 5 years, with the first year of operation requiring active dewatering to commence late in 2009 to enable ore extraction in 2010. For this project, the mine design team allocated the required 15 m buffers, to satisfy DFO in mitigating active mining activities on the tributary.

7.2 Mitigation

LIM engineers, in combination with SNC Lavalin, have prepared preliminary pit designs and, as such, a mitigations option to maintain the viability of the Unnamed Tributary as viable fish habitat has been developed and includes the following mitigation measures to be implemented:

- Water pumped from groundwater dewatering wells for the James North and South Mine will be diverted into a 24 hour retention pond to allow particulate from the groundwater, if present, to precipitate out prior to maintaining flows in the Unnamed Tributary,
- Water quality from groundwater sampling indicates good water quality, with the exception of elevated total iron associated with suspended solids, as dissolved iron values are not considered to be elevated, based on CCME Guidelines (e.g., CCME, 2003, 2005, 2007) and presented in Section 4.1.5 of the EIS for the West Central Labrador Iron Ore Project
- Groundwater quality being diverted back into the stream will meet provincial water quality regulations and a regular water sample monitoring program will be developed and implemented;

- Should excess groundwater be present, it would be diverted into James Creek. It is also expected that a percentage of the groundwater can be redirected to the beneficiation area and/or used for general site use (dust suppression etc.);
- Pit dewatering and beneficiation area wash water will be directed to the Ruth Pit, an existing historical mining pit that has been tested to show that it is not fish habitat, to ensure that water that has come into contact with pit operations is not conveyed into areas of direct fish habitat,
- Upon closure, the pour point for the surface topography of the closed out mining areas will be directed back into the unnamed tributary to re-establish pre-development flows, and
- A monitoring program will be developed to assess the success of the mitigation outlined above (fish being present).

8. Conclusion

Based on the information provided by WESA 2008, the water that supplies the two springs (James Spring North and James Spring South) will be intercepted during dewatering activities and diverted back into the unnamed tributary, ensuring viable fish habitat during the operations of the mines. Past mining activities on the James Property has had no detectable impact on the unnamed tributary and thus no further detectable impacts to the unnamed tributary would be expected considering the proposed mining operation.

Mitigation measures to maintain viable fish habitat during and after mine operations will ensure that fish and fish habitat associated with the unnamed tributary will not be negatively impacted.

It is strongly believed that the information provided within this report and attached WESA 2008 report (Appendix A), will enable the DFO to determine their departments involvement during the EIS and permitting process.

9. References

Beak. 1980. Fisheries resources of tributaries of the lower Churchill River. Prepared by Beak Consultants Limited for the Lower Churchill Development Corporation, St. John's, Newfoundland and Labrador.

Canadian Council of Ministers of the Environment (CCME). 2007. Canadian Environmental Quality Guidelines for the Protection of Aquatic Life. Update 7.0. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba. Available at: www.ccme.ca/publications/.

Canadian Council of Ministers of the Environment (CCME). 2005. Canadian Environmental Quality Guidelines. Update 5.0. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba (www.ccme.ca/publications/).

Canadian Council of Ministers of the Environment (CCME). 2003. Canadian Water Quality Guidelines for Protection of Aquatic Life Guidance for Site-Specific Application of Water Quality Guidelines in Canada and Procedures for Deriving Numerical Water Quality Objectives. Canadian Council of Ministers of the Environment, Winnipeg, Manitoba.

Drake, John J. 1981. Effects of iron mining on surface water quality in the Schefferville Area. *Applied Geography,* 1: 287-296..

McCarthy, J.H, Grant. C and D. Scrutton. 2007. DRAFT Interim Standard Methoids Guide for the Classification and Quantification of Fish Habitat in Rivers of Newfoundland and Labrador.

Sooley, D.R., E.A. Luiker and M.A. Barnes. 1998. Standard methods guide for freshwater fish and fish habitat surveys in Newfoundland and Labrador: rivers and streams. Fisheries and Oceans, St. John's, NF. iii + 50p.

WESA. 2008. James Property Hydrology and Water Balance, submitted to LIM as Section 4.1.4 of the Environmental Impact Statement for the West Central Labrador Iron Ore Project.

Appendix A

WESA 2008, James Property Hydrology and Water Balance, (Section 4.1.4) of the Environmental Impact Statement for Labrador Iron Mines Ltd. pp.19.

JAMES PROPERTY HYDROLOGY
and WATER BALANCE

Prepared for:

Labrador Iron Mines Limited

Prepared by:

WESA Inc.
The Tower, The Woolen Mill
4 Cataraqui Street
Kingston, ON   K7K 1Z7

WESA File No. K-B6836

December 2008

TABLE OF CONTENTS

LIST OF PHOTOGRAPHS

LIST OF CHARTS

LIST OF TABLES

LIST OF FIGURES

(at end of text)

1.0 HYDROLOGY

This report is an excerpt from a section on hydrology that will be included in the Environmental Impact Statement (EIS) report currently being prepared by Labrador Iron Mines (LIM) for submission to the Department of Environment and Conservation, Government of Newfoundland and Labrador. Discussions with the Department of Fisheries and Oceans (DFO) at a meeting in St. John's Newfoundland and Labrador on September 5, 2007 indicated that a fish habitat assessment report would be required to determine whether a *Section 35(2) Harmful Alteration, Disturbance and Destruction* (HADD) *Authorization* would be required for the proposed mining operation. Two components for this fish habitat assessment report include; the actual physical fish habitat present and the role of groundwater contributions to the Unnamed Tributary as well as a water balance and hydrology report (this report).

This report describes the general hydrological conditions at the James Property and presents flow monitoring data from specific stream monitoring stations installed in June 2008 and monitored until the fall of 2008. A water balance for the James Creek/Bean Lake watershed is also presented, and an assessment is provided of potential impacts to the water balance from pit and beneficiation operations at the James site.

The drainage systems in the area are strongly influenced by the underlying geology. Streams and lakes tend to be oriented northwest/southeast to match the strike of the bedrock units. Watershed boundaries are generally quite clearly defined by exposed bedrock ridges that run in a northwest/southeast direction.

James Property:

The James Property is located at the base of an eastern slope of a significant northwest/southeast trending bedrock ridge (Figure "James Creek/Bean Lake Drainage Area"). Bean Lake is located to the east of the site and is the closest lake to the James Property. This lake is fed by James Creek which enters Bean Lake at its northern-most point. James Creek begins in the area east of Ruth Pit, flows southeast past the south end of Ruth Pit into Slimy Lake, then flows out of Slimy Lake continuing southeast to Bean Lake (Figure "James Creek/Bean Lake Drainage Area"). There are two springs on the James Property that are the source of an unnamed tributary that flows into Bean Lake (Figure "James Springs and Unnamed Tributary")). These springs (and tributary) figure prominently in the hydrological assessment of the James site and to the water balance of the system. Bean Lake outlets from the southeast and flows into a stream that outlets from Lejeune Lake.

WESA installed stream gauges and groundwater monitoring wells around the site in 2008. Stream gauges were installed to collect stream flows into and out of Bean Lake, which is the main surface water feature near the James Property, and to collect flow data from the two springs located on the James Property. Data from the monitoring wells were used to estimate the groundwater component of the water balance for the site.

1.1 WATER BALANCE APPROACH

James Creek and Bean Lake are the focal points for the water balance assessment of the James Property since these are the closest surface water features and because shallow groundwater from the site flows to the east/southeast, toward the lake. The approach taken with respect to the water balance involved measuring surface water flow into and out of the lake, estimating groundwater discharge to the lake, and incorporating evaporation data from available meteorological data sources.

2.0 METHODOLOGY

Methodologies and data sources used in determining the surface water inputs to the water balance are described in this section.

2.1 SURFACE WATER

Velocity-Area Method of Discharge Calculation

The Velocity-Area Method of calculating stream discharge (Q) estimates Q as the product of flow velocity (V) and cross-sectional area (A):

$$Q=(V)(A)$$

In order to calculate the discharge of a channel, the channel cross-section must first be divided into several subsections. A tag line was set up perpendicular to the flow direction at each pre-selected gauging station to ensure accurate measurements of each subsection width. The stream depth was measured at these specific intervals across the stream, which allowed a stream profile to be constructed. From this profile, the cross-sectional area of the stream at the gauging site was determined. The average velocity of the cross-section was measured using the FP101 Global Flow Probe. The methodology outlined in the probe manual (Global Water, 2004) was utilized whereby the probe is moved in a serpentine pattern across the stream cross-section yielding a single average flow velocity. This average velocity was then multiplied by the cross-sectional area to determine stream discharge.

Continuous Stream Depth Measurement

Water level dataloggers were installed at five locations (SG-1, 2, 4, 5, and 8) on June 7, 2008. One additional datalogger was installed at SG-4 on July 7, 2008 to measure barometric pressure. Solinst® Levelogger® Gold Model 3001 and Barologger Gold dataloggers were used. These loggers are equipped with the datalogger, battery, pressure transducer, and temperature sensor. All loggers were programmed to record real-time data every 15 minutes which could be downloaded from the loggers using direct read cables.

Loggers at SG-1, 2, and 8 were installed in natural stream cross-sections using a length of 1.5-inch diameter ABS pipe extended horizontally from one bank to the other, perpendicular to the direction of flow. This pipe not only anchored the Levelogger, but also served as the tag line used for cross-section measurements. A second length of ABS pipe was bolted vertically to the horizontal piece such that it extended down to the streambed. This vertical ABS pipe had holes drilled through it to allow water to pass into and through the pipe in order for the water depth inside the ABS to reflect the water level of the stream. The vertical ABS acted as a sort of "stilling-well" in which the Levelogger was contained. The Levelogger was secured inside the vertical ABS by attaching the direct read cable to it with zip-ties. The direct read cable was attached to the Levelogger and run along the ABS pipe (secured using zip-ties) to the shore where the other end remained on a spool to allow for easier downloading of the Levelogger. Photographs 1 and 2 below show leveloggers set up in a stream.

Photograph 1: SG2 Stream Gauge Levelogger Looking Southeast

Photograph 2: SG1 Stream Gauge Levelogger

Sites SG-4 and 5 required Leveloggers to be mounted in culverts using threaded steel rods. A hole was drilled in the top of the culvert through which the steel rod was inserted until it came in contact with the bottom of the culvert.

Photograph 3: SG4 Levelogger Looking West

2.2 PRECIPITATION

Precipitation was estimated using the meteorological data collected at the Schefferville Airport weather station from May to November 2008. This weather station is located approximately 4 km from the site. A meteorological station was installed at the Houston Property by LIM. The data from the Schefferville station was used because that station is closer to the James Property. Although weather patterns in the area can be extremely localized, over the course of a season, the precipitation at Schefferville would be a reasonable approximation of the amount of rainfall at Bean Lake, given the proximity of the site to the weather station and the similar elevations of each. Furthermore, a comparison of the James Property stream gauge data with the Schefferville precipitation data shows a qualitative correlation between higher levels of precipitation at Schefferville, and higher water levels in the monitored streams (Charts 1-4, below).

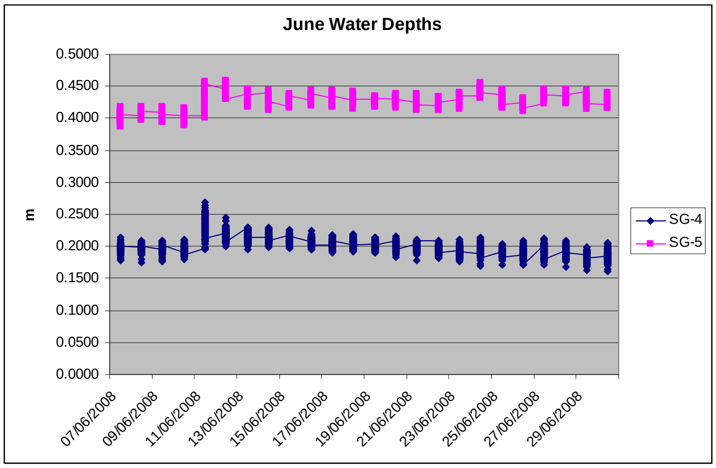


Chart 1: Stream Gauge Data, June 7 – 29

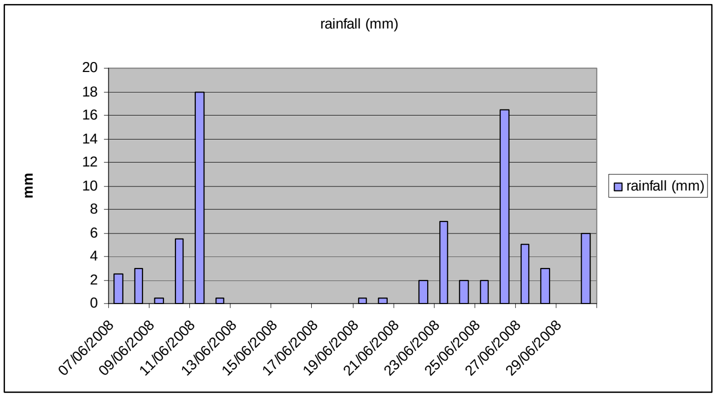


Chart 2: Rainfall Data, June 7- 29

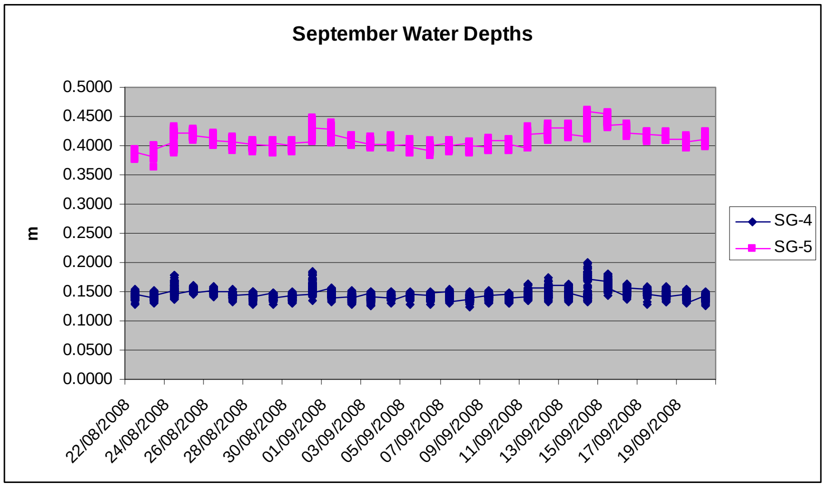


Chart 3: Stream Gauge Data, August 22 – September 19

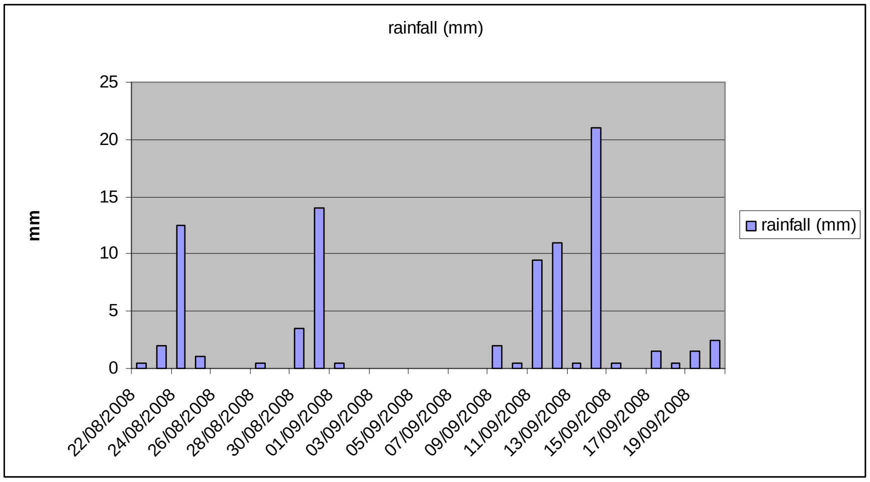


Chart 4: Rainfall Data, August 22 – September 19

3.0 WATER BALANCE

The water balance for Bean Lake can be described in terms of the contributions made by each of the following:

- Surface water inflow and outflow
- Groundwater discharge
- Evaporation

In addition to the continuous monitoring, the balance of flows into and out of the lake was examined as a kind of 'snapshot' at two points in time, one on a day in early spring (June 6) and the other on a day in late fall (Sep 25). These two sets of data were then compared to each other.

Precipitation was not included in the balance due to the fact that the week preceding each of these two days had been dry, as discussed below. Lake storage was also excluded from the balance based on the expectation that storage contribution would be minimal using the snapshot approach.

The components of the water balance are discussed in more detail below.

3.1 SURFACE WATER

Surface water inflow to Bean Lake is primarily through James Creek, which forms the main inlet at the north end, and from an inlet (unnamed tributary) along the west side of the lake that represents the combined flow of the two springs at the proposed mine site. In addition, there are some minor streams flowing into the lake near the south end. Extensive visual observation of the perimeter of the lake did not reveal any other significant inflows to the lake, and it is therefore assumed that the surface water input to the lake is captured by these inflow streams. All of the water in the area of the proposed mine site appears to drain into Bean Lake.

3.1.1 Stream Gauges

Stream gauges were placed in both of the two larger inlets (James Creek and the unnamed tributary) and the outlet, as well as the two springs near the proposed mine site. The stream gauges collected water level readings every 15 minutes. Water level readings were corrected for barometric pressure.

The locations of the stream gauges are shown on Figure “Monitoring Wells and Stream Gauges Locations” and are described as follows:

SG-1: The northern of two springs in the proposed mine area (James North Spring). The stream gauge was installed in a stream about 3.3 m wide, with a depth of approximately 30 cm at its deepest point.
SG-2: The southern spring in the proposed mine area (James South Spring). This small stream is approximately 90 cm wide, with a depth of about 20 cm.
SG-4: The combined drainage of the two springs (unnamed tributary), just before it enters Bean Lake, passes through a culvert (formerly a 24" round culvert, now deformed such that the sides in the lower portion form a V-shape).
SG-8: The main inflow to Bean Lake (at the north end of the lake) is James Creek, a stream approximately 2.9 m wide and 30 cm deep.
SG-5: The outflow from Bean Lake passes through a 12 ft corrugated steel culvert.

In addition, measurements of cross-sectional areas and stream velocities were made on July 30, 2008 at the two small streams near the south end of Bean Lake (XS-1-N and XS-2-S).

3.1.2 Stream Velocities

Stream velocities were measured during three field visits, on June 5 & 6, July 30 and September 25 & 26.

June measurements were collected during spring high levels following a period of little precipitation; July measurements followed a heavy rain; and late September measurements would be expected to represent the seasonal low. Despite these variations in conditions, measured flow velocities did not vary by more than 20% over the course of the season. The measured velocities are presented in Table 1, below.

Table 1: Measured Stream Velocities

Stream Gauge	Location	Jun-06	Jul-30	Sep-25	mean
		m/s	m/s	m/s	m/s
SG-1	James North spring	0.09	0.07	0.05	0.07
SG-2	James South spring	0.34	0.32	0.41	0.36
SG-4	Combined spring flow, unnamed tributary, at inlet to Bean Lake (culvert)	1.31	1.49	1.24	1.35
SG-8	James Creek, primary Bean Lake inlet	0.91	0.74	0.88	0.84
XS-1-N	Minor stream (culvert)		0.98		0.98
XS-2-S	Minor stream (culvert)		0.73		0.73
SG-5	Bean Lake outlet (culvert)	1.52	1.41	1.30	1.41

3.1.3 Stream Flows

Flow in the surface streams was calculated based on velocity measurements collected on June 5 & 6, July 30 and September 25 & 26. The measured flows in the streams are summarized in Table 2, below.

Table 2: Measured Flows

		June 6	July 30	Sep 25
Stream Gauge	Location	m^3/min	m^3/min	m^3/min
SG-1	James North spring	3.3	2.0	1.5
SG-2	James South spring	2.2	1.6	2.7
SG-4	combined spring flow, unnamed tributary, at inlet to Bean Lake (culvert)	2.4	2.4	1.2
SG-8	James Creek, primary Bean Lake inlet	42.1	32.1	41.8
SG-5	Bean Lake outlet (culvert)	61.0	56.1	54.4

Maximum, minimum and mean flows were calculated based on a combination of stream gauge data and measured values. The maximum flow was calculated using the highest water level (either measured or recorded by the stream gauge) and the maximum velocity. The minimum flow was similarly calculated using the lowest water level (either measured or recorded by the stream gauge) and the minimum velocity. Mean flows were calculated using the average depth recorded by the stream gauge or the average measured depth, and the average of the three measured velocities. These values are presented in Table 3, below.

Table 3: Maximum, Minimum and Mean Flows

		Max	Min	Mean
Stream Gauge	Location	m³/min	m³/min	m³/min
SG-1	James North spring	3.4	1.1	2.0
SG-2	James South spring	2.7	1.6	2.1
SG-4	combined spring flow, unnamed tributary, at inlet to Bean Lake (culvert)	3.2	0.9	1.6
SG-8	James Creek, primary Bean Lake inlet	48.6	19.7	26.3
SG-5	Bean Lake outlet (culvert)	72.8	41.5	55.9

3.1.4 Periods of Low Precipitation

Average rates of precipitation in the area, based on data collected from 1949 until 2007, falls in the range of 2.6 – 3.9 mm/day (or 19 - 27 mm/week), for the months of June through October (see Table 4).

Table 4: Meteorological Data - Daily Averages (1949 - 2007)

Month	Min Temp (C)	Max Temp (C)	Mean Temp (C)	Rain (mm)	Snow (mm)	Total Precipitation (mm)
Jun	3.4	14.0	8.73	2.41	0.24	2.65
Jul	7.8	17.5	12.65	3.20	0.01	3.21
Aug	6.8	15.7	11.25	2.97	0.07	3.04
Sep	2.1	9.6	5.83	2.98	0.56	3.53
Oct	-4.0	2.1	-0.96	2.44	1.49	3.93

In order to determine the water balance for Bean Lake, periods of very low precipitation have been examined. Without input from precipitation and runoff, the water balance consists of surface water inputs, groundwater inputs, and evaporation.

Stream measurements were collected on June 5 & 6, which was at the end of a relatively dry period (5 mm of precipitation in the week preceding June 5, and an additional 1.5 mm on June 6), as compared to the weekly average for June of approximately 19 mm/week. June 18 also marked the end of a seven-day period of very little precipitation (0.5 mm). The stream water levels at SG-4 were very similar on both June 6 and June 18, and stream velocities did not vary a great deal over the entire season; similarly for SG-5. Flows calculated for early June are therefore considered to represent a period of minimal precipitation in June.

Similarly, September 8 marked the end of a seven-day dry period (0 mm of precipitation). Stream measurements were taken on September 25 and 26, which also marked the end of a period of low precipitation (4.5 mm over the preceding seven days). The stream water levels at SG-4 were very similar on both September 8 and September 25/26 (Chart 5), and similarly at SG-5; flows calculated for late September are considered representative of a period of minimal precipitation in September.

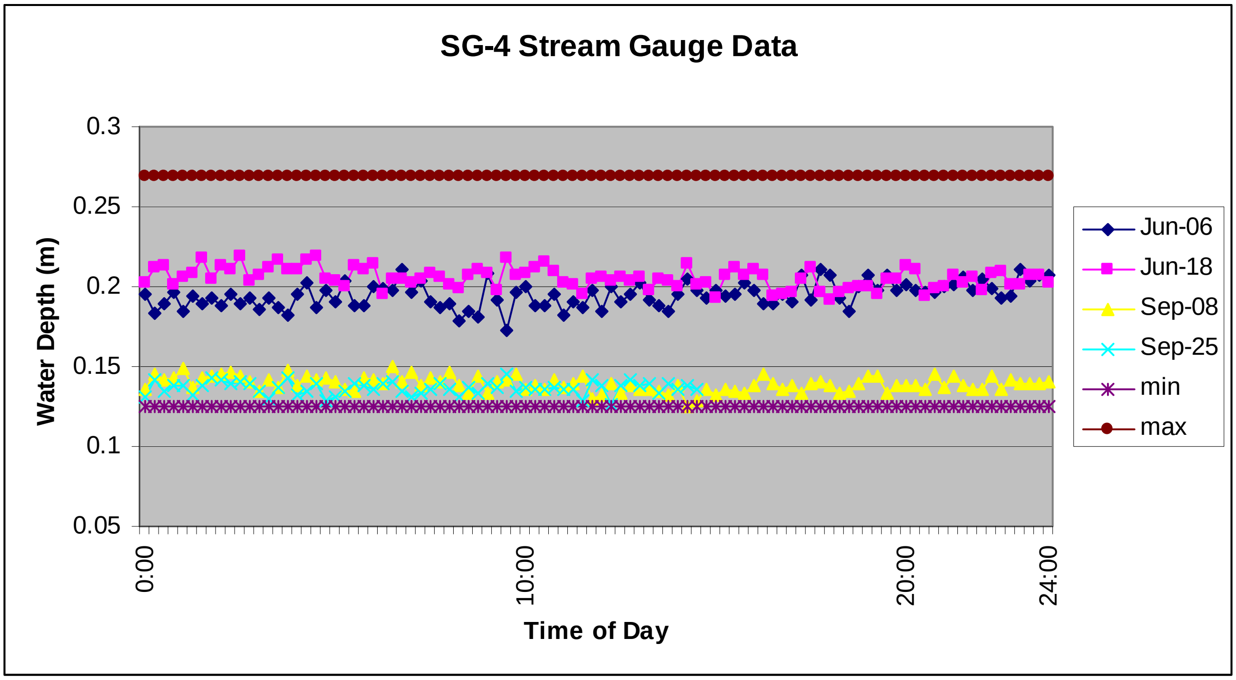


Chart 5: SG-4 Stream Gauge Data on June 6 & 18, Sep 8 & 25

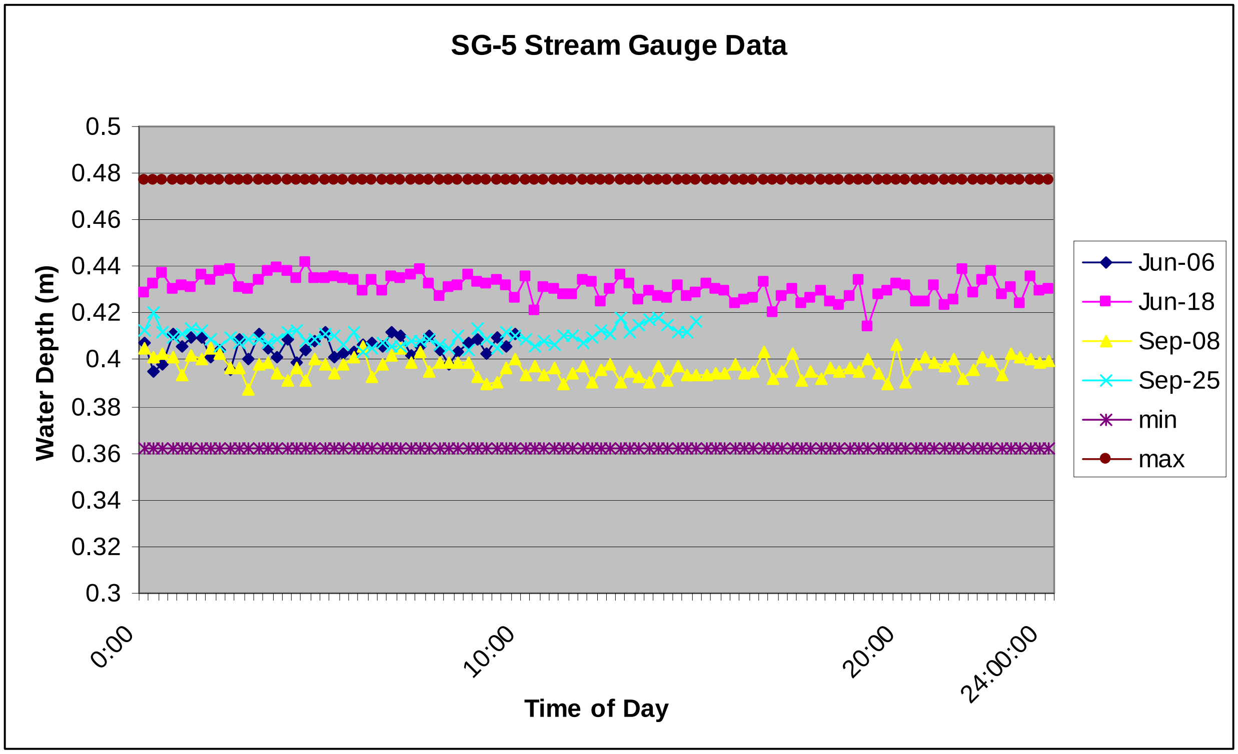


Chart 6: SG-5 Stream Gauge Data on June 6 & 18, Sep 8 & 25

3.2 GROUNDWATER FLOW

An estimate of the groundwater discharge to Bean Lake was made using information obtained during a hydrogeological assessment of the site. This assessment involved installing a total of 27 groundwater monitoring wells at 8 well nest locations across the property, conducting single well response testing to determine hydraulic conductivity, conducting a constant discharge pumping test as a further estimate of hydraulic conductivity, sampling the wells for chemical analysis, and measuring groundwater elevations to determine hydraulic gradients. The locations of the wells are shown on Figure "Monitoring Locations and Stream Gauges Locations".

Groundwater discharge to the west side of Bean Lake (from the James property side of the lake) was approximated using:

$$Q = kiA,$$

Where Q = Groundwater Flux
K = Hydraulic Conductivity
A = Cross sectional area of flowpath

The groundwater discharge estimate is an approximation and does not include any groundwater flow that may discharge to the lake from the north, south or east sides of the lake. Based on the topography, the groundwater contributions to the lake from these directions are thought to be much less than the flow from the west.

The mean hydraulic conductivity measured from single well response testing and from pumping tests conducted on pumping wells located southeast of the James North Spring was determined to be 2.69 x 10^{-4} m/sec. The estimated horizontal hydraulic gradient of groundwater monitoring wells installed in the shallower zone at the James site (the zone most likely to potentially discharge to Bean Lake) was determined to be 0.08. The cross sectional area of the groundwater flow path along the west side of Bean Lake was roughly estimated to be 15000 m^2. Based on these input values the groundwater discharge to the lake from the James Property side was estimated to be approximately 19 m^3/min.

3.3 EVAPORATION

Evaporation in this case includes all evaporation directly from the surface of Bean Lake.

According to the Water Resources Atlas of Newfoundland, the mean annual potential evapo-transpiration in the area falls in the range of 375 – 400 mm. Evaporation from lakes in Newfoundland and Labrador falls in the range of 300 – 600 mm. Based on this information, it was assumed that the evaporation from Bean Lake would occur at the rate of 400 mm/year.

It is also assumed that all of the evaporation takes place during the period when the lake is not frozen. There are approximately 185 ice-free days in the region.

The area of Bean Lake is 547,760 m^2. Based on this area and an evaporation rate of 400 mm in 185 days, the loss from Bean Lake due to evaporation is estimated to be 0.8 m^3/min.

4.0 JAMES CREEK/BEAN LAKE WATER BALANCE SUMMARY

The combined inflows to Bean Lake (surface and groundwater) and the combined outflows (surface water flow and evaporation) are presented in Table 5 and Charts 7 & 8, below.

Table 5: Water Balance Summary

Stream Gauge	June m3/min	Sep m3/min
XS-1-N	0.4	0.2
XS-2-S	2.2	1.1
SG-4 (Un-named tributary)	2.4	1.2
Groundwater Discharge	18.9	18.9
SG-8 (James Creek)	42.1	41.8
TOTAL INFLOW	66.0	63.2
Evaporation	0.8	0.8
SG-5	61.0	54.4
TOTAL OUTFLOW	61.8	55.2
Difference	4.2	8.0

The difference between the total inflow and outflow amounts is assumed to represent the cumulative error in the measurements and estimations that make up the components of the water balance. The June values balance very closely while the balance for September is not as close. The total inflow values to Bean Lake were very consistent between the June and September 2008 measurement periods. The component with the greatest unknown degree of accuracy is the groundwater flux, because the cross-sectional area of flow was determined based on an estimate of the width and depth of the groundwater flowpath that discharges to Bean Lake. In reality, the area of this flowpath may differ from the estimate. Notwithstanding this estimate, the overall water budget balanced quite closely giving a measure of confidence in the groundwater estimate. Additional groundwater assessment work will be conducted in 2009 to refine the dewatering requirements.

The outflow estimate from Bean Lake was lower in September than in June; it is possible that the groundwater discharge to Bean Lake decreased over the course of the summer and/or that water from the lake was lost to groundwater later in the season.

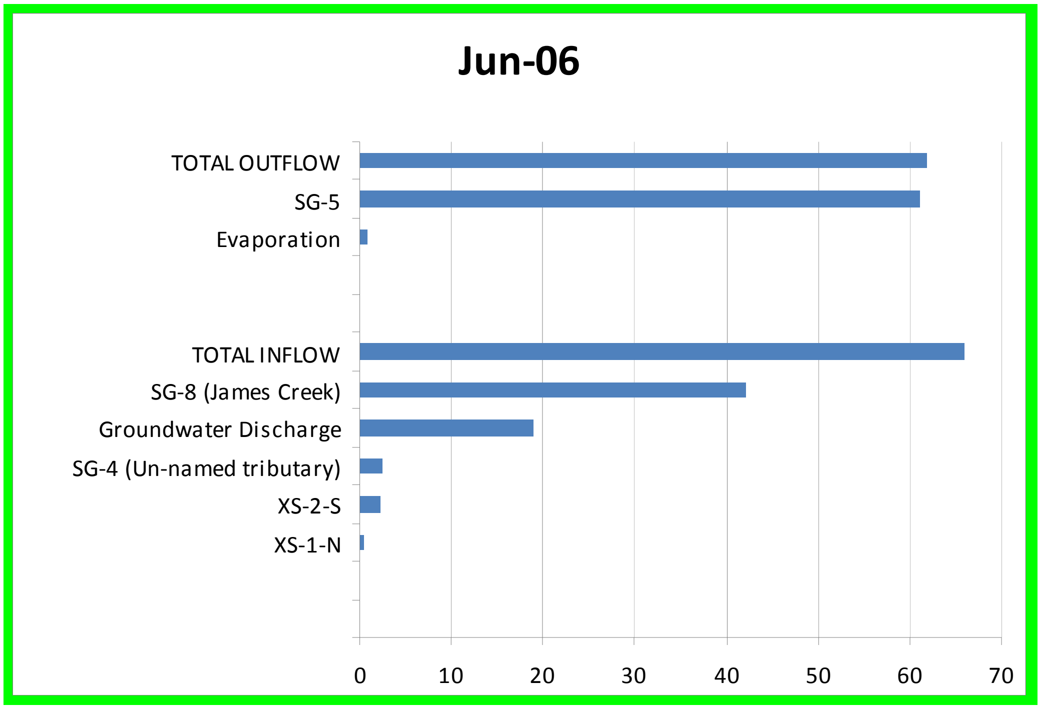


Chart 7: Components of the Water Balance for June 6

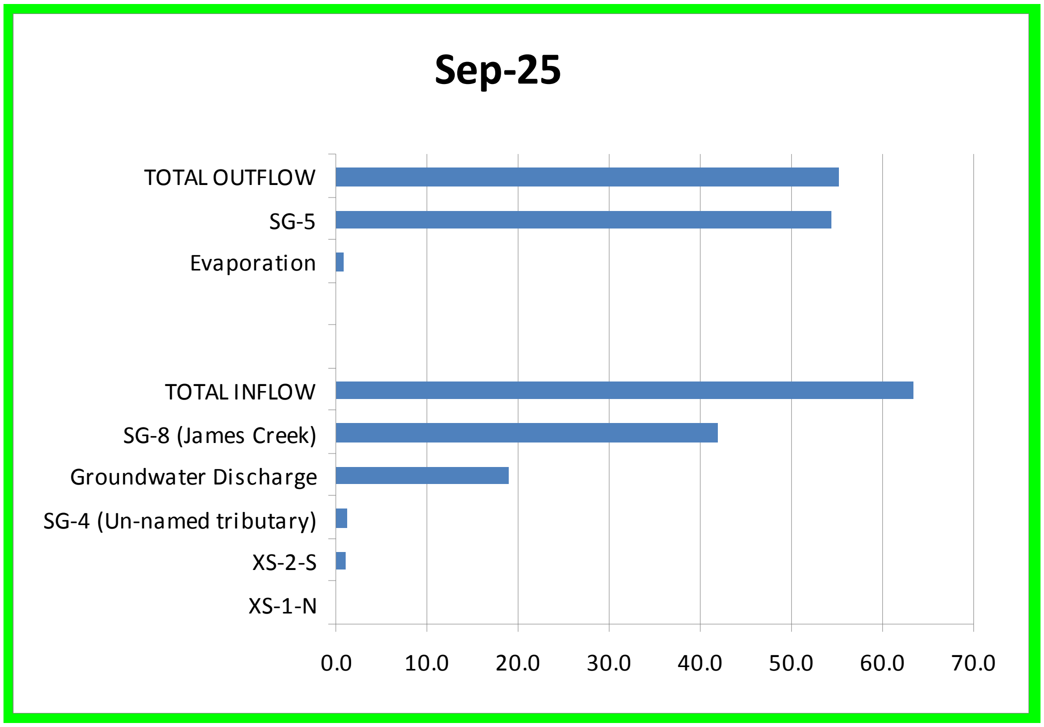


Chart 8: Components of the Water Balance for September 25

Overall, the June and September water balance ‘snapshots’ were quite similar: the flows were similar, and the relative contributions of the various components in the balance were similar. They are therefore considered to be representative of the entire ice-free season.

Comparison of Measured Flow Rates to Theoretical Rates – James Creek/Bean Lake Watershed:

Theoretical maximum runoff (R) estimates for the James Creek/Bean Lake watershed can be made by determining inputs to the watershed from precipitation (P) and subtracting the potential evapotranspiration (ET) based on the area of the watershed and published P and ET rates for the area. This approach assumes that any infiltration that occurs eventually discharges back to surface further along in the system.

The area of the watershed is estimated to be 1305 hectares. Precipitation data obtained from Environment Canada for the area for the period of 1949 to 2007 indicates average annual precipitation of 775 mm. A potential ET rate for the area of 375 mm was obtained from the Newfoundland and Labrador Water Atlas. Using these values yields an average annual runoff value of 5222504 m^3. This works out to 28230 m^3/day using a six month period as a basis and 14308 m^3/day over a twelve month period. These maximum theoretical values are considerably lower than the stream flow rates that were measured in James Creek from June to October 2008 if the measured flow rates are extrapolated over a full year.

Stream flow measurements over the spring/summer/fall of 2008 appear to represent seasonally above average flow conditions and the flow rates drop substantially during the winter months. Longer term full season monitoring will be undertaken in the future to confirm these conditions.

5.0 IMPACT OF JAMES PIT DEVELOPMENT ON WATER BALANCE

5.1 Pit Dewatering Impacts on James Springs and Unnamed Tributary:

The approximate locations of the proposed James Pits (North and South) are shown on Figure “Proposed James Pit and Dewatering Wells”. Pit dewatering will be required to lower the water table in the immediate vicinity of the pits to allow mining to occur. Dewatering will be achieved using primarily perimeter dewatering wells and, as required, in pit sumps. Given the proximity of the springs to the pits (North Spring is between the two proposed pits and the south spring is within the proposed James South Pit), the lowering of the water table in response to pit dewatering is expected to impact the flow from the James North and James South Springs. Since the springs are the source of flow in the unnamed tributary, the interception of flow from the springs by pit dewatering will likely lead to a significant reduction and perhaps even complete cessation of flow from the unnamed tributary unless steps are taken to replace the lost flow. The most appropriate way to manage this is to divert a portion of the water pumped from the groundwater dewatering back to the unnamed tributary to replace the groundwater that, under normal circumstances, would discharge from the two springs.

Based on current pumping test data, it is expected that water from the James Pit dewatering system will need to be directed to a sediment removal system or settling pond system to remove suspended solids before discharge to the natural environment. Anecdotal information (Don Hindy, former IOC engineer, December 2008) has indicated that historical groundwater observations were that the groundwater eventually became quite clear. However, a conservative approach will be taken to reduce TSS prior to the entrance of this water back into the nearby water systems.

The maximum, minimum, and mean flows from the James North and James South Springs over the June to October recording period are summarized below.

Flow	James North Spring – SG1	James South Spring – SG2
Maximum (m^3/min)	3.4	2.7
Minimum (m^3/min)	1.1	1.6
Mean (m^3/min)	2	2.1

Flow from the James North Spring forms the upper end of an unnamed tributary that flows southeast, accepts additional flow from the James South Spring, and ultimately discharges into Bean Lake (Figure 'James Springs and Unnamed Tributary"). Flow rates for the unnamed tributary were also recorded from June to mid October 2008 at a location just before it discharges to Bean Lake (SG4). The maximum, minimum, and mean flow rates for this location are summarized below.

Flow	Unnamed Tributary at Bean Lake – SG4
Maximum (m^3/min)	3.2
Minimum (m^3/min)	0.9
Mean (m^3/min)	1.6

The flow rate from SG4 (downstream end of the tributary) was always less than the combined flow from the two springs, indicating that water in the tributary infiltrates into the ground as it flows toward Bean Lake.

Based on the locations of the James North and James South Springs, the proposed outline of the James Pit, and the observations made during pumping tests at the site, it is highly probable that dewatering from the proposed pit will affect the flow rates from the springs, and in all probability the springs will stop flowing at some point during the development of the pit without the supplementation of water back into the fish habitat sections of the tributary. The mitigation strategy will involve diverting a portion of the perimeter groundwater well water to the unnamed tributary after running the water through a settling/filter system to remove suspended solids. The targeted redirected water flow rate to the tributary during operations would be the maximum rate measured from the tributary (SG4 flow data) during the 2008 monitoring period, while the average flow rate measured would be used during winter shutdown periods.

Groundwater is the source of water that discharges from the springs, therefore replacing the spring water with water from the dewatering wells means that the same source of water will be feeding the unnamed tributary before, during and after site development.

5.2 Effects of Dewatering Water on Bean Lake:

SNC Lavalin is conducting engineering work for the proposed mine. They have estimated that the cumulative amount of groundwater pumped by the pit dewatering system will be 113 m^3/min. Approximately 8 m/min of this water will be diverted to the unnamed tributary to offset water lost from the springs by dewatering, therefore approximately 105 m^3/min of dewatering water will be sent to Bean Lake via the inlet from James Creek. The area of Bean Lake is approximately 54 ha, therefore a discharge rate of 113 m^3/min only adds about 0.02 cm/min to the hydraulic loading of Ruth Pit and Bean Lake. The hydraulic impact to Bean Lake is considered to be negligible.

5.3 Effects of Process Water Use:

An additional item in the James Creek/Bean Lake water balance includes process water used to wash the ore prior to shipment. It is estimated that 505 m^3 of water per hour will be required. The best source for this water is considered to be pit dewatering water that can be diverted from the James pit dewatering system. This process water (reject fines wash water) will contain approximately 21 % solids after washing, therefore it will be pumped to Ruth Pit, located north of the James Property for settling. This additional volume (505 m^3/hour) will have a negligible hydraulic impact on Ruth Pit, which has an area of 61 hectares and a depth of 120 m (hydraulic loading of 0.001 cm/min). Ruth Pit has more than adequate capacity to accommodate this additional flow and no hydraulic impacts to James Creek are anticipated.

6.0 REFERENCES

Department of Environment and Lands, Water Resources Division, Government of Newfoundland and Labrador. Water Resources Atlas of Newfoundland. 1992.

Environment Canada, 2008. National Climate Data and Information ArchiveEnvironment Canada, Meteorological data

Findlay, B.F. Precipitation in Northern Quebec and Labrador: An Evaluation of Measurement Techniques. 1967.

Global Water, 2004. FP101-FP102 Global Flow Probe User's Manual.

Nichols, Lee Clifford. Hydrologic Balance of a Complex Drainage Area in New Quebec. June 1967.

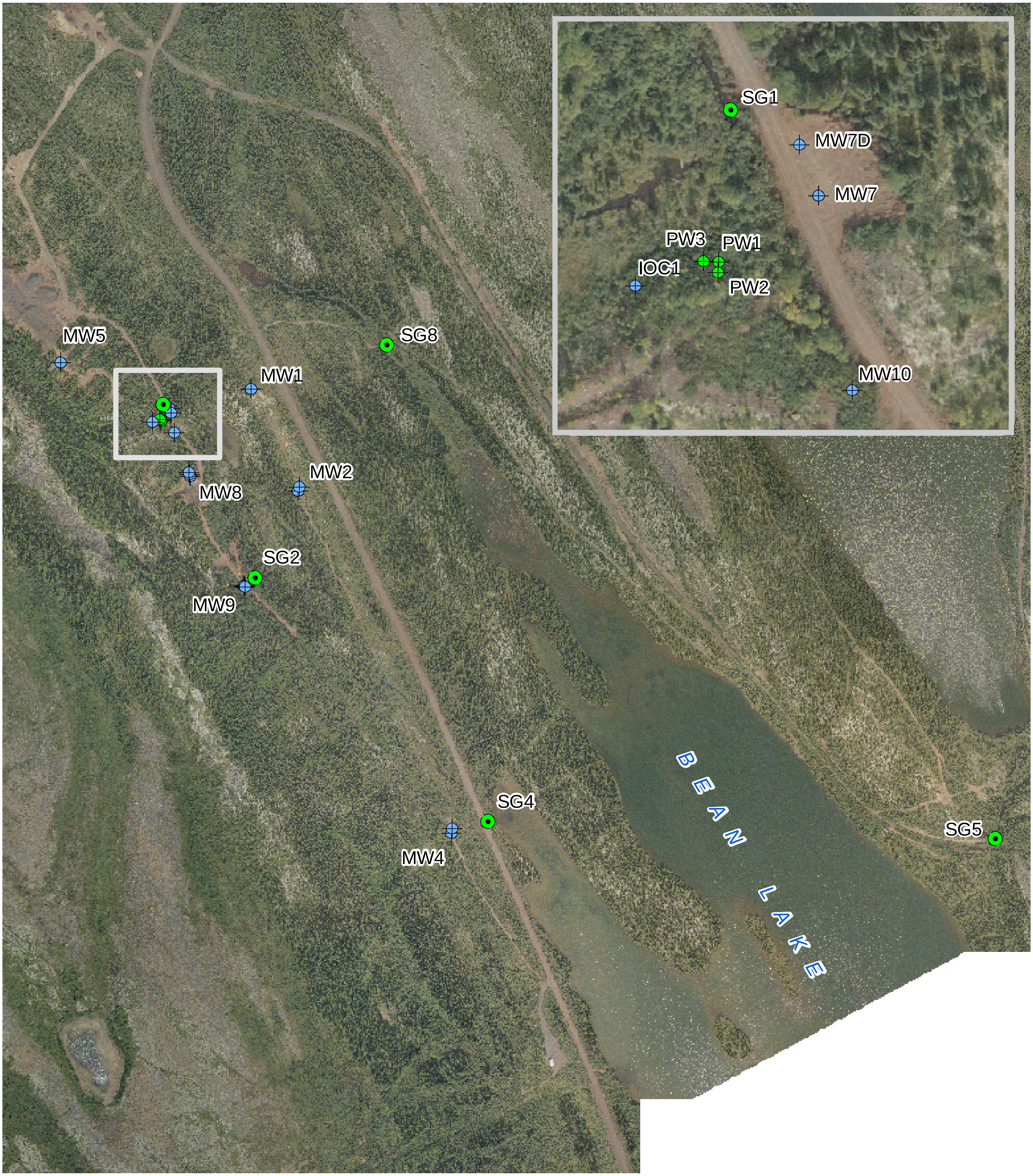


Figure xx: Monitoring Wells and Stream Gauges Locations

LEGEND:

- ⌖ Bedrock Wells
- ⌖ Pumping Wells
- ● Stream Gauges

Project Number:
K-B6836

Date: November 27, 2008

Data Source:
Eagle Mapping

WESA
A Better Environment For Business

N

0 25 50 100 150 200
Meters

LEGEND

Flow Direction

James Creek / Bean Lake Watershed Boundary

REFERENCE

Note:
Data Source : Geomatics Canada 1:50 000 NTS, Google Earth
Coordinate System : UTM NAD83 Zone 19 North

0 75 150 300 450 600
Meters

1:16,000

PROJECT

LIM SCHEFFERVILLE

TITLE

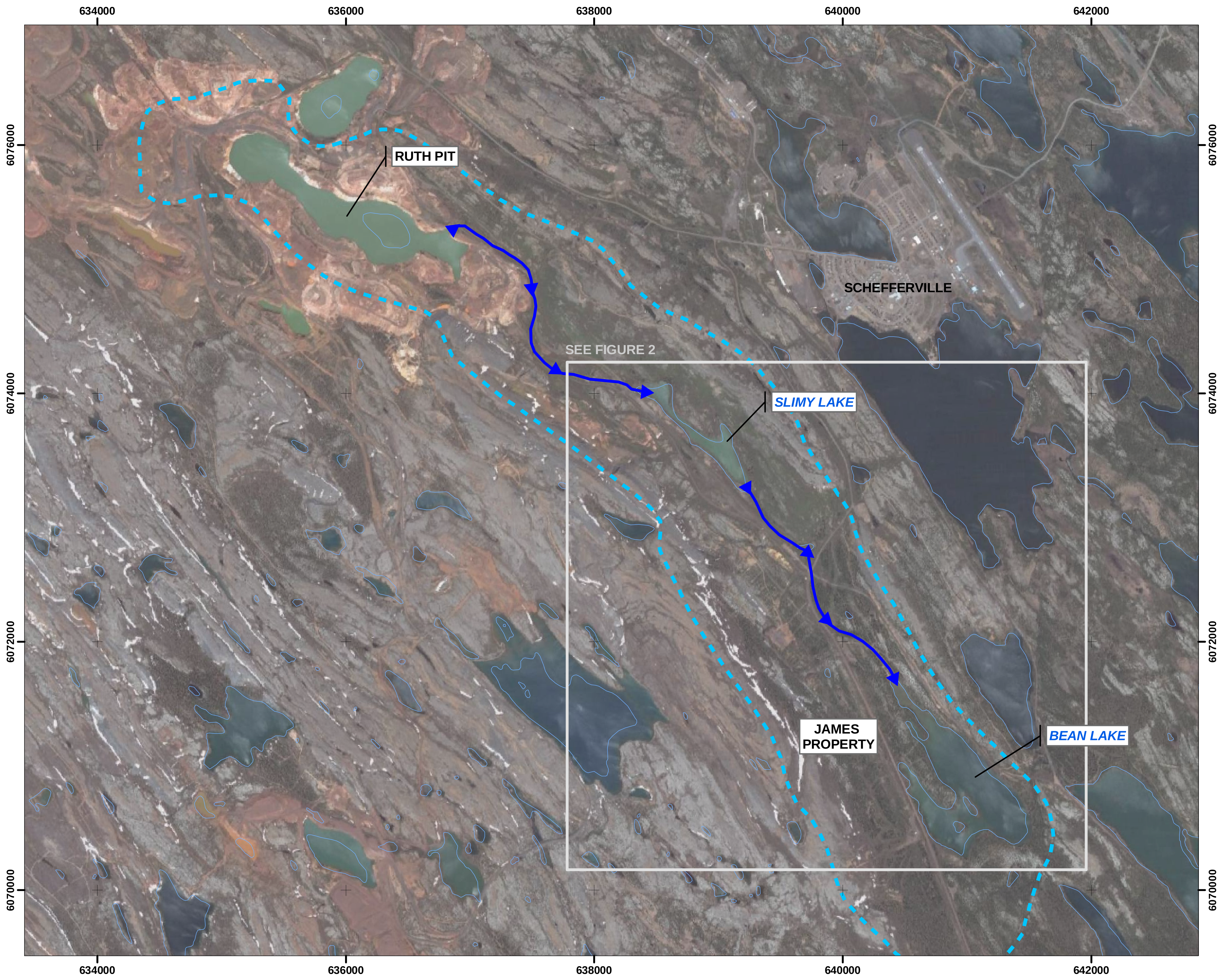
James Springs and
Unnamed Tributary

WESA
A Better Environment For Business

PROJECT No. KB6832		
DESIGN	JFD	
GIS	JFD	24/11/2008
CHECK	BOC	24/11/2008
REVIEW		

FIGURE xx

FIG2_LIM_DFO



LEGEND

→	Flow Direction
▭	James Creek / Bean Lake Watershed Boundary

REFERENCE

Note:
Data Source : Geomatics Canada 1:50 000 NTS, Google Earth
Coordinate System : UTM NAD83 Zone 19 North

0 100 200 400 600 800
Meters

1:30,000

PROJECT

LIM SCHEFFERVILLE

TITLE

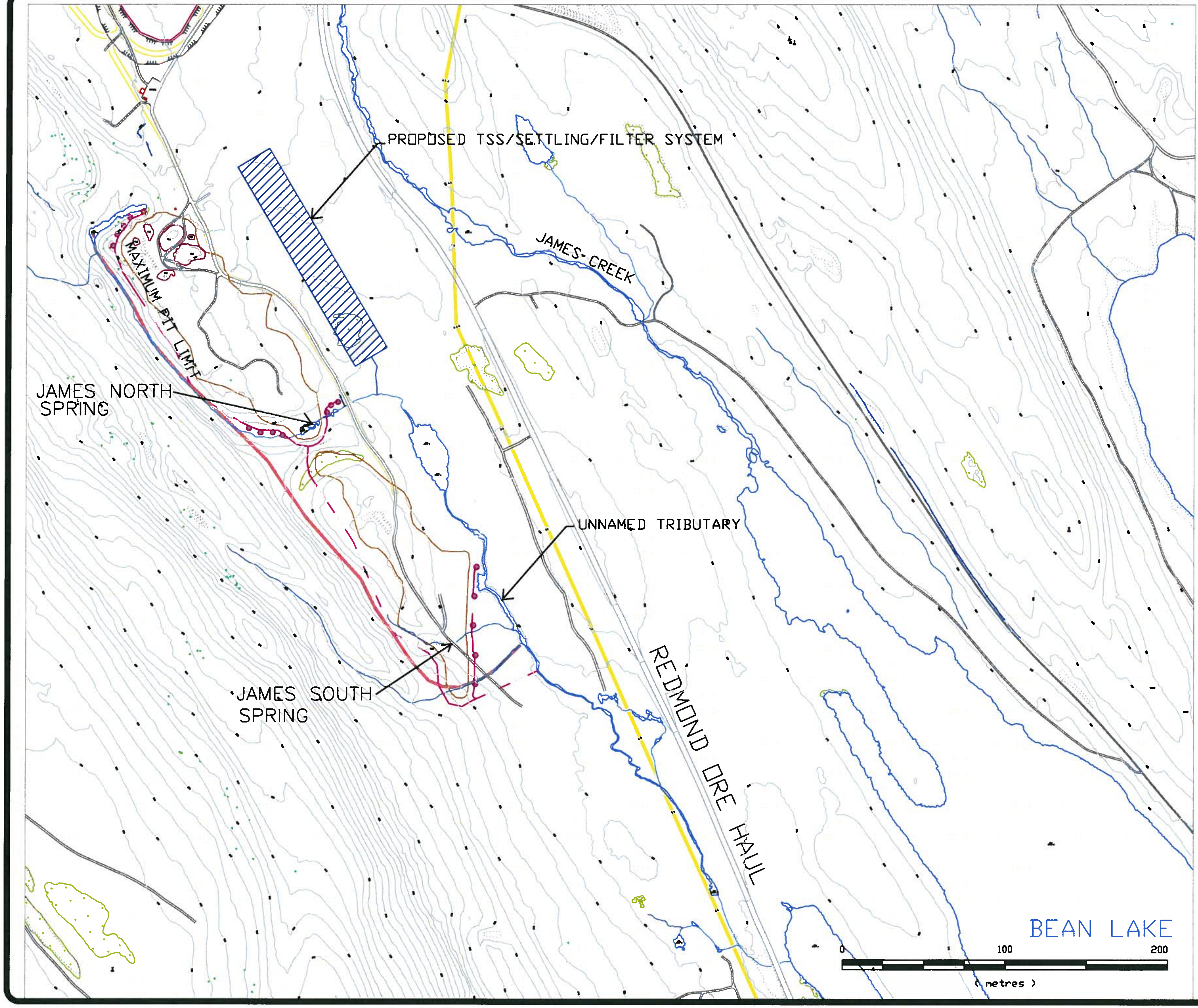
James Creek/Bean Lake
Drainage Area

WESA
A Better Environment For Business

PROJECT No. KB6832		
DESIGN	JFD	
GIS	JFD	24/11/2008
CHECK	BOC	24/11/2008
REVIEW		

FIGURE xx

FIG1_LIM_DFO



LEGEND

● PROPOSED DEWATERING WELL LOCATION

PROJECT NUMBER: B6836	DRAWN BY: C.M.R.	DESIGNED BY: B.O'C.
DATE: 05 DECEMBER 2008	CHECKED BY B.O'C.:	
SCALE: AS SHOWN	CAD FILE NO.: B6836-SP	

FIGURE:

PROPOSED JAMES PIT AND DEWATERING WELLS

WEST CENTRAL LABRADOR IRON ORE PROJECT

WESA
A Better Environment For Business

Appendix B

SITE PHOTOGRAPHS DESCRIPTIONS

Photograph Descriptions for Figures 3, 4 and 5

Figure 3

- **A.** Intermittent section of tributary in historically excavated site
- **B.** Small area of pooled water on the northern margin of historical stockpile site – no fish occurrence in this section
- **C.** Stream flow in sections that are represented in photos C and D were alternating surface and subsurface in nature
- **D.** Same as C
- **E.** Section of wide flats. Electrofishing resulted in no fish captures.
- **F.** Active spring in upstream section of tributary
- **G.** High gradient area of surface and subsurface flow
- **H.** Origin of tributary at upwelling on east side of access road. Adult and juvenile brook trout were observed at this site.

Figure 4

- **A.** Flow station site east of James Spring North
- **B.** Large pond with maximum depth <0.5m
- **C.** Riffle section at south end of pond
- **D.** Section of flats
- **E.** Side section of flats where numerous adult brook trout and redds were observed in the fall of 2007
- **F.** Smaller tributary that originates at James Spring South. The channel was choked with mats of watercress and a few juvenile brook trout were observed in this section
- **G.** Sections G and H are meandering sections of flats with high occurrences of large woody debris and overhead cover
- **H.** Same as G

Figure 5

- **A.** Section of mainly flats with high occurrences of LWD and overhead cover
- **B.** Wide section of flats
- **C.** Side area of flats where numerous adult brook trout were observed in September, 2007
- **D.** Channelized reach that consisted mainly of flats and riffles
- **E.** Same as D
- **F.** Same as D
- **G.** Culvert inflow on west side of road
- **H.** Stream discharge from perched culvert on east side of road

APPENDIX O

Summary of Stakeholder Consultation

Labrador Iron Mines Ltd Stakeholder Consultation

Report Parameters:
Start Date: 1 Jan 2005
End Date: 15 Dec 2008

Community Visit 30 May 2005 Kawawachikamach	
Participants: Phillip Einish Chief – Naskapi Nation John Mameamskum Naskapi **Team Members:** Erick Chavez Gerry Gauthier John Kearney Terence McKillen	**Summary:** Introductory visit to Schefferville. Reviewed project proposal. No major issues raised. Do not want to see any new mining resulting in the visual “eyesore” left behind by IOC. Aboriginals effectively shut out by IOC operations.

Meeting 23 Sep 2005	
Participants: Uashat Band Council Gilbert Pilot Uashat **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Initial MOU discussion and project introduction. No significant issues other than jobs and economic benefits.

Meeting 21 Oct 2005 Uashat Meeting	
Participants: Richard Bell TSH **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** TRT rail capacity discussion. Upgrade on a yearly approach.

Meeting 18 Nov 2005 Sept-Iles	
Participants: Normand Laprise Norma Lebri **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Meeting with Band officials in Sept-Iles and City Officials. Presentation of LIM project.

Meeting 1 Dec 2005	
Participants: Ben Michel Labrador Innu **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Meeting with Grand Chief - Innu of Labrador. Discussion on project and benefits for Labrador.

Phone Call
2 Dec 2005

Participants: Gilbert Pilot Uashat **Team Members:** Terence McKillen	**Summary:** Reviewed Anglesey press release and discussed scope of project. Asked to set up a meeting with Development Corporation and Band Council.

Meeting
7 Mar 2006

Participants: Innu Chiefs and Advisors **Team Members:** Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Meeting with aboriginal leaders. Project presentation and benefits.

Meeting
4 May 2006
Sept-Iles

Participants: Chief Andree Chief - Uashat Gilbert Pilot - Uashat Daniel Ashini Labrador Innu Ben Michel Labrador Innu Dave Nuke Labrador Innu **Team Members:** John Kearney Joseph Lanzon Bill Hooley Veikko Koskella Terence McKillen Dan O'Rourke	**Summary:** LIM meets jointly with Labrador Innu Association and Uashat Innu Council. Review of project proposal. Aboriginal issues revolve around ensuring economic benefit accrues to their communities as they all felt they were abandoned by former IOC operations. Ben Michel outlined a vision for pan-provincial cooperation among the aboriginal groups and thought it should be possible to have a single negotiating table when it came time to negotiate the economic benefits from the project. Separate presentation made to the Uashat community. Issues raised related to jobs and protection of the environment with respect to ensuring that the communities can continue to “live off the land”.

Phone Call
8 May 2006

Participants: Gilbert Pilot Uashat **Team Members:** Terence McKillen	**Summary:** To set up Wabash meeting with Ben Michel and Uashat Chief.

Meeting
10 May 2006
Wabush

Participants: Daniel Ashini Labrador Innu Ben Michel Labrador Innu	**Summary:** Meeting with Labrador Innu Association. Review of project development and issues for LIA. Mr. Michel spoke of his vision for development of Labrador and the extension of a rail link from Labrador City to Goose Bay and further north to open up the country for development.

Meeting
10 May 2006
Wabush

Team Members: John Kearney Joseph Lanzon Terence McKillen	

Meeting
18 May 2006
Montreal

Participants: Daniel Ashini Labrador Innu Dave Nuke Labrador Innu Gilbert Pilot Uashat **Team Members:** Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Meeting to discuss project and Labrador based and Innu connected contractors. Uashat community anxious that LIM allow consultants and contractor with whom their Development Corporation has entered in to partnerships to have opportunity to bid on any contracts. LIM discussed the necessity of securing a qualified diamond drill company for a summer drill program. Mr. Nuke (LIA) was not in favour of LIM using Goose Bay-based Cartwright Diamond Drilling Co.

Phone Call
19 May 2006

Participants: Dave Nuke Labrador Innu **Team Members:** Terence McKillen	**Summary:** Gave advice on potential drill contractors and other Labrador contractors.

Phone Call
23 Jun 2006

Participants: Gilbert Pilot Uashat **Team Members:** Terence McKillen	**Summary:** Contractor for rail study.

Meeting
28 Jun 2006
Ottawa

Participants: John Mameamskum – Director General Naskapi Nation **Team Members:** John Kearney Dan O'Rourke Joseph Lanzon	Project update. Discussion on TSH railway.

Meeting 28 Jun 2006 **Ottawa**	
Participants: Chief Andre – Matimekush Innu Real Mckenzie Gilbert Pilot – Uashat Innu **Team Members:** John Kearney Dan O'Rourke Joseph Lanzon	Project update. Issues for Matimekush community are jobs, sustainable economic development and ensuring that the community benefits from mine development this time. Discussion on the economic benefit for TSH railway.

Phone Call 5 Jul 2006	
Participants: Richard Bell TSH **Team Members:** Terence McKillen	**Summary:** Discussed TSH support for an independent Rail Study.

Meeting 30 Aug 2006 Montreal	
Participants: Daniel Ashini Labrador Innu Leo F Dillon Advisor - Labrador Innu Ben Michel Labrador Innu Dave Nuke Labrador Innu Gilbert Pilot Uashat **Team Members:** Joseph Lanzon Terence McKillen	**Summary:** Discussion on possibility of having single negotiating table. Mr. Michel reiterated his belief and desire to have a single negotiating table, however, it was still necessary for him to consult with the Naskapi and the Innu of Matimekush. No specific issues emerged other than economic development and jobs for the communities.

Meeting 5 Nov 2006 Montreal	
Participants: Chief Andree Chief - Uashat Gilbert Pilot Uashat **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Meetings with Band Members and Councilors. Project update.

Meeting 4 Jan 2007 Quebec City	
Participants:	**Summary:** Economic development initiatives to help Schefferville. Mining project

Meeting 4 Jan 2007 Quebec City	
Andre Cote Gilbert Pilot Uashat **Team Members:** Joseph Lanzon Dan O'Rourke	update.

Presentations 16 Jan 2007 Sept-Iles	
Participants: Uashat Band Council **Team Members:** Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Public presentation to new Council of Uashat. LIM review proposed project development and took the new council through the substantive consultation process already initiated with the former Chief and Council.

Meeting 18 Jan 2007 St.John's	
Participants: Norm Mercer Mines Richard Wardle Assistant Deputy Minister - Gov't of NL - Mines **Team Members:** John Kearney Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Introductory Meeting with Mines Ministry Representatives. Necessity to ensure benefits accruing to the province. Consult with Labrador Innu.

Meeting 12 Feb 2007 Schefferville	
Participants: Chief Andree Chief - Uashat Rodrigue Mckenzie **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** MOU negotiations.

Meeting 13 Feb 2007 Kawa	
Participants: John Mameamskum Naskapi **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Review project development with Naskapi Leadership and Band members. Discussed economic stimulus from TSH railway.

Email 3 Apr 2007	
Participants: Chief Andree Chief - Uashat Daniel Ashini Labrador Innu **Team Members:** Bill Hooley Joseph Lanzon Terence McKillen	**Summary:** Set up meeting with Daniel Ashini.

Email 5 Apr 2007	
Participants: Marvin Barnes Regional Manager, EA and Major Projects - DFO Michael Cahill Gov't of NL - Environment and Conservation Bill Coulter CEAA **Team Members:** Terence McKillen	**Summary:** Conceptual project description draft.

Email 6 Apr 2007	
Participants: Schefferville Community Labrador Innu **Team Members:** Terence McKillen Dan O'Rourke	**Summary:** Project update.

Email 6 Apr 2007	
Participants: John Mameamskum Naskapi **Team Members:** Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Possible letter from John M. dated April 4.

Email 8 Apr 2007	
Participants: Chief Andree Chief - Uashat Labrador Innu William Johnson **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Band meeting April 11.

Meeting
11 Apr 2007
Schefferville

Participants:

Chief Andree
Chief - Uashat

William Johnson

Chief - Innu Matimekush/Lac John First Nation

Jean Marc Robert
General Director - Societe de Gestion Innu

Team Members:
Matthew Coon Come
Joseph Lanzon
Rodrigue Mckenzie
Dan O'Rourke

Summary: Schefferville negotiation meeting.

Email
29 Apr 2007

Participants:

Paul Wilkinson

Team Members:
Joseph Lanzon
Terence McKillen
Dan O'Rourke

Summary: Contact information for NL and Labrador Consultants.

Meeting
16 May 2007
Montreal

Participants:

Gilbert Pilot
Uashat

Team Members:
Joseph Lanzon

Summary: Preparations for LIM's corporate presentations in Sept-Iles.

Email
20 Jun 2007

Participants:

John Mameamskum
Naskapi

Team Members:
Bill Hooley
John Kearney
Joseph Lanzon
Terence McKillen

Summary: TRT MOU.

Email
24 Jul 2007

Participants:

Daniel Ashini
Labrador Innu

Edgar Branton

Leo F Dillon
Advisor – Labrador Innu

Summary: MOU draft changes. No new issues. LIA is unlikely to participate in direct jobs on site but would participate through LIA businesses and through partnerships with contractors, etc.

Email
24 Jul 2007

Labrador Innu John Olthuis Lawyer - Labrador Innu-Nation Maggie Wente **Team Members:** Joseph Lanzon Terence McKillen	

Meeting
5 Aug 2007
Schefferville

Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon	**Summary:** Initial meeting sessions with newly elect Chief Real McKenzie. Review project proposal and importance of TSH railway. Chief recognized that jobs and sustainable economic development are important for his community. Young community with high unemployment. Despite importance of jobs and economy, the land must also be protected. They have to live with IOC's legacy.

Meeting
6 Aug 2007

Participants: George Ernest Chief - Uashat **Team Members:** Joseph Lanzon	**Summary:** Meeting with newly elected Band Council members and Chief George Ernest.

Email
22 Aug 2007

Participants: Schefferville Community **Team Members:** Joseph Lanzon Terence McKillen Dan O'Rourke	**Summary:** Meeting planning to Schefferville.

Email
27 Aug 2007

Participants: Marvin Barnes Regional Manager, EA and Major Projects - DFO Roger Johnson Senior Habitat Biologist - DFO Sigrid Kuehnemund Senior Regional Habitat Biologist - Fisheries and Oceans Canada Shawna Powell Kevin Power Michelle Roberge Habitat Planning and	**Summary:** DFO HADD information package, DFO site visit in September and aquatic program.

Email
27 Aug 2007

Operation - DFO **Team Members:** Gary Epp Terence McKillen Derek Parks	

Email
31 Aug 2007

Participants: Jason Kelly Habitat Evaluation Section Assessor - DFO **Team Members:** Gary Epp Terence McKillen Derek Parks	**Summary:** Update on DFO site visit in September; Fish Habitat Compensation staff to attend; Presentation of project details.

Meeting
9 Sep 2007
Quebec City

Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon	**Summary:** Meeting with Chief Real McKenzie and other Band Council members.

Email
14 Sep 2007

Participants: Daniel Ashini Labrador Innu Labrador Innu John Olthuis Lawyer - Labrador Innu-Nation **Team Members:** Joseph Lanzon Terence McKillen	**Summary:** Revised MOU.

Email
22 Sep 2007

Participants: Leo F Dillon Advisor - Labrador Innu Mark Nui Grand Chief Labrador Innu Peter Penashue Deputy Grand Chief - Labrador Innu **Team Members:** Terence McKillen	**Summary:** Election results.

Other 28 Sep 2007	
Participants: Chief Andree Chief - Uashat **Team Members:** Joseph Lanzon Dan O'Rourke	**Summary:** Participated in Youth Retreat organized by Band Councils for Uashat and Matimekush. Presentation of project.

Meeting 12 Oct 2007 **Toronto**	
Participants: Chief Philip Einish – Naskapi Paul Wilkinson **Team Members:** John Kearney Terence McKillen	**Summary:** Overview of project. Chief Einish indicated community need for jobs and development. Need to protect the environment.

Meeting 29 Oct 2007 Montreal	
Participants: J Pratt Legal Counsel - Paul Wilkinson **Team Members:** John Kearney Joseph Lanzon	**Summary:** Naskapi MOU discussion.

Email 19 Nov 2007	
Participants: Labrador Innu Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon Terence McKillen	**Summary:** Schefferville and Naskapi draft MOU and December 4th to 5th meeting.

Email 23 Nov 2007	
Participants: Labrador Innu Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Erick Chavez John Kearney Joseph Lanzon Terence McKillen	**Summary:** December 6th to 7th Schefferville travel arrangements and meeting with Labrador Innu.

Email
28 Nov 2007

Participants: Peter Penashue Deputy Grand Chief - Labrador Innu **Team Members:** Matthew Coon Come Joseph Lanzon Terence McKillen	**Summary:** December meeting in Goose Bay.

Meeting
6 Dec 2007
Schefferville

Participants: Council Matimekush Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Erick Chavez Matthew Coon Come John Kearney Joseph Lanzon Terence McKillen	**Summary:** Meeting with Matimekush - Council and Community. Review project update and use of TSH railway. Council members indicated support for LIM proposal and reiterated need to participate in economic benefit this time.

Meeting
7 Dec 2007
Goose Bay

Participants: Mark Nui Grand Chief - Labrador Innu Peter Penashue Deputy Grand Chief - Labrador Innu Chief Anastasia Quepee Chief Prote Poker **Team Members:** Erick Chavez Matthew Coon Come John Kearney Joseph Lanzon Terence McKillen	**Summary:** Introduction to new council and Innu leadership. LIA introduced economic development corporation and the businesses associated with their community. They feel that it is unrealistic to assume that very many of their community would seek jobs in Schefferville area operations but their businesses would very definitely wish to bid on provision of goods and services. It was noted that the LIA partnership with SNC Lavalin for engineering work in the Province was nearing completion and that LIM had already engaged SNC to prepare a Technical Report and to continue with engineering design work.

Meeting
7 Dec 2007
Kawawachikamach

Participants: Phillip Einish Chief - Naskapi **Team Members:** Erick Chavez Matthew Coon Come John Kearney Joseph Lanzon	**Summary:** Community Visit and Presentation to Chief and Administrators. MoU discussion.

Meeting
7 Dec 2007
Kawawachikamach

Terence McKillen	

Meeting
11 Dec 2007
Ottawa

Participants: Labrador Innu **Team Members:** Joseph Lanzon	**Summary:** Labrador Innu business opportunities IBA discussion. Partnership on procurement.

Meeting
9 Jan 2008
St. John's

Participants: Chief Anastasia Quepee Labrador Innu Grand Chief Marc Innu Labrador Innu Peter Penashue Deputy Grand Chief - Labrador Innu Chief Prote Poker Paul Rich Innu Development Corp **Team Members:** Joseph Lanzon Terence McKillen	**Summary:** IBA process and final MoU negotiations. MoU provides for community support for the project and focuses on economic participation, opportunity for Innu businesses, community consultation on issues such as training, environmental, heritage and cultural protection, etc. MoU executed.

Meeting
21 Jan 2008
Wabush

Participants: Mayor Wabush Mayor Labrador City **Team Members:** Joseph Lanzon Bill Hooley	Meeting with the mayors of Labrador City and Wabush. Provide project overview and update.

Meeting
4 Feb 2008
St. John's

Participants: Labrador Innu **Team Members:** Matthew Coon Come Joseph Lanzon	**Summary:** Negotiating IBA.

Meeting
25 Feb 2008
Quebec City

Participants: Innu Chiefs of Uashat and	**Summary:** Project update. Discussion on TSH Railway.

Meeting 25 Feb 2008 **Quebec City**	
Matimekush and council members **Team Members:** John Kearney Terence McKillen Joseph Lanzon	

Meeting 28 Feb 2008 Sept-Iles	
Participants: Representative New Millenium **Team Members:** Marc Duclos Joseph Lanzon Terence McKillen	**Summary:** LIM Project Presentation - TSH Board Meeting.

Meeting 29 Feb 2008 St. John's	
Participants: Vanessa Rodrigues CEAA Marvin Barnes DFO Randy Decker Transport Canada Alen Troke Environment & Conservation Bill Coulter CEAA Michael Cahill Gov't of NL - Environment and Conservation Carol Grant DFO **Team Members:** Linda Wrong Derek Parks	**Summary:** Joint Provincial/Federal Regulatory meeting with LIM to discuss the draft Project Registration document and to identify any issues. No serious identified.

Meeting 3 Mar 2008 PDAC Toronto	
Participants: Chief - Montagnais-Schefferville Chief - Montagnais - Sept-Iles **Team Members:** Marc Duclos	**Summary:** Chief of Montagnais - Sept-Iles and Chief of Montagnais Schefferville. Rail discussion.

Meeting 3 Mar 2008 PDAC Toronto	
Joseph Lanzon	

Meeting 4 Mar 2008	
Participants: Minister Dunderdale Dick Wardle **Team Members:** Linda Wrong Bill Hooley Joseph Lanzon John Kearney Terence McKillen Matthew Coon Come	**Summary:** Presentation to Minister Dunderdale and Dick Wardle.

Email 4 Mar 2008	
Participants: Michael Cahill Gov't of NL - Environment and Conservation Patrick Marrie Gov't of NL - Environment and Conservation Carl Strong Department of Environment and Conservation **Team Members:** Linda Wrong	**Summary:** St. John's meeting, Crown Land Referral, acceptability of bulk sample for metallurgical purposes.

Commitment 13 Mar 2008 Youth Centre	
Participants: Council Matimekush **Team Members:** Joseph Lanzon Terence McKillen John Kearney Linda Wrong Matthew Coon Come	**Summary:** Signing of MOU - with Matimekush. MoU provides for community support for the project and emphasizes job opportunities, business participation, development of the TSH railway, economic participation, and training as well as consultation with the community over environmental, cultural and heritage issues.

Meeting 14 Mar 2008 **Kawa**	
Participants: Chief Philp Einish **Team Members:**	Project update and presentation of final MOU for signature. MoU provides for community support for the project and emphasizes job opportunities, business participation, development of the TSH railway, economic participation, and training as well as consultation with the community over environmental, cultural and heritage issues.

Meeting 14 Mar 2008 **Kawa**	
John Kearney Terence McKillen Joseph Lanzon	

Email 19 Mar 2008	
Participants: Chantale Basque Principal - Schefferville School Schefferville Schools **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** Dates of the opening of Schefferville School and interest in catering.

Email 4 Apr 2008	
Participants: Daniel Andre Helper - Schefferville Community Benedict Mckenzie Helper - Schefferville Community **Team Members:** Rodrigue Mckenzie Derek Parks Linda Wrong	**Summary:** Resource/machinery and helpers discussions.

Email 4 Apr 2008	
Participants: Schefferville Community **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** Plans to attend conference and plans to meet with community elders.

Email 11 Apr 2008	
Participants: Marvin Barnes Regional Manager, EA and Major Projects - DFO Michael Cahill Gov't of NL - Environment and Conservation Bill Coulter CEAA Len Mandville Mineral Development Geologist - Gov't of NL - Mines	**Summary:** Confirmation of St. John's meeting location and time.

Email
11 Apr 2008

Team Members: Terence McKillen Linda Wrong	

Email
14 Apr 2008

Participants: Marvin Barnes Regional Manager, EA and Major Projects - DFO Jason Kelly Habitat Evaluation Section Assessor - DFO **Team Members:** Derek Parks Linda Wrong	**Summary:** Discussion to complete scientific fish collection activities, DFO fish collection permit.

Meeting
16 Apr 2008
Sept-Iles

Participants: COPIC **Team Members:** Marc Duclos Joseph Lanzon	**Summary:** LIM Presentation to COPIC - Economic Development Corporation of Sept-Iles

Meeting
17 Apr 2008

Participants: Pierre Gagnon Port of Sept-Iles Raynald Quellet Port of Sept-Iles **Team Members:** Marc Duclos	**Summary:** Meeting with Port of Sept-Iles

Meeting
17 Apr 2008
Toronto

Participants: Grand Chief – Mark Nui (LIA) Deputy Grand Chief Peter Penashue Chief Anastasia Quepee Chief Prote Poker Simon Michel John Olthius **Team Members:** Joseph Lanzon Terence McKillen Matthew Coon Come	**Summary:** IBA schedule preparation.

Email 21 Apr 2008	
Participants: Schefferville Community **Team Members:** Rodrigue Mckenzie Terence McKillen Derek Parks Linda Wrong	**Summary:** Request for program helpers.

Meeting 22 Apr 2008	
Participants: Chief Georges Ernest Gregoire - Uashat **Team Members:** Joseph Lanzon	**Summary:** MOU schedule preparation.

Commitment: 22 Apr 2008	
Participants: Chief Philip Einish – Naskapi **Team Members:** John Kearney Terence McKillen	**Summary:** Sign MOU.

Email 27 Apr 2008	
Participants: John Mameamskum Naskapi **Team Members:** Terence McKillen Derek Parks Linda Wrong	**Summary:** Reimbursement and rental rates. Community helpers.

Meeting 30 Apr 2008 Ottawa	
Participants: Ministry of Indian Affairs Railway Association of Canada **Team Members:** Marc Duclos Joseph Lanzon	**Summary:** LIM Presentation to Ministry of Indian Affairs and The Railway Association of Canada (RAC).

Meeting 8 May 2008 **Halifax**	
Participants: Mark Nui – Labrador Innu Peter Penashue John Olthius	**Summary:** Negotiation table for IBA. No new issues.

Meeting 8 May 2008 **Halifax**	
Gerry Kerr Simon Michel **Team Members:** Terence McKillen Joseph Lanzon	

Phone Call 13 May 2008	
Participants: Paul Rich Innu Development Corp **Team Members:** Terence McKillen	**Summary:** Update on Innu-SNC JV.

Email 14 May 2008	
Participants: Schefferville Community **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** Community meeting reminder and details.

Meeting 20 May 2008 **Sept-Iles**	
Participants: Richard Bell TSH Team Members: Marc Duclos	Summary: LIM Operating Schedule Mid 2009.

Meeting 20 May 2008 **Sept-Iles**	
Participants: Richard Bell TSH **Team Members:** Gilles Blouin Marc Duclos	Summary: Technical Operating Meeting.

Meeting 26 May 2008 Montreal	
Participants: Council Matimekush Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:**	**Summary:** Review of LIM Project

Meeting
26 May 2008
Montreal

Marc Duclos
Joseph Lanzon

Email
26 May 2008

Participants: Schefferville Community Schefferville Schools **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** Clarification of LIM Schefferville visit and LIM's offer to provide graduation robes.

Email
28 May 2008

Participants: Schefferville Schools **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** LIM buys and delivers graduation robes and caps to Shefferville graduates.

Email
28 May 2008

Participants: Heather Cranford NL Human Resources John Davis Director, Mineral Resources Mines Branch - Newfoundland Government Randy Decker Senior Environmental Assessment Officer - Transport Canada Garry R. Gosse NL Transportation and Works Dan Gulliver NL Human Resources Michael Harvey NL Intergovernmental Affairs Cluney Mercer NL Transportation and Works Dan Michielsen NL Pollution Prevention Dexter Pitman NL Pollution Prevention Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation NL Dept. of Justice NL Dept. of Aboriginal and	**Summary:** Date confirmation of screening committee meeting, St. John's, NL, and partial list of attendees.

Email 28 May 2008	
Labrador Affairs NRCAN (telecon) **Team Members:** Linda Wrong Joanne Robinson Derek Parks	

Email 29 May 2008	
Participants: John Davis Director, Mineral Resources Mines Branch - Newfoundland Government **Team Members:** Linda Wrong	**Summary:** Travel plans to St. Johns for a meeting with the Department of Environment and Conservation.

Email 30 May 2008	
Participants: Marvin Barnes Regional Manager, EA and Major Projects - DFO Bill Coulter CEAA Randy Decker Senior Environmental Assessment Officer - Transport Canada Garry R. Gosse NL Transportation and Works Len Mandville Mineral Development Geologist - Gov't of NL - Mines Kathy Martin Gov't of NL Bill Parrott Deputy Minister - Gov't of NL - Environment and Conservation Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation Vanessa Rodrigues Senior Program Officer - CEA Agency **Team Members:** Derek Parks Linda Wrong	**Summary:** Meeting arrangements in St. John's concerning the registration document with Province and Federal Regulators.

Email
30 May 2008

Participants: John Mameamskum Naskapi **Team Members:** John Kearney Linda Wrong	**Summary:** Discussion of education and dates of Schefferville visit.

Meeting
2 Jun 2008
Sept-Iles

Participants: Uashat Band Council **Team Members:** Matthew Coon Come Marc Duclos Joseph Lanzon Terence McKillen	**Summary:** MOU Negotiation. The community is interested in jobs and business development. Families that hold trap line lots may need to be compensated.

Meeting
2 Jun 2008
St. John

Participants: Vanessa Rodrigues Senior Program Officer - CEA Agency Annette Tobin NRCAN/MPMO **Team Members:** Linda Wrong Derek Parks Joanne Robinson	**Summary:** Meeting with MPMO and CEAA. Project not likely to trigger MPMO.

Meeting
2 Jun 2008
St. John's

Participants: Heather Cranford NL Human Resources John Davis Director, Mineral Resources Mines Branch - Newfoundland Government Randy Decker Senior Environmental Assessment Officer - Transport Canada Garry R. Gosse NL Transportation and Works Dan Gulliver NL Human Resources Michael Harvey NL Intergovernmental Affairs Cluney Mercer NL Transportation and	**Summary:** Meeting with Provincial and Federal Regulators, LIM and Consultants.

Meeting
2 Jun 2008
St. John's

Works Dan Michielsen NL Pollution Prevention Dexter Pitman NL Pollution Prevention Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation NL Dept. of Justice NL Dept. of Aboriginal and Labrador Affairs NRCAN (telecon) **Team Members:** Linda Wrong Joanne Robinson Derek Parks	

Email
2 Jun 2008

Participants: John Mameamskum Naskapi Curtis Tootoosis Principal - Jimmy Sandy Memorial School **Team Members:** John Kearney	**Summary:** Discussion of educational support from LIM for Kawa schools.

Meeting
3 Jun 2008
Sept-Iles

Participants: Pierre Gagnon Port of Sept-Iles Carol Soucy Port of Sept-Iles **Team Members:** Matthew Coon Come Marc Duclos Joseph Lanzon Terence McKillen	**Summary:** Review and Update of LIM Project.

Meeting
4 Jun 2008
Happy Valley-Goose Bay

Participants: Fred Hall Innu Development Ltd. Partnership Wayne Kelsie Innu Development Ltd. Partnership	**Summary:** Project Overview and discussion of environmental program.

Meeting 4 Jun 2008 Happy Valley-Goose Bay	
Paula Reid Innu Nation **Team Members:** Linda Wrong	

Meeting 4 Jun 2008 Happy Valley-Goose Bay	
Participants: Paul Aylward - Department of Crown Lands **Team Members:** Linda Wrong	**Summary:** Surface title application and confirmation that correct process being followed.

Meeting 4 Jun 2008 **Toronto**	
Participants: Nadir Andre – lawyer Matimekush Innu **Team Members:** Joseph Lanzon Terence McKillen	**Summary**: Discussion on commercial agreement arising from MoU.

Email 5 Jun 2008	
Participants: Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation **Team Members:** Linda Wrong	**Summary:** Baseline water quality data to Province.

Email 9 Jun 2008	
Participants: Michael Cahill Gov't of NL - Environment and Conservation Deborah Clements Bill Coulter CEAA Livain Michaud Debra Myles CEAA Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation	**Summary:** Federal coordination notice and Spring 2008 environmental baseline program to address outstanding information requirements.

Email
9 Jun 2008

Vanessa Rodrigues
  Senior Program Officer - CEA Agency

Annette Tobin
  NRCAN/MPMO

Glenn Troke

Julie Whiteway

Jerry Wolchuck

Team Members:
  Linda Wrong
  Joanne Robinson
  Derek Parks
  Bruce Bennett

Email
10 Jun 2008

Participants:

Michael Cahill
  Gov't of NL - Environment and Conservation

Randy Decker
  Senior Environmental Assessment Officer - Transport Canada

Jason Kelly
  Habitat Evaluation Section Assessor - DFO

Paul Rideout
  Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation

Vanessa Rodrigues
  Senior Program Officer - CEA Agency

Team Members:
  Marc Duclos
  Bill Hooley
  John Kearney
  Linda Wrong

Summary: Confirmation that no major undertakings are necessary for the rail line, need for a decision regarding culverts.

Email
11 Jun 2008

Participants:

Linda Poitras
  Naskapi Development Corporation

Schefferville Schools

Curtis Tootoosis
  Principal - Jimmy Sandy Memorial School

Team Members:
  Bill Hooley
  John Kearney
  Joseph Lanzon
  Terence McKillen
  John Rogers

Summary: Schefferville Graduation. Linda Wrong attends and provides awards to graduates.

Email 11 Jun 2008	
Linda Wrong	

Email 14 Jun 2008	
Participants: Schefferville Community Linda Poitras Naskapi Development Corporation Jean Marc Robert General Director - Societe de Gestion Innu Schefferville Schools **Team Members:** Erick Chavez Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Schefferville visit by Linda Wrong

Email 18 Jun 2008	
Participants: Schefferville Community **Team Members:** Rodrigue Mckenzie Linda Wrong	**Summary:** Program update.

Email 25 Jun 2008	
Participants: Team **Team Members:** Erick Chavez Bill Hooley Joseph Lanzon Rodrigue Mckenzie Terence McKillen Derek Parks Joanne Robinson Linda Wrong	**Summary:** Environmental monitoring hiring and training for all sites.

Email 25 Jun 2008	
Participants: Michael Cahill Gov't of NL - Environment and Conservation Labrador Innu Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation **Team Members:** Joseph Lanzon	**Summary:** Update on IBA discussions with Labrador Innu.

Email
25 Jun 2008

Linda Wrong	

Meeting
27 Jun 2008
Sept-Iles & Schefferville

Participants: Tommy Volant President - TRT **Team Members:** Marc Duclos Bill Hooley	**Summary:** TRT train from Sept-Iles to Schefferville.

Meeting
28 Jun 2008
Schefferville

Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Marc Duclos Bill Hooley Joseph Lanzon	**Summary:** Meeting with Chief Real McKenzie.

Meeting
4 Jul 2008

Participants: Peter Penashue Labrador Innu Chief Georges Ernest Gregoire Uashat Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon	**Summary:** Project overview.

Meeting
8 Jul 2008

Participants: Gerry Kerr – advisor to Labrador Innu **Team Members:** Joseph Lanzon Terence McKillen	**Summary:** Final amendments to IBA document. Ready for signature.

Email
9 Jul 2008

Participants: Chantale Basque	**Summary:** Educational support

Email 9 Jul 2008	
Principal - Schefferville School Schefferville Schools **Team Members:** Joseph Lanzon Rodrigue Mckenzie Linda Wrong	

Email 9 Jul 2008	
Participants: Chantale Basque Principal - Schefferville School Schefferville Community Schefferville Schools Curtis Tootoosis Principal - Jimmy Sandy Memorial School **Team Members:** Joseph Lanzon Rodrigue Mckenzie Linda Wrong	**Summary:** Update on laptops; guidelines for community support next year. LIM waiting to organize meeting with trappers/traditional knowledge.

Phone Call 14 Jul 2008	
Participants: Fred Hall Business Manager - Innu Development Limited Partnership **Team Members:** Terence McKillen	**Summary:** Innu business opportunities. IDLP to provide updated list of qualified businesses and individuals in the communities.

Email 16 Jul 2008	
Participants: Schefferville Community **Team Members:** Erick Chavez Joseph Lanzon Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Newsletters and appearances on local radio station to provide project updates.

Commitment: 17 Jul 2008 **Quebec City**	
Participants: Labrador Innu **Team Members:** Joseph Lanzon John Kearney Terence McKillen	**Summary:** Signing of Impact Benefit Agreement (IBA).

Email 18 Jul 2008	
Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon Linda Wrong	**Summary:** Project development.

Email 18 Jul 2008	
Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Joseph Lanzon Linda Wrong	**Summary:** Update to Chief Real

Email 21 Jul 2008	
Participants: Schefferville Community **Team Members:** Marc Duclos Bill Hooley John Kearney Joseph Lanzon Terence McKillen Linda Wrong	**Summary:** Information on Aboriginal-owned cell phone provider.

Email 21 Jul 2008	
Participants: Schefferville Community Schefferville Schools **Team Members:** Marc Duclos Joseph Lanzon Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Project update.

Public Communication 31 Jul 2008	
Participants: Schefferville Community **Team Members:** Linda Wrong	**Summary:** First Nations Yearbook advertisement: plans in Schefferville.

Public Meeting
11 Aug 2008
Schefferville, Quebec

Participants:
Schefferville Community

Team Members:
Joseph Lanzon
Rodrigue Mckenzie
Derek Parks
Linda Wrong

Summary: Project overview, traditional knowledge information review and sharing with Elders, discussion of all project issues particularly environmental and including presentation of baseline information, confirmation of wildlife, avifauna presence, caribou, etc.

Meeting
13 Aug 2008
Sept-Iles

Participants:
Port of Sept-Iles Authority
Management - TRT

Team Members:
Marc Duclos

Summary: LIM Project Meeting.

Meeting
18 Aug 2008
Kawawachikamach

Participants:
Ruby Sandy Robinson
Administrative Director - Naskapi Development Corporation

Team Members:
Rodrigue Mckenzie
Paul Thibaudeau

Summary: Discussion with Ruby Sandy Robinson of Naskapi Development Corporation.

Meeting
19 Aug 2008
Kawawachikamach

Participants:
Phillip Einish
Chief - Naskapi

Team Members:
Rodrigue Mckenzie
Paul Thibaudeau

Summary: Met with Chief Phillip Einish.

Meeting
19 Aug 2008
Kawawachikamach

Participants:
Ruby Sandy Robinson
Administrative Director - Naskapi Development Corporation

Team Members:
Rodrigue Mckenzie
Paul Thibaudeau

Summary: Meeting with Ruby Sandy Robinson and Rodrigue McKenzie about community.

Meeting
19 Aug 2008
Jimmy Sandy Memorial School, Kawawachikamach

Participants: Curtis Tootoosis Principal - Jimmy Sandy Memorial School **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Meeting with school.

Meeting
19 Aug 2008
Local Community Service Centre, Kawawachikamach

Participants: Marcel Lortie Director General - CLSC Health Centre **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Discussion of CLSC operating capacity.

Meeting
19 Aug 2008
Kawawachikamach

Participants: Theresa Chemaganish Training and Management Facilitator - Management Board, NDC **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Training and education.

Meeting
19 Aug 2008
Band Office, Kawawachikamach

Participants: Sampson Einish **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Naskapi Nation employment.

Meeting
19 Aug 2008
Kawawachikamach

Participants: Barry Einish Computer Technician - Naskapi Imuun Inc. **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Discussion with Barry Einish.

Meeting 19 Aug 2008 Sachidun Day Care, Kawawachikamach	
Participants: Myna Mameanskum Director - Sachidun Day Care **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Day care capacity discussions.

Meeting 20 Aug 2008 Innu Band Office	
Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Rodrigue Mckenzie John Rogers Paul Thibaudeau	**Summary:** Project update

Meeting 20 Aug 2008 Conseil de la Nation Innu Matimekush-Lac John	
Participants: Marc Jean Pierre Employment Officer - Conseil de la Nation Innu Matimekush-Lac John **Team Members:** Paul Thibaudeau	**Summary:** Discussions with Marc Jean Pierre.

Meeting 20 Aug 2008 LIM Schefferville Office	
Participants: Chantale Basque Principal - Schefferville School **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Schefferville school operating capacity.

Meeting 21 Aug 2008 Schefferville	
Participants: Marcella Beaudoin Administrator - Town of Schefferville **Team Members:** Paul Thibaudeau	**Summary:** Official contact with Administrator for Town of Schefferville.

Meeting
21 Aug 2008
Schefferville Airport

Participants:

Gervais Boudreau
Fire Chief and Director of Transport - Town of Schefferville

Team Members:
Paul Thibaudeau

Summary: Fire fighting and airport capacity.

Meeting
21 Aug 2008
Schefferville Airport

Participants:

Sylvain Vollant
Recreation Director - Nation Innu Matimekush-Lac John

Team Members:
Paul Thibaudeau

Summary: Policing service and recreation facilities for youth.

Meeting
21 Aug 2008
Northern Store, Schefferville

Participants:

M. Fortunat
Manager - Northern Store

Team Members:
Rodrigue Mckenzie
Paul Thibaudeau

Summary: Meeting with M. Fortunat of Northern Store.

Meeting
21 Aug 2008
Schefferville

Participants:

Gilles Porlier
Businessman - Gestion Porlier Ltee

Team Members:
Rodrigue Mckenzie
Paul Thibaudeau

Summary: Tour and information about Gestion Porlier Ltee.

Meeting
21 Aug 2008
Hotel Royal, Schefferville

Participants:

Sylvie Fortier
Co-Owner with Albert Fortier - Hotel Royal Ltd.

Team Members:
Rodrigue Mckenzie
Paul Thibaudeau

Summary: Details of accommodations and services offered by Mr. and Mrs. Fortier.

Meeting 21 Aug 2008 Schefferville	
Participants: Jean Marc Robert General Director - Societe de Gestion Innu **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Details of Societe Gestion Innu services and equipment.

Meeting 21 Aug 2008 Kawawachikamach	
Participants: Jimmy James Einish Deputy Chief and Director of Recreation - Band Council of Naskapi Nation of Kawawachikamach **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Meeting with Deputy Chief/Recreation Director.

Meeting 21 Aug 2008 Kawawachikamach	
Participants: Samuel Pien Director - Naskapi Police Force **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Discussion re: Naskapi Police Force.

Meeting 21 Aug 2008 Kawawachikamach	
Participants: Paul Mameanskum Councillor and Director - Naskapi Nation Band Council and Department of Public Works **Team Members:** Rodrigue Mckenzie Paul Thibaudeau	**Summary:** Description of some Public Works equipment and functional characteristics.

Meeting 22 Aug 2008 Kawawachikamach	
Participants: George Guanish Administrator - Hunter Support Programme Committee **Team Members:**	**Summary:** Hunting and training discussions.

Meeting
22 Aug 2008
Kawawachikamach

Paul Thibaudeau	

Meeting
3 Sep 2008
Sept-Iles

Participants: Port of Sept-Iles Authority Management - TRT **Team Members:** Marc Duclos	**Summary:** Review of Project Status.

Phone Call
29 Sep 2008

Participants: Marcella Beaudoin Administrator - Town of Schefferville **Team Members:** John Kearney	**Summary:** Discussion on social services in Schefferville.

Meeting
7 Oct 2008
Sept-Iles

Participants: Jean Marc Robert General Director - Societe de Gestion Innu **Team Members:** Marc Duclos	**Summary:** Bulk sample shipment discussion.

Meeting
7 Oct 2008
Sept-Iles

Participants: Donald Gonthier Jean Marc Robert General Director - Societe de Gestion Innu Raoul Thibeault John Velis **Team Members:** Marc Duclos Joseph Lanzon	**Summary:** Contracts review and partnerships discussions.

Phone Call
8 Oct 2008

Participants: Marcella Beaudoin Administrator - Town of Schefferville **Team Members:** Linda Wrong	**Summary:** Official contact with Administrator of Town of Schefferville.

Meeting 10 Oct 2008	
Participants: Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation **Team Members:** Marc Duclos Joseph Lanzon	**Summary:** Project update.

Meeting 13 Oct 2008 Sept-Iles	
Participants: Labrador Innu Chief Real McKenzie Chief - Innu Matimekush/Lac John First Nation Tommy Volant President - TRT **Team Members:** Marc Duclos Joseph Lanzon	**Summary:** Business opportunities.

Meeting 13 Oct 2008	
Participants: Council Matimekush **Team Members:** Joseph Lanzon	**Summary:** AGM Band members meeting in Matimekush. Project update.

Meeting 30 Oct 2008 Newfoundland Delta Hotel	
Participants: Jim Farrell Mayor - Wabush Graeme Letto Mayor - Labrador City **Team Members:** John Kearney Joseph Lanzon Terence McKillen	**Summary:** To pursue possibility of holding a joint meeting with their respective councils and to address the Labrador West Chamber of Commerce.

Meeting 30 Oct 2008 St. John	
Participants: Allison Dancey Policy and Prog. Development Specialist - Gov't of NL - Natural Resources Hon. Kathy Dunderdale	**Summary:** Meeting with Representatives Department of Education and Woman's Policy to increase training, education and leadership positions for women in the industry.

Meeting
30 Oct 2008
St. John

Minister - Department of Education and Woman's Policy Heather MacLellan Assistant Deputy Minister - Ex. Council,Ex. Support - Gov't of NL - Women's Policy Office **Team Members:** Joseph Lanzon Joanne Robinson Linda Wrong	

Meeting
30 Oct 2008
St. John

Participants: Hon. John Hickey Minister of Labrador Affairs - Lake Melville District - Gov't of NL - Labrador and Aboriginal Affairs Peter Penashue Deputy Grand Chief - Labrador Innu Hon. Patty Pottle Minister Aboriginal Affairs - Gov't of NL - Aboriginal Affairs **Team Members:** John Kearney Joseph Lanzon Terence McKillen Linda Wrong	**Summary:** Discussion of the entire project, job and commercial opportunities and the impact for the province as a whole, for Labrador and specifically for the Central and Northern part of Labrador.

Phone Call
31 Oct 2008
Schefferville

Participants: Frances Duberco Director - Duberco, Inc. **Team Members:** Paul Thibaudeau	**Summary:** Information on services.

Phone Call
31 Oct 2008
Schefferville

Participants: Jean-Pierre Ouellette Guide and Business Owner - Auberge Wedge Hills **Team Members:** Paul Thibaudeau	**Summary:** Details of local hunting guide outfit.

Phone Call 31 Oct 2008 Schefferville	
Participants: Joseph Dominique Caribou Hunter - Innu Nation **Team Members:** Paul Thibaudeau	**Summary:** Survey Calls for Hunting Camps in Schefferville.

Meeting 31 Oct 2008 St. John	
Participants: Greg Jones Senior Business Development Analyst - NL Hydro Derrick Sturge Vice-President Finance & CFO - NL Hydro Glenn Winsor Asset Manager - Menihek Generating Station - NL Hydro **Team Members:** John Kearney Joseph Lanzon Terence McKillen	**Summary:** Provision of electrical power supply.

Phone Call 3 Nov 2008 Jimmy Sandy Memorial School	
Participants: Fred Curtis Vice-Principal - Jimmy Sandy Memorial School **Team Members:** Paul Thibaudeau	**Summary:** Information about number of teachers and pupils at the school.

Phone Call 3 Nov 2008 Schefferville	
Participants: Marc Jean Pierre Employment Officer - Conseil de la Nation Innu Matimekush-Lac John **Team Members:** Paul Thibaudeau	**Summary:** Occupation discussions.

Phone Call 4 Nov 2008 Kawawachikamach	
Participants: James Pien Project Manager - Public	**Summary:** Details about Public Works Equipment and Staff.

Phone Call
4 Nov 2008
Kawawachikamach

Works, Kawawachikamach **Team Members:** Paul Thibaudeau	

Phone Call
4 Nov 2008
Montreal

Participants: Christopher Coggan Researcher - Atmacinta Consulting Inc. **Team Members:** Paul Thibaudeau	**Summary:** Consultation Services on Economic Development for EIS.

Phone Call
7 Nov 2008
Schefferville

Participants: Marcella Beaudoin Administrator - Town of Schefferville **Team Members:** Paul Thibaudeau	**Summary:** Capacities of the Town of Schefferville

Meeting
20 Nov 2008
Wabush/Lab City

Participants: Mayor - Council of Wabush Mayor Wabush **Team Members:** John Kearney Joseph Lanzon	**Summary:** Meeting with Mayors and Councils of Wabush and Labrador City- Project Overview and municipal procurement.

Meeting
21 Nov 2008
Goose-Bay

Participants: Chief Anastasia Labrador Innu Brian King Manager, Business Development - Innu Business development Centre Mark Nui Labrador Innu Peter Penashue Deputy Grand Chief - Labrador Innu **Team Members:** John Kearney Joseph Lanzon	**Summary:** Meeting with Innu Development Corp. Aboriginal procurement discussion.

Public Meeting
26 Nov 2008
Hotel North 2 - Goose Bay

Participants: Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation **Team Members:** Joseph Lanzon Terence McKillen Linda Wrong	**Summary:** Public Meeting pursuant to the EIS process in Goose Bay. Participants very supportive. No environmental issues were raised. Communities interested in business opportunities and whether Goose Bay might be a fly-in point.

Public Meeting
27 Nov 2008
Wabush Hotel - Wabush, Labrador City

Participants: Mayor Council of Wabush Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation **Team Members:** Joseph Lanzon Terence McKillen Linda Wrong	**Summary:** Public Meeting pursuant to the EIS process in Wabush-Labrador City. Participants very supportive. No environmental concerns. People seemed interested in job opportunities. Administrator confirmed support.

Meeting
28 Nov 2008
Schefferville

Participants: Marcella Beaudoin Administrator - Town of Schefferville **Team Members:** Joseph Lanzon Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Potential demand for municipal services.

Meeting
28 Nov 2008
Schefferville

Participants: Helen Littlejohn Board Member - Schefferville Health Dispensary **Team Members:** Joseph Lanzon Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Discussion on availability of medical services.

Public Meeting
28 Nov 2008
Salle du Court Municipal - Schefferville

Participants: Schefferville Community Marcella Beaudoin Administrator – Town of Schefferville Paul Rideout Environmental Scientist - Gov't of NL - EA Division, Dept. of Environment and Conservation **Team Members:** Joseph Lanzon Rodrigue Mckenzie Terence McKillen Linda Wrong	**Summary:** Public Meeting pursuant to the EIS process in Schefferville. Community seemed to be very supportive. The Administrator of Schefferville asked that she be consulted as far ahead of time as possible with respect to demands that might be placed on municipal services.

Email
2 Dec 2008

Participants: Jean Madill President - College of The North Atlantic **Team Members:** Linda Wrong	**Summary:** Introduction letter re: commitment to training and educational programs and possibility of working together with College to identify any potential synergies.

APPENDIX P

Public Information Sessions Notice

PUBLIC NOTICE

Public Information Session on the Proposed

Labrador Iron Mines Limited
Schefferville Area Iron Ore Mine
West-Central Labrador

shall be held at

Hotel North Two
882 Hamilton River Road
Happy Valley – Goose Bay, NL
Conference Room 1

On Wednesday, November 26th 2008
at 7:00 p.m.

This session shall be conducted by the Proponent,

Labrador Iron Mines Limited
as part of the environmental assessment for this Project.

Contact +1 647-728-4125
for confirmation in case of bad weather or for general comment

The purpose of this session is to describe all aspects of the proposed Project, to describe the activities associated with it, and to provide an opportunity for all interested persons to request information or state their concerns.

ALL ARE WELCOME

PUBLIC NOTICE

Public Information Session on the Proposed

Labrador Iron Mines Limited
Schefferville Area Iron Ore Mine
West-Central Labrador

shall be held at

Wabush Hotel
9 Grenfell Drive
Wabush, NL
Conference Room

On Thursday, November 27th 2008
at 7:00 p.m.

This session shall be conducted by the Proponent,

Labrador Iron Mines Limited
as part of the environmental assessment for this Project.

Contact +1 647-728-4125
for confirmation in case of bad weather or for general comment

The purpose of this session is to describe all aspects of the proposed Project, to describe the activities associated with it, and to provide an opportunity for all interested persons to request information or state their concerns.

ALL ARE WELCOME

PUBLIC NOTICE

Public Information Session on the Proposed

Labrador Iron Mines Limited

Schefferville Area Iron Ore Mine
West-Central Labrador

shall be held at

Wabush Hotel, Wabush, NL
On Thursday, November 27th 2008
at 7:00 p.m.

This session shall be conducted by the Proponent,

Labrador Iron Mines Limited
as part of the environmental assessment for this Project.

Contact +1 647-728-4125
for confirmation in case of bad weather or for general comment

The purpose of this session is to describe all aspects of the proposed Project, to describe the activities associated with it, and to provide an opportunity for all interested persons to request information or state their concerns.

ALL ARE WELCOME

L'AVIS PUBLIC

Session d'information publique sur le proposant

Labrador Iron Mines Limited
Schefferville Area Iron Ore Mine
West-Central Labrador

Aura lieu à
La Salle de Cour Municipale, 74 rue Atlantic
Schefferville, QC
Le vendredi, novembre 28, 2008
à 7:00 p.m.

Cette session sera conduite par la compagnie,

Labrador Iron Mines Limited
comme partie de l'estimation de l'environnement pour ce Projet.

Contactez +1 647-728-4125
En cas de mauvais temps ou pour tout commentaire

L'objectif de cette session est de décrire tous les aspects entourant ce Projet, décrire les activités connexes et offrir une occasion pour toutes personnes intéressées d'avoir de l'information sur ce projet.

TOUT SONT BIENVENUS

T.N. McKillen
Executive Vice-President

APPENDIX Q

Project Summary Handout

Newsletter November 2008
www.labradorironmines.ca

Labrador Iron Mines Limited
TSX - LIR

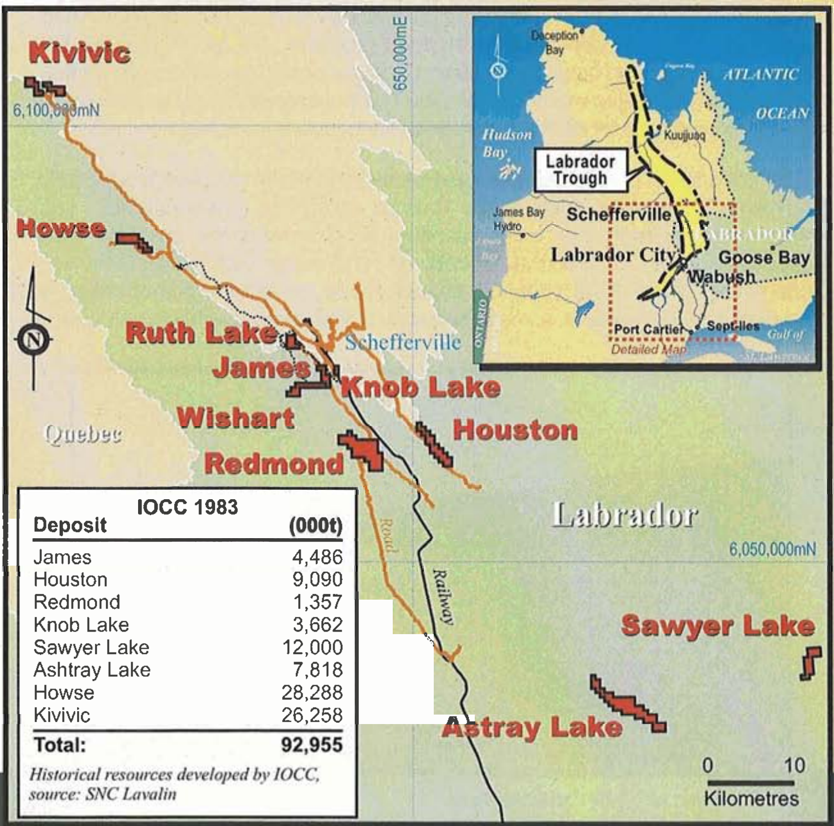
Direct Shipping Iron Ore Project

rejuvenation of an historic mining camp

The Schefferville Area Iron Ore Mine Project, West Central Labrador

Project Highlights, 2008

- Drilling, trenching and test pits to verify the historic resources as delineated by IOCC
- Bulk sampling - 6,500 tonnes (crushed and screened)
- Engineering and resource study (SNC Lavalin and Geostat)
- Rail Transportation studies (shipment of bulk samples)
- Incorporation of LabRail Inc. (ore transportation)
- Environmental Baseline Data and Traditional Knowledge programs
- Training programs
- Submission of Project Description and initiation of EA process
- Community consultations
- IBA with Innu of Labrador



IOCC 1983

Deposit	(000t)
James	4,486
Houston	9,090
Redmond	1,357
Knob Lake	3,662
Sawyer Lake	12,000
Ashtray Lake	7,818
Howse	28,288
Kivivic	26,258
Total:	**92,955**

Historical resources developed by IOCC, source: SNC Lavalin

Bulk sampling at James Deposit

Crushing

Lump ore products, James (left) and Houston (right)

Environmental Baseline Studies

Newsletter November 2008
www.labradorironmines.ca

Labrador Iron Mines Limited
TSX - LIR

Reopening Direct Shipping Iron Ore Operations in West Central Labrador

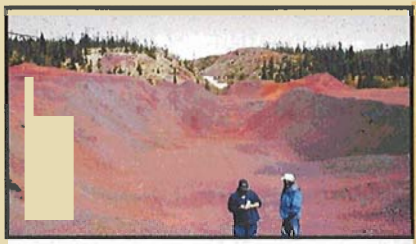
Highlights

- **Phased development of direct shipping iron ore production**
- **Project is fully funded**
- **Planned construction of historical James and Redmond Mines in 2009**
- **Environmental Assessment and Permitting programs underway**
- **20+ year project life**
- **Contract mining services and supplies from Labrador**
- **Direct and indirect job opportunities**
- **IBA with Innu of Labrador**

Labrador Iron Mines Holdings Limited (TSX - LIR) through its wholly owned subsidiary **Labrador Iron Mines Limited (LIM)** has acquired interests in mineral claims and mineral licenses in the historical iron ore mining area of northwest Central Labrador

The project will be developed in phases with Phase 1 comprising the James and Redmond "brownfield" sites - having been stripped and partially prepared for development or partially mined by IOCC. LIM anticipates preliminary production will be achieved during the second half of 2009 from James and will ramp up to 3 million tonnes a year over time

LIM plans to produce lump and sinter fine direct shipping (**DSO**) iron ore products from eight deposits comprising approximately 90 million tons of historical resources at 56-58% Fe starting with the historically developed James and Redmond deposits.. LIM's operations will utilize much of the existing infrastructure constructed for the former Iron Ore Company of Canada (IOCC) operations. Available infrastructure includes access roads, the 585 km railway linking northwest Central Labrador to Sept-Iles, hydro-electric power and distribution lines, airport and other services, and proximity to the mining and service centres of Labrador West and Goose Bay.


James Deposit

Mining will be by open pit methods and broken ore will be screened and washed to upgrade the iron content of the shipped products prior to rail loading. No chemicals will be used in the beneficiation process other than water and residual fines will be returned to existing open pits. The Environmental Assessment and Permitting programs for Phase 1 have been successfully launched.

LIM is committed to developing the James and Redmond deposits in a socially and environmentally sustainable manner and has demonstrated this commitment through the early initiation of environmental baseline data collection (2005 to present), traditional knowledge gathering program, undertaking of an Environmental Impact Study, development and training programs for local workers, and maximization of economic benefits to Labrador.


Bulk sample stockpiles at Silver Yard

MANAGEMENT TEAM

John Kearney - Chief Executive
Bill Hooley - President & COO
Terence McKillen - Executive Vice President
Marc Duclos - VP Transportation Services
Linda Wrong - VP Environment & Permitting
Danesh Varma - CFO
Joseph Lanzon - Manager of Gov't & Community Affairs

BOARD OF DIRECTORS

John Kearney - Chairman
Richard Lister - Lead Director
Bill Hooley
Terence McKillen
Matthew Coon Come
Gerald Gauthier
Eric Cunningham

Corporate Office:
220 Bay St. Suite 700
Toronto, Ontario, Canada M5J 2W4
Tel:647-728-4125 Fax: 416-368-5344
Email: info@labradorironmines.ca

APPENDIX R

Public information Session Presentation

Labrador Iron Mines Limited

www.labradorironmines.ca

IRON ORE IN WEST-CENTRAL LABRADOR

The Re-establishment of Direct Shipping Iron Ore Production

Public Consultation Meetings

Wabush, Labrador City & Happy Valley-Goose Bay, NL - November 26-27, 2008

Agenda

- **Who We Are:**
    - **Company**
    - **Team**
    - **Project**
- **Area History**
- **Existing Infrastructure**
- **Resource Estimate**
- **Details of Mining Phases**
- **Description of Mine Activities**
- **2008 Activities**
- **Environment & Socio-Economic Studies**
- **Jobs & Business Opportunities**
- **Training, Education**
- **Summary**

Who We Are

Labrador Iron Mines Limited ("LIM"):

- **A Canadian-based exploration and mine development company**
- **Interests in an estimated 90 million tonnes of high grade iron ore in west-central Labrador, formerly part of the iron ore reserves and resources established by the Iron Ore Company of Canada (IOCC)**
- **LIM has the necessary capital available to bring the project into initial production**
- **Subject to completion of permitting process, first production is targeted 2009**
- **LIM is managed by a team of experienced mining professionals and is working with qualified NL based contractors, consultants and suppliers**

Who We Are

Labrador Iron Mines Limited Team Presenters:

- **Terence McKillen, Executive Vice President**
- **Linda Wrong, P.Geo., Vice President, Environment and Permitting**
- **Joseph Lanzon, Manager, Government & Community Affairs**

- **LIM team members have prior experience in Newfoundland and Labrador, including the former IOCC operations**
- **Project is supported by Innu Nation of Labrador (IBA)**
- **LIM has contracted consultants, technical services and supplies from Labrador and will accelerate this with the start of construction/operations**
- **LIM has provided jobs and business opportunities for Labrador throughout the exploration and evaluation phases and will continue to do so with mine development**

Who We Are

The Project:

- **Re-establishing direct shipping iron ore (DSO) production in an area originally mined/assessed by IOCC**
- **There will be 3 phases to the project with expected 20+ years mine life:**
  - **Phase 1a: James North and South and Redmond deposits**
  - **Phase 1b: Knob Lake and Houston deposits**
  - **Phase 2: Sawyer and Astray deposits**
  - **Phase 3: Howse and Kivivik deposits**
- **Project is located in the heart of the "Labrador Trough" – a geological formation occurring in the Quebec-Labrador Peninsula that also hosts three of Canada's largest iron ore mines (at Lab West) comprising all Canadian iron ore production**
- **The project benefits from significant infrastructure remaining from the previous operations of IOCC**
- **LIM commenced exploration and environmental baseline work in this former IOCC area in 2005**
- **Full commercial production of 3 million tonnes/yr by 2012**

History of Iron Ore Development

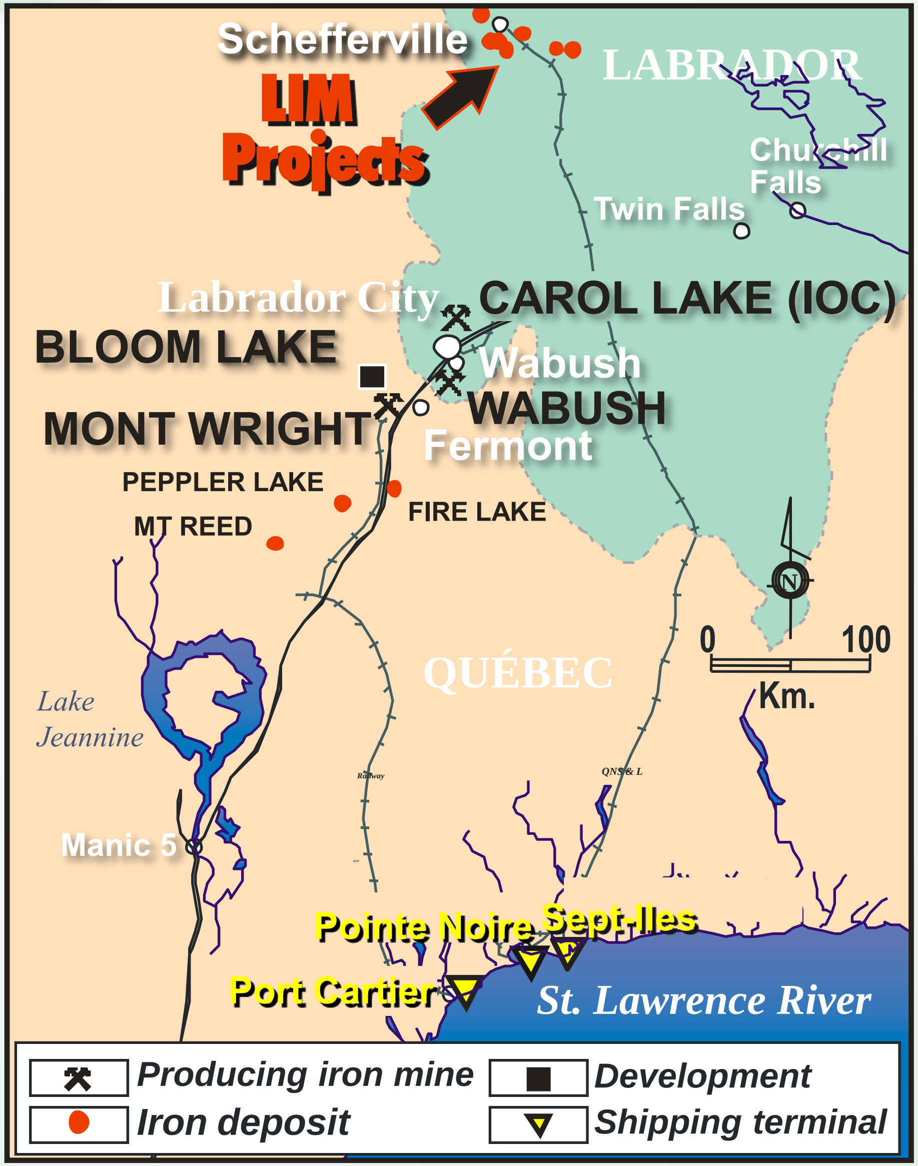
- A major iron ore mining camp was developed in the Knob Lake Iron Range by IOCC and operated from 1954 to 1982

- Town of Schefferville, the Menihek power station, airport and the railway connection were built to service the iron ore industry in the region

- IOCC outlined 400 million tons of iron ore in the Knob Lake Iron Range but produced and shipped 150 million tons over the 28 year period

- LIM has acquired ~90 million tons of the remaining historical resources, located exclusively in west-central Labrador

Project Location



Location of Deposits & Infrastructure

TSX : LIR

Existing Infrastructure

Labrador Communities

1

Fuel Station

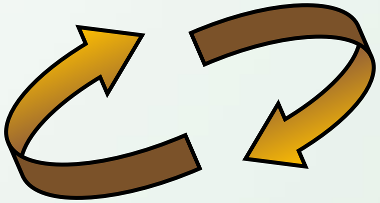
Near Processing Sites

2

NL Hydro Plant

Menihek Dam - 35km from the Project

3



4

Electricity

Power Lines crossing property

5

TSH Railway

Freight and Passengers from Sept-Îles to Schefferville

6

Port Facilities at Sept-Îles

Ship loading with existing installations

Resource Estimate

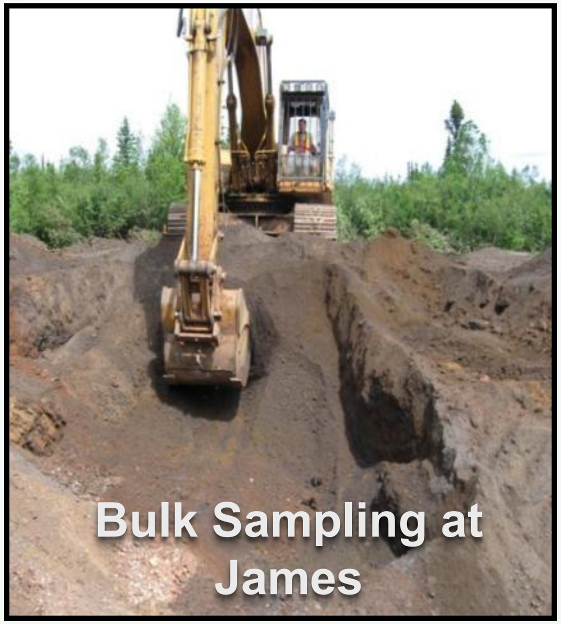
IOCC 1983	
Deposit	(000t)
James	4,486
Redmond	1,357
Knob Lake	3,662
Houston	9,090
Sawyer	12,000
Astray	7,818
Howse	28,288
Kivivik	26,258
Total:	92,959

Source: SNC Lavalin Technical Report dated September 10, 2007

Historical resources are non NI 43-101 compliant

- Historical resources based on IOCC calculations
- Grade of ore mined is expected to be 56%-58% Fe based on IOCC's historical operations
- Screening and washing is expected to increase grade to 64-65% Fe
- This ore grade is higher than the Lab West iron deposits and therefore does not require concentration or pelletizing
- James North and South & Redmond deposits comprise Phase 1a development

Phase 1a Development



Bulk Sampling at James

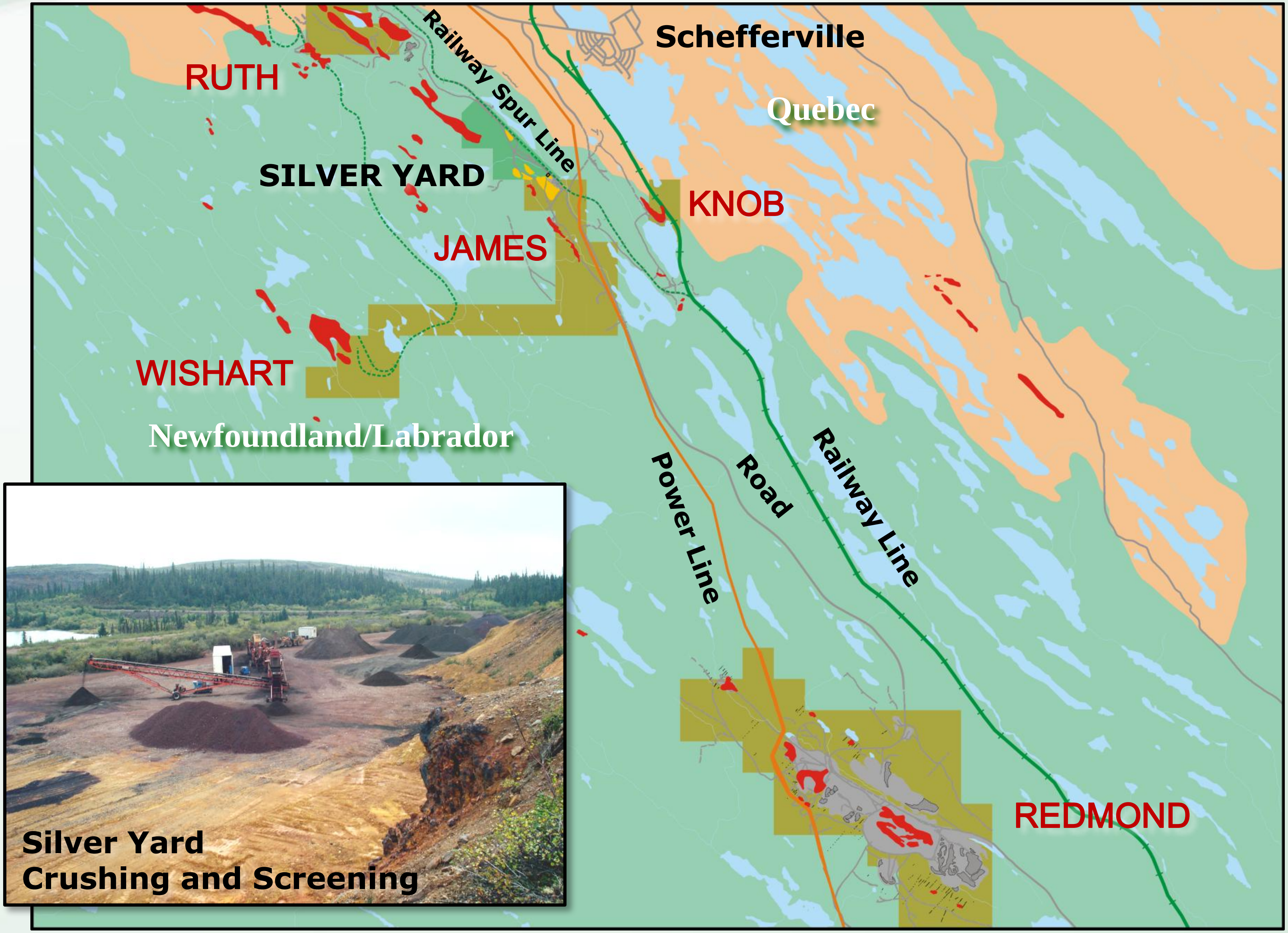
Phase 1a – James North, James South & Redmond

- 6 million tonnes, 4-5 year production schedule
- Brownfield sites
- James is within 1 km of the rail spur line
- Accessible by existing roads
- James and Redmond deposits are partially pre-stripped since the 1980s and are ready for development

James Deposit

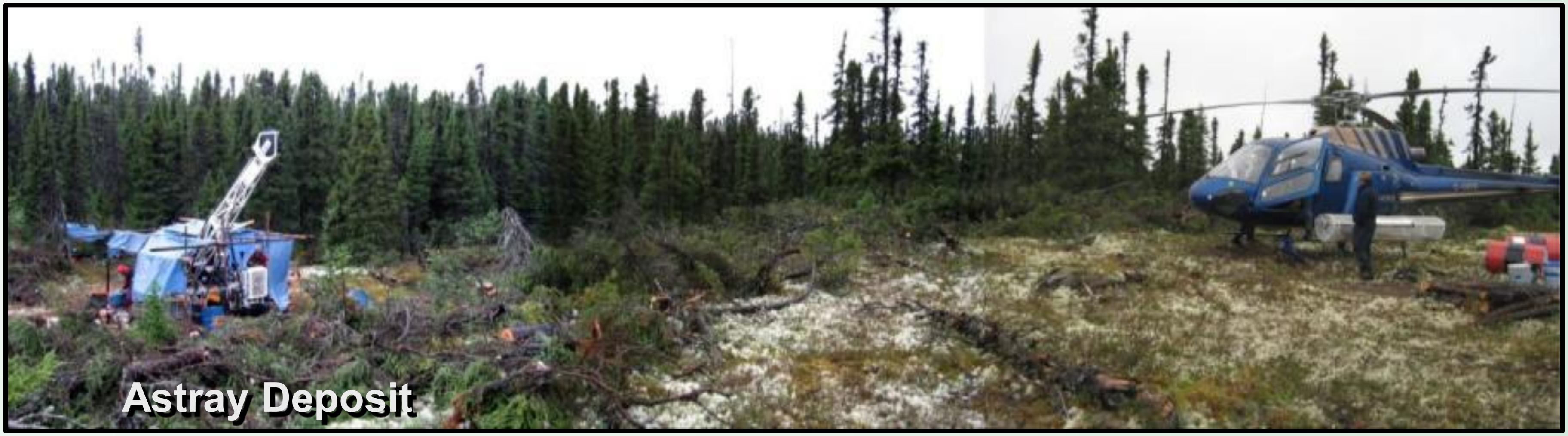
Redmond Deposit

James & Redmond Mines and Plant



Phases 1b,2 & 3 - Future Development

- **Not included in scope of current EIS**
- **6 deposits - 80 million tons, 15-20 year production schedule**
- **Houston and Knob are close to the James deposit and existing infrastructure**
- **Astray and Sawyer approximately 60km southeast**
- **Howse & Kivivic are 20 & 50 kms respectively to northwest**
- **Accessible by existing roads (except Astray and Sawyer– require road access)**
- **Production may increase to 6 million tonnes/yr**



Description of Mine Activities

- Open pit mining
- 2,000 tonnes per day (tpd) increasing to 9,000 tpd total for three deposits (over 8 month operating cycle)
- Drilling and blasting of ore
- Loading onto 65t trucks – delivery to plant
- Crushing to Lump product (gravel size & larger) & Sinter (fine product)
- Washing to remove silica and fines (no chemicals used in process)
- Water source mainly from historical pit and rock fines discharge to same
- Load on to 90 tonne gondola rail cars
- 3 trains per week – no negative impact to current rail operations
- Delivery to port
- Environmental monitoring of air and water during all phases of mine life
- Reclamation and closure

LIM's 2008 Activities

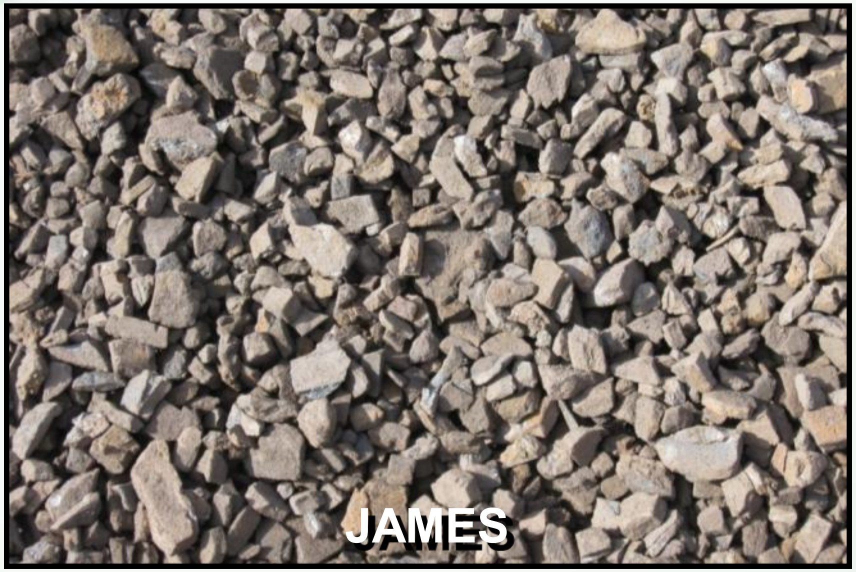
TSX : LIR

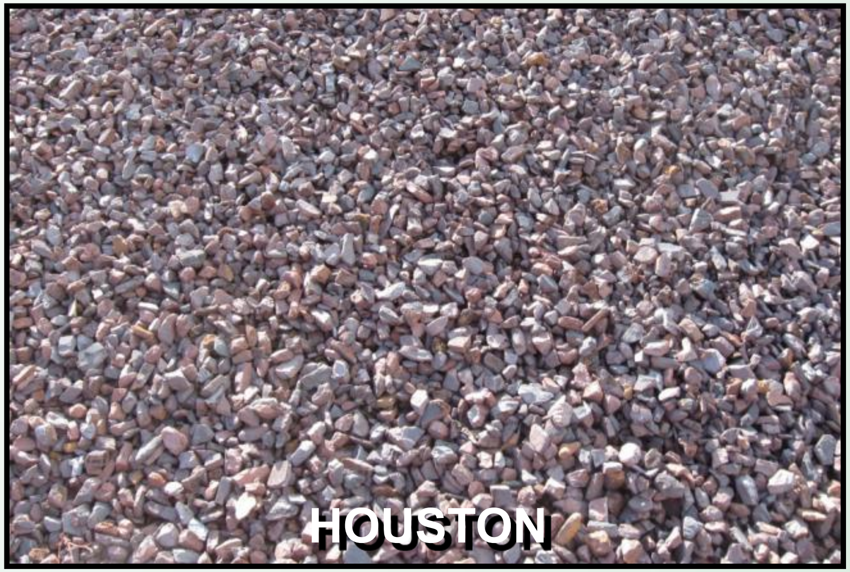
- Drilling
- Resource verification
- Bulk sampling
- Metallurgical testing
- Transportation studies
- Marketing
- Community consultation

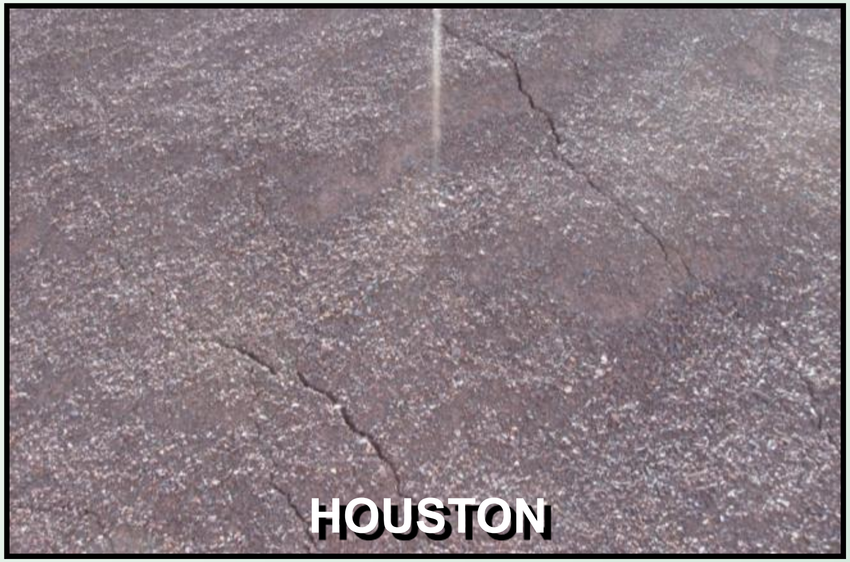
- System flowsheet design
- Engineering designs and specifications
- Capital and Opex estimates
- Environmental Baseline studies
- Start of EA Process

Products - Lump & Sinter Fine Ore

TSX : LIR







Environment & Socio-Economic Studies

- Environmental Baseline Data collection started during exploration (2005)
- Community Meetings, Outreach Programs & Consultation started 2005
  - Consultations and MOUs with local First Nations
- Traditional Knowledge and Trappers'/Elders' Committees
- Initiated training of Local Environmental Technicians
- Environmental Monitoring of work areas
- Socio-Economic Baseline Program
- Regional Economic Development:
  - Training
  - Educational Support
  - Regional Sourcing of Goods and Services
- Impact Benefit Agreement with Innu Nation of Labrador
  - Business opportunities and jobs through the Innu Development Corporation
  - Environmental protection & monitoring
  - Social, cultural and community support

Jobs & Business Opportunities

- LIM is committed to Labrador-based employment and goods and services procurement
- Labrador based businesses will provide:
  - Mining, loading, haulage, crushing & washing, loading of rail cars
  - Supplies, equipment, fuel, accommodations/catering, road maintenance, equipment maintenance, air transport
- IBA with Innu Nation of Labrador:
  - Business opportunities and jobs through the Innu Development Corporation
- Commitment to maximizing economic benefit to Labrador
- LIM and its contractors plan to utilize a "commute system" providing air or rail transportation from hubs at Lab West and Goose Bay

Training & Education

- **LIM is committed to maximizing the social and economic benefits to Labrador**
- **LIM is committed to ensuring adequate training is available:**
  - **Human Resources and Social Development Canada (HRSD)**
  - **Newfoundland & Labrador Department of Education (DOE)**
  - **College of the North Atlantic (CNA)**
  - **Women in Resource Development Committee (WRDC)**
  - **Apprenticeship opportunities**
- **LIM is committed to employment equity and affirmative action**
  - **Development and implementation of Employment Equity Plan**
  - **Ensure Full and Fair Opportunity and First Consideration for employment, contracting, procurement, education and training**
  - **Ensuring compliance from its contractors and suppliers for these commitments**
- **LIM is committed to the incorporation of traditional knowledge into the mine development:**
  - **LIM has conducted meetings with Elders to discuss and record Traditional Knowledge**
  - **LIM is in contact with the Innu Nation to work together to support their Traditional Knowledge initiatives**
  - **LIM has met with local trappers and hunters to discuss and record observations about the environment**

Summary

- **Modest-scale direct shipping iron ore production**
  - **proposed operation at 25% of IOCC operation in 1982**
  - **LIM's production would add <10% to volume of rail traffic**
- **The Phase 1a development has modest foot print**
  - **is a "brownfield" site**
  - **utilizes existing infrastructure**
  - **Sources water and discharges to existing pits**
- **Will provide sustainable jobs and business opportunities for Labrador**
- **Project is financed**
  - **not subject to current financial markets**
- **Project has support of Innu Nation of Labrador**
- **Targets for 2009**
  - **approval, construction, marketing 1H 2009**
  - **production start up 2H 2009**

Corporate Contacts

Labrador Iron Mines Limited

Suite 700, 220 Bay Street
Toronto, Ontario, Canada M5J 2W4
Tel: +1 647-728-4125 Fax: +1 416-368-5344
Toll Free: +1 877-728-4125
E-mail: info@labradorironmines.ca Website : www.labradorironmines.ca

Contacts:
John F. Kearney
Chairman and Chief Executive Officer
+1 416-362-6686

Bill Hooley
President and Chief Operating Officer
+1 647-728-4111

Terence N. McKillen
Executive Vice President
+1 647-728-4102

Thank-You


WELCOME
Annual General Assembl
Labrador Iron Mines
Labrador Iron Mines
Holdings Limited
Mining 90+ Million Tons
of DSO Iron Ore at Schefferville
Provincial Airlines

APPENDIX S

Environmental Assessment Methods

Environmental Assessment Methods

Environmental assessments generally focus on those components of the environment that are valued by society and that can serve as indicators of environmental change. These Valued Environmental Components (VECs) may include both biophysical and socioeconomic components.

The methods employed in this EA are therefore intended to:

- focus on issues of greatest concern;
- address regulatory requirements, including those identified through the project-specific Environmental Impact Statement Guidelines;
- address issues raised by the public and other stakeholders during project-specific consultation; and
- integrate engineering design, mitigation, and monitoring programs into a comprehensive environmental management planning process.

The approach and methods used for the EIS are based largely on the work of Beanlands and Duinker (1983), the CEA Agency (1994; 1999), and Barnes et al. (2000), as well as the study team's experience in conducting environmental assessments. The EA methods provide a systematic evaluation of the potential environmental effects that may arise from each Project phase (construction, operation, and abandonment/decommissioning) as well as malfunctions and accidents, with regard to each of the identified VECs. Project related effects are assessed within the context of temporal and spatial boundaries established for each VEC. The evaluation of potential cumulative effects includes past, present and likely future projects and activities that may interact with Project-related environmental effects within the spatial and temporal boundaries defined in the EIS.

This environmental assessment provides detailed effects analyses for each of the VECs. The specific steps involved in the assessment for each VEC include:

- determination of the assessment boundaries;
- description of the existing conditions for each VEC;
- identification of potential Project-VEC interactions;
- overview of existing knowledge and mitigation or effects management measures;
- definition of the significance criteria for residual environmental effects;
- assessment of the environmental effects and mitigations or effects management measures;
- determination of the significance of Project residual environmental effects.
- cumulative effects assessment; and,
- identification of any monitoring or follow-up requirements.

Each of these is described in more detail in the following sections.

Boundaries

The EIS considers the potential effects of the proposed Project within the spatial and temporal boundaries defined for each VEC. These boundaries may vary with each VEC but generally reflect a consideration of:

- the proposed schedule/timing of the construction, operation, maintenance, and abandonment phases;
- the natural variation of a VEC;
- the timing of sensitive life cycle phases in relation to the scheduling of proposed Project activities;
- interrelationships/interactions between and within VECs;
- the time required for recovery from an effect and/or return to a pre-effect condition, including the estimated proportion, level, or amount of recovery; and
- the area within which a VEC functions and within which a Project effect may be felt.

Spatial Boundaries

The Assessment will be limited to the development of the James and Redmond leases.. Spatial boundaries may be limited to the immediate Project area (e.g., project “footprint” or zone of influence) or may be regional or larger in extent in consideration of the distribution and/or movement of some VECs. The geographic limits and migration patterns of wildlife populations, for example, are important considerations in determining spatial boundaries and may influence the extent and distribution of an environmental effect. For this assessment, the area that could potentially be affected by Project activities and interact with VECs is referred to as the Assessment Area. The Assessment Area is also developed in consideration of the timing and type of Project activity being considered and the sensitivities within the particular VEC being assessed. The assessment of potential Project effects and determination of the significance of those effects occurs within the Assessment Area.

Temporal Boundary

Project effects for this EIS have been assessed from construction through to decommissioning and abandonment. With the exception of those activities which will occur seasonally, effects of Project activities have been assessed as “year round” for the period 2009-2029. The effects of decommissioning, abandonment and site rehabilitation will be assessed and are assumed to occur after 2029. Potential accidental events will be considered and could occur at any point during the life of the Project.

Administrative Boundaries and Technical Boundaries

Administrative boundaries refer to the spatial and temporal dimensions imposed on the environmental assessment for political, socio-cultural or economic reasons. Administrative boundaries can include such elements as the legislation, regulations, and government agencies that govern Project-related activities and the VECs selected for the EIS. Administrative boundaries can also include pertinent government guidelines and wildlife management zones and hunting/fishing seasons. These boundaries are defined for each VEC individually.

Technical Boundaries include and data and information gaps with a focus on data gaps important to environmental effects predictions and determination of significance or to satisfaction of the EIS guidelines. Such boundaries could include limits on availability of existing information and/or field surveys.

Existing Environment

The description of the existing environment (i.e., pre-Project or baseline conditions) for the Assessment Area (as specified in the EIS Guidelines) includes:

- Physical Environment;
    - Climate
    - Air Quality
    - Landscape
    - Hydrology
    - Ambient water quality
- Biological Environment;
    - Wetlands and Flora
    - Wildlife (including caribou and other species)
    - Avifauna (including osprey, eagles and other birds)
    - Fish and fish habitat
    - Fishing
- Socio-economic
    - Employment and business
    - Communities

The description of the existing environment is based primarily on:

- field programs undertaken for the project;
- historical project information for other developments in the area;
- previous environmental assessments for other projects in the area;
- baseline research on the socioeconomic environment in the Assessment Area;
- recent scientific publications and databases; and
- personal communications with local experts and scientific authorities.

The information available through the above sources is considered to be sufficient and acceptable for the purposes of this environmental assessment. While data gaps are always present when describing the natural environment, the gaps for this Project are not considered of sufficient scale and/or nature to affect the integrity of this assessment.

Potential Interactions and Existing Knowledge

A list of potential interactions between the Project activities and each VEC is presented in Table 1.These interactions represent the pathways/mechanisms through with the Project could have environmental effects on the VECs being considered in the EIS. Existing knowledge concerning these potential interactions is also reviewed and summarized.

Table 1 Potential Project-VEC Interactions (Example)

Project Activities and Physical Works	VEC			
	Fish and Fish Habitat	Caribou and Caribou Habitat	Employment and Business	Communities
Construction (Project activities in 2009)				
Site Preparation (grubbing, clearing, excavating)				
Placement of Infrastructure (reinstatement of rail spur, roads, utilities)				
Placement of Equipment and Buildings				
Construction (on-site power generation, solid waste, grey water, human presence, transportation)				
Employment and Expenditures				
Operation (Project activities starting in 2010)				
Iron Ore Extraction (excavation – mechanical, blasting)				
Iron Ore Beneficiation (crushing, washing, screening, stockpiling, hazardous and mining waste disposal)				
Stormwater and Wastewater Management				
Transportation (on-site trucking, rail loading)				
Operations (on-site power generation, solid waste, grey water, human presence)				
Employment and Expenditures				
Abandonment and Decommissioning				
Removal of Facilities and Equipment				
Site Reclamation (grading, re-vegetation)				

Residual Environmental Effects Significance Criteria

Significant adverse environmental effects are those effects that will cause a change that will alter the status or integrity of a VEC beyond an acceptable level. The significance of environmental effects is determined according to criteria defined in each of the VECs.

The definitions for significant adverse environmental effects are based primarily on key factors such as: magnitude (i.e., the portion of the VEC population affected); potential changes in VEC distribution and abundance; effect duration (i.e., the time required for the VEC to return to pre-project levels); frequency; and geographic extent (refer to Section 6.5 for a more detailed definition of these criteria). They also include other important considerations such as interrelationships between populations and species, as well as any potential for changes in the overall integrity of affected populations. A positive effect is one that may enhance a population or socio-economic component.

Environmental Effects Assessment, Identification of Effects Management and Residual Effects Determination

This effects assessment analyses potential effects associated with Project components/activities and potential accidental events for each of the VECs under consideration. Effects are analyzed qualitatively and, where possible, quantitatively using existing knowledge, professional judgment and appropriate analytical tools. The assessment of accidental events and cumulative effects will be considered within each individual VEC chapter.

Some of the key factors that can be considered for determining adverse environmental effects, as per the Agency guidelines (CEA Agency 1994) include:

- negative environmental effects on the health of biota;
- loss of rare or endangered species;
- reductions in biological diversity;
- loss or avoidance of critical/productive habitat;
- fragmentation of habitat or interruption of movement corridors and migration routes;
- transformation of natural landscapes;
- discharge of persistent and/or toxic chemicals;
- loss of, or detrimental change in, current use of lands and resources for traditional purposes;
- foreclosure of future resource use or production; and
- negative effects on human health or well-being.

Potential environmental effects on each VEC are characterized using the following five descriptors:

- Magnitude – the nature and degree of the predicted environmental effect. Rating depends on the nature of the VEC and the potential effect. For biophysical/ecological VECs the rating system is as follows:
    - Low - Affects a specific group or critical habitat for one generation or less; within natural variation;
    - Medium - Affects a portion of a population or critical habitat for one or two generations; temporarily outside the range of natural variability;
    - High - Affects a whole stock, population or critical habitat (may be due to the loss of an individual(s) in the case of a species at risk) outside the range of natural variability.

For socio-economic VECs the magnitude of potential effect is defined as:

    - Low - Does not have a measurable effect on valued socio-economic components;
    - Medium - Has a measurable effect on socio-economic components, but is temporary and/or is highly localized;
    - High - Has a measurable and sustained adverse effect on socio-economic components.
- Geographical Extent: describes the area within which an effect of a defined magnitude occurs;
- Frequency: the number of times during a project or a specific project phase that an effect may occur (i.e., one time, multiple);
- Duration: typically defined in terms of the period of time required until the VEC returns to its baseline condition or the effect can no longer be measured or otherwise perceived (defined specifically for each VEC, may be a specific period of time); at a minimum, it is divided into three timeframes: short-term, mid-term and long-term;
- Reversibility: the likelihood that a measurable parameter will recover from an effect, including through active management techniques such as habitat restoration works; and
- Ecological Context: the general characteristics of the area in which the project is located; typically defined as limited or no anthropogenic disturbance (i.e., not substantially affected by human activity) or anthropogenically developed (i.e., the area has been substantially disturbed by human development or human development is still present).

Based on the potential interactions identified for each VEC, technically and economically feasible mitigation measures will be identified to reduce or eliminate potentially significant adverse effects.

Where possible, a proactive approach to mitigating potential environmental effects has been taken by incorporating environmental management considerations directly into program design and planning; these are noted in the Project Description (Section 3.0). Additional mitigation measures are identified in the environmental assessment to further mitigate potential adverse effects where economically and technically feasible. These mitigation measures are identified and discussed within each individual VEC chapter. Residual environmental effects predictions are made taking into consideration these identified mitigation measures.

A summary of the environmental assessment for each VEC is presented for Project construction and operation as noted in Table 2.

Table 2 Template for Summary of Residual Environmental Effects for [VEC]: [Project Phase]

Mitigation	
Significance Determination	
Geographic extent	
Frequency of occurrence	
Duration of effect	
Magnitude of effect	
Permanence/reversibility	
Significance	
Confidence	
Likelihood of occurrence	
Follow-up and monitoring	

The evaluation of the significance of the predicted residual environmental effects is based on a review of relevant literature and professional judgment. In some instances, assessing and evaluating potential environmental effects is difficult due to limitations of available information. Ratings are therefore provided to indicate the level of confidence in each prediction. The level of confidence ratings provide a general indication of the confidence within which each environmental effects prediction is made based on professional judgment and the effects recorded from similar existing projects. The likelihood of the occurrence of any predicted significant adverse effects is also indicated, based on previous scientific research and experience.

Cumulative Environmental Effects

Environmental effects of individual projects operating in the same geographic region can overlap spatially and temporally resulting in cumulative environmental effects. This environmental assessment includes consideration of cumulative environmental effects for each VEC.

Cumulative effects are considered as part of the Project-specific environmental effects analyses described above (i.e., the overall effect of each project on a VEC). Other projects or activities that could interact cumulatively with the LIM Project include the New Millennium proposal for the Elross Lake area and increased railway traffic as a result of the proposed Bloom Lake Railway; these will be considered in the cumulative effects assessment (Table 3).

Table 3 Projects and Activities Considered in Cumulative Environmental Effects Analysis

Project	Status
Elross Lake Iron Ore Mine Proponent: New Millenium Capital Corporation • New Millenium Capital Corporation is planning to develop an iron ore mine at a previously mined site in Western Labrador, approximately 10 kilometres northwest of Schefferville, Quebec. • Ore will be transported via rail to a marshalling yard in Schefferville and then sent via rail to Sept-Îles , Quebec , for shipment to customers.	Reasonably Foreseeable Project
Bloom Lake Railway Proponent: Consolidated Thompson Iron Mines Ltd. • Consolidated Thompson Iron Mines proposes to construct and operate a new 31.5 kilometre long single-track railway line to connect the company's new load-out facilities within Labrador with the existing railway line between Wabush Mines and the Quebec North Shore & Labrador Railway.	Reasonably Foreseeable Project

As determined by the Guidelines, the assessment of cumulative environmental effects will involve consideration of the following:

- temporal and spatial boundaries;
- interactions among the Project’s environmental effects;
- interactions between the Project’s environmental effects and those of existing projects and activities;
- interactions between the project’s environmental effects and those of planned projects and activities; and,
- mitigation measures employed toward a no-net-loss or net-gain outcome (e.g. recovery and restoration initiatives pertinent to a VEC that can offset predicted effects).

Accidental Events

Each VEC will discuss the potential environmental effects resulting from malfunctions or accidental events that may occur in connection with the Project. These shall be discussed with respect to risk, severity and significance. This discussion shall include (as required by the Guidelines):

- discussion of accidents and malfunctions that could occur related to the Project and the potential interactions with environmental features
- reference to the standards, codes and regulations applicable to governance of the project

Monitoring and Follow-up

The EIS Guidelines require the consideration of any monitoring and follow-up programs that might be required. The purpose of the follow-up program is to:

- verify the accuracy of the environmental assessment; and
- determine the effectiveness of mitigation measures.

As part of the environmental effects analysis, monitoring and follow-up programs are described where warranted. Monitoring and follow-up is considered where there are important Project-VEC interactions, where there is a high level of uncertainty, where significant environmental effects are predicted, or in areas of particular sensitivity.

Effects of the Environment on the Project

The EIS also assesses the effects of the environment on the mine. In particular the EIS will identify the vulnerability of the mine to climatic elements (including wind, weather and global climate change) and describe the provisions for minimizing any identified risk.

APPENDIX T

Methods to Control Ammonia and Nitrate Levels in Mine Waste Water

Methods to Control Ammonia and Nitrate Levels in Mine Waste Water

The main source of nitrogen in mine waste waters is from nitrogen components in explosives. Residues from mine blasting operations enter surface runoff water and depending on the form (nitrate, nitrite, ammonia) and concentration of nitrogen and the characteristics of the receiving stream, nitrogen compounds can have adverse effects to aquatic life.

Many mine operators have learned that there is a direct relationship between the ammonia and nitrate levels in mine waste water and the amount of undetonated explosives in the rock through which the water flows. Most commercial blasting agents contain 70% to 94% (by weight) ammonium nitrate. When some of the explosives end up in shot rock and ore, through either spillage or incomplete detonation, ammonia and nitrates can leach into the ground water. When a blast is completely detonated, there is no blast residue.

There are several ways that undetonated explosives end up on the ground or in shot rock:

- Sloppy handling, storage and loading practices may cause a significant amount of explosive spillage, particularly when bulk explosives are used.
- Poor drilling and loading practices can also cause significant amounts of explosives to remain undetonated.
- Drill patterns, stemming or collar length, explosive selection, priming methods and delay timing are the elements of blast design that can be adjusted to control charge cutoffs and failures

The objective of reducing ammonia and nitrate levels in mine waste water from blasting activities would be to implement actions that contribute to the complete detonation of a blast and reduce the amount of undetonated explosives. This can be achieved through the following approaches:

- Limiting the amount of explosives used.
  - Based on field investigations to-date, it is expected that only periodic blasting will be required during the initial benches, with mechanical means (example dozer with ripper) being used to break the rock. For those infrequent times and for the lower benches, where it is expected the rock is somewhat harder and less leached, packaged emulsion explosives are planned to be used. A relatively low powder factor is still expected for the lower benches.
- Controlling Explosive Losses through storage and handling controls
  - Bulk ANFO and bulk emulsion blasting agents are often spilled during storage, transfer or loading. Development of spill containment and clean-up procedures are integral.
  - Based on field investigations to-date, it is LIM's plan to use packaged explosives (and not bulk explosives) for their periodic blasting requirements. The use of packaged explosives is expected to reduce the amount of explosive spillage due to handling and loading practices.
  - Development of an ongoing explosive management program (as either part of an Operations Manual or Environmental Protection Plan) that outlines proper storage, handling, and loading controls.

- Selection of Blasting Agent
    - The type of explosive used can have a dramatic effect on overall explosive losses. For example, if bulk explosives are used instead of packaged explosives, spillage losses will be relatively high. If bulk ANFO is used in wet holes, losses caused by complete failure or partial detonation will be high.
    - As stated above, it is LIM's intention to use packaged emulsion explosive. These typically consist of 70% ammonium nitrate liquor, 15% water, and 15% mix of diesel oil and surfactant. (ANFO, the most commonly used blasting agent, is usually a mixture of 6% fuel oil and 94% ammonium nitrate).
    - The rate at which nitrates leach from different explosives varies dramatically, based on the explosive's composition. It has been reported that Emulsions did not release nitrates as readily as the ANFO or watergel explosives (the ammonium nitrate is contained in an aqueous phase that is surrounded by an oil (or oil and wax) fuel phase).
- Implementing engineered blasting practices that minimize to the extent possible, the amount of blasting material used and residue produced
    - For many reasons, including safety, environmental, and economic, blast designs should include measures that ensure complete detonation of all explosives.
    - Incomplete detonation can occur as a result of a cutoff. Drill pattern design, explosive loads, and initiation methods can be adjusted to reduce/eliminate the potentiality of a cutoff.
    - This can be accomplished by the use of multiple in-hole delay primers, using appropriate delay time between holes,
    - Stemming heights, stemming material, burden and spacing sizing are other blast pattern design variables that can be adjusted to optimize the complete detonation of explosives and reduce the potential of undetonated explosives from entering the mine waste water.
    - Incomplete detonation can also occur when using a non-water resistant product (ex. ANFO) in wet holes. The planned use of packaged emulsion explosives (which is water resistant) is an attempt to avoid incomplete detonation.
- Minimizing surface runoff that can enter a blasting area
    - For example, the use of a diversion ditch that would divert surface runoff away from the blasting area.
- Properly designed and operated settling pond
    - Settling ponds are considered to represent best practicable technology for treating mine wastewater.
    - In LIM's case, the in-pit sump which is the first stage of mine waste water collection and management, could offer an initial pre-settling and retention time depending on the capacity of the sump.

Summarized in part from "Practical Methods to Control Explosive Losses and Reduce Ammonia and Nitrate Levels in Mine Water", G.F. Revey, Mining Engineering (SME), July 1996