ENVIRONMENTAL ASSESSMENT REGISTRATION PURSUANT TO THE NEWFOUNDLAND AND LABRADOR *ENVIRONMENTAL PROTECTION ACT*

AGS Fluorspar Project
St. Lawrence, NL

Submitted to:
Newfoundland and Labrador Department of Environment and Conservation, Environmental Assessment Division

Submitted by:
Canada Fluorspar (NL) Inc.

June 2015

Environmental Assessment (EA) Registration

AGS Fluorspar Project
St. Lawrence, NL

Prepared for:

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Executive Summary

Canada Fluorspar (NL) Inc. (CFI) is proposing to develop the AGS Fluorspar Mine (the Project) in St. Lawrence, in the province of Newfoundland and Labrador (NL). The Project includes construction, operation, and rehabilitation and closure of the following primary components:

- surface and underground mine development of the AGS Vein, including four open pits; underground mine workings; waste rock, overburden, and topsoil dumps/stockpiles;
- Mill facility, with a production capacity of up to 200,000 tonnes per year of fluorspar concentrate and 200,000 tonnes per year of dense media separation floats (i.e., high-quality construction aggregate or used as underground backfill);
- Tailings Management Facility (TMF) within an area historically used as a tailings lagoon, capable of storing 2.8 million tonnes of flotation tailings over the life of the Project, conveyed as slurry by pipeline;
- ancillary infrastructure to support the Mine and Mill, including access roads, explosives magazine storage, conveyors, administration building, warehouse and maintenance building, employee facilities, concentrate storage building, security building, and electrical building; and
- Marine Terminal facility at Blue Beach Cove, capable of handling vessels from 10,000 deadweight tonnage (DWT) to 65,000 DWT and loading ships at a rate of 500 tonnes per hour.

The purpose of the Project is to mine fluorspar ore from the AGS Vein, to process it to produce acid-grade fluorspar concentrate, and to export this product to domestic and international markets. The fluorspar deposits of St. Lawrence are recognized for their accessibility, relatively high grades, and absence of impurities. The location of the Project, with an ice-free, deep water harbor close to major North Atlantic shipping routes provides a strategic advantage.

The Project is subject to a provincial environmental assessment (EA) under the NL *Environmental Protection Act*. Over the past few months CFI has consulted with the Canadian Environmental Assessment Agency (CEA Agency), and this agency determined that a federal EA is not required under the *Canadian Environmental Assessment Act*, 2012 (F. Kirstein 2015, pers. comm.). In 2002, the area of Blue Beach Cove was rezoned by the municipality to support the development of a marine terminal, following a public consultation process.

St. Lawrence and the Project area have a long mining history dating back to 1933, and three EAs have been completed since the mid-1990s to support fluorspar mine reactivation in the St Lawrence area. In 2010, CFI (formerly Burin Minerals Limited [BML]) was released from a harmonized provincial and federal EA for the proposed reactivation of two underground mines (Tarefare and Blue Beach North mines) in St. Lawrence, known as the Newspar project. This approval included the reactivation of the fluorspar mines, an upgrade to the existing mill, development of a TMF centred on Shoal Cove Pond, and construction of a marine terminal at Blue Beach. One of the province's EA release conditions, that stream flows be diverted from the proposed tailings facility, prompted a federal EA amendment to address requirements under the *Fisheries Act* and the *Navigable Waters Protection Act*. A screening report, which focused on a storm flow diversion and fish pass structure at the outlet of Clarkes Pond, was submitted by Newspar to the CEA Agency and the undertaking was released from EA in February 2012.

Shortly after EA release in 2010, CFI partnered with Arkema Spar NL Limited Partnership (Arkema) and formed Newspar in October 2011 as a 50/50 joint venture to develop the Newspar project, however this project is currently on hold. The second of three one-year extensions to the provincial EA release was granted by the NL Department of Environment and Conservation (NL DOEC) in 2014. If construction does not begin before the last extension expires on October 28, 2016, then the EA release will expire.

In 2012 and while engineering on the Newspar project was underway, CFI began an aggressive exploration program within other parts of its mineral license area. This program resulted in the discovery of a large fluorspar deposit: the AGS Vein. The AGS Vein presents itself as an economically attractive fluorspar deposit, with resource estimates comparable to those of the combined Tarefare and Blue Beach North veins. As such, the Project appears to have potentially compelling economics relative to other fluorspar resources on the peninsula. The proposed TMF and Marine Terminal were previously approved for the Newspar project and the designs of these two structures in the proposed Project are similar to the ones approved as part of the Newspar project.

In the past, authorization and approvals were issued by federal agencies to either BML, Newspar or CFI and are still valid today. These include:

- *Fisheries Act* Authorization: Authorization issued by Fisheries and Oceans Canada (DFO) in 1997 and Fish Habitat Compensation Agreement signed to ensure no net loss of fish habitat of Shoal Cove Pond, Shoal Cove Brook and Clarkes Pond Brook;
- *Navigation Waters Protection Act* Approval (Transport Canada), issued in 2012 for the Cutoff Wall at Clarkes Pond; and
- *Navigation Protection Act* Approval: Approval for the Marine Terminal issued by Transport Canada in 2012 under the *Navigable Waters Protection Act* and reissued in 2015 under the *Navigation Protection Act*.

In 2012, CFI requested an amendment to the 1997 *Fisheries Act* Authorization and submitted an updated Compensation Plan (now referred to as an Offset Plan) to DFO for offsets related to the TMF and the Clarkes Pond cutoff wall and diversion channel. In addition, a marine fish habitat Compensation Plan was submitted to DFO during the same year for offsets related to the Marine Terminal for the St. Lawrence Fluorspar Mine Reactivation Project. The amendment to the 1997 *Fisheries Act* Authorization and marine fish habitat Compensation Plans were both reviewed and accepted by DFO. While the offset concepts and approaches previously described in the existing plans will not change dramatically, recent revisions to the *Fisheries Act* as well as design concepts for the Project, require a review of the potential serious harm to fisheries, a revision of the offset measures and costs (for generation of a letter of credit), and submission of the Request for Project Review to DFO.

The Project will be undertaken in four specific phases, contingent on receipt of all required approvals, permits, and authorizations:

- pre-construction (ongoing);
- construction (Q4 2015 to end of 2017);
- operations (2017 to 2026); and
- rehabilitation and closure (2027 to 2029).

Once the operation phase of the Mine has ended, the facilities will be properly closed and rehabilitative measures will be implemented to return the site and surrounding areas are to an environmentally appropriate condition according to the proposed Rehabilitation and Closure Plan. The Rehabilitation and Closure Plan is designed to restore, to an acceptable state, the biological, chemical and physical quality of the environment that may have been affected by the Project. Post-closure monitoring activities will be conducted to determine the effectiveness of decommissioning. Post-closure monitoring activities will include surface and groundwater quality monitoring with testing of standard water quality parameters and metals, treatment of water until quality reaches applicable standards, biophysical monitoring, and stability monitoring on open pits and the tailings dam.

CFI's public participant list includes potentially affected and/or interested stakeholders from several groups including municipalities, regulatory agencies, economic development agencies, education and training institutes, and environmental and recreation associations. There are no designated Aboriginal lands in the St. Lawrence region and Project activities are not likely to affect Aboriginal or First Nations groups within the province.

Several meetings occurred with municipalities and regulatory agencies to provide an update on the Project, discuss the EA process and answer questions, and in addition, a public information session was held on April 16, 2015 in St. Lawrence. The general topics/issues identified by municipalities and regulatory agencies include the following:

- water diversion of Grebes Nest Pond and potential effects on fish;
- diversion and size of drainage area around TMF;
- potential effects of dust;
- site security and access effects on recreational users and cabin owners;
- potential effects of water discharging downstream of the TMF; and
- TMF closure concept.

A summary of the frequency of issues raised by the public is shown in Figure E-1. The most frequently raised issues by participants included economy and employment, and current/historical land use.

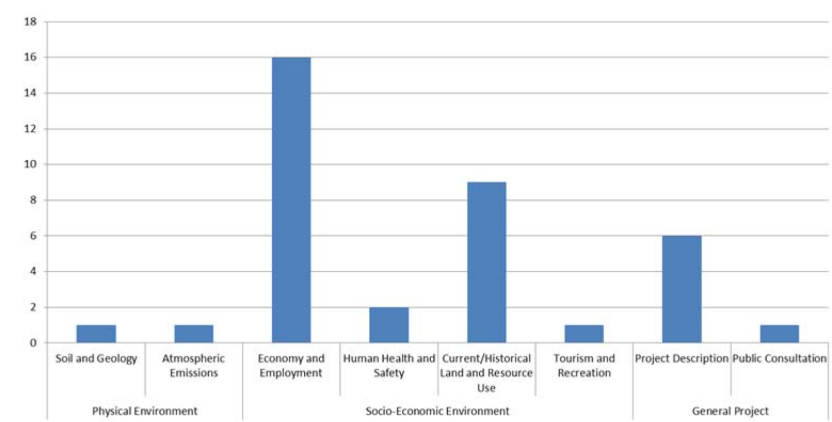

Figure E-1: Frequency of Issues Identified through Written and Verbal Comments Received

The existing environmental setting presented in Section 6.0 includes the environmental or socio-economic elements that were considered when determining likely effects that could occur as a result of the Project. The environmental baseline, describing the existing environment and socio-economic elements as they are at the time of the preparation of this EA Registration, is the basis for determining the potential change and likely environmental and socio-economic effects associated with the Project. Information from the following sources was reviewed and used to describe the existing environment:

- publicly available topographic and resource maps, aerial imagery, databases, scientific papers, technical reports, government websites, interactive websites, information letters, and fact sheets;
- Project-specific field investigations;
- previous environmental applications prepared for the proposed reactivation of the St. Lawrence Fluorspar Mine;
- environmental applications prepared for other projects in the area; and
- communication with local land users, representatives from local and regional governments, local, provincial and federal regulators, and the general public.

In addition, Ecological Land Classification (ELC) was completed to describe the vegetation and wildlife habitat at the local level, and field surveys were conducted for specific resources. The results of environmental field surveys conducted for the Project have been included in this EA Registration to the extent that they were available for meaningful analysis and interpretation at the time of writing. The timing, scheduling, and coordination of field surveys conducted to date, and those to be completed in support of detailed Project planning and other approvals, have been subject to the following limitations and considerations: preferred and optimal season and timing window for various surveys (e.g., fish and fish habitat assessment); and weather.

A scoping exercise was undertaken to identify an appropriate list of Valued Ecosystem Components (VECs) upon which to focus the assessment. VECs were established based on government guidance, consultation with stakeholders, and understanding of the proposed Project. Following this process, the following VECs were retained for analysis:

- Physical Environment (Soil and Geology);
- Atmospheric Environment (Climate, Air and Noise);
- Water Resources (Groundwater, Surface Water and Freshwater Fish and Fish Habitat);
- Terrestrial Environment (Vegetation Communities and Habitat Types, Wetlands and Species at Risk);
- Wildlife (Birds [Terrestrial and Marine] and Species at Risk);
- Marine Environment (Fish and Fish Habitat, Marine Mammals and Species at Risk); and
- Socio-economic Environment (Human Health, Economy and Employment, Infrastructure and Services, Quality of Life, Historic Resources, Navigation, Commercial Fisheries and Tourism).

A step-wise process was used to analyse the environmental effects of the Project in a systematic and transparent manner once the relevant Project works and activities, assessment boundaries, and relevant environmental and socio-economic VECs were identified. The methodology included the following steps: identifying likely environmental and socio-economic effects; and developing technically and economically feasible mitigation. In addition to the analysis of environmental or socio-economic effects of the Project by itself, the analysis also considered the environmental effects of the Project in combination with those from other projects and activities that have been, or will be, carried out in the foreseeable future, and which may interact with the likely effects of the Project (i.e., cumulative effects). Environmental monitoring and follow-up measures are proposed and will be undertaken to ensure compliance with applicable regulations, standards and guidelines, to verify environmental effect predictions and refine mitigative measures (i.e., adaptive management).

As stated previously, the Project area has a long history of mining activity and portions of the area have, at some point, been previously disturbed (i.e., brownfield site). The Project area in general is not a particularly unique biological or socio-economic environment. Only a small number of provincially or federally listed flora or fauna species at risk have been historically documented in the St. Lawrence area. Furthermore, the Project area does not support substantial commercial, recreational or aboriginal fisheries or other industries or land uses where potential resource use conflicts could occur (e.g., recreation, shipping and navigation). With the implementation of best management practices and the proposed mitigation measures including post-construction monitoring, likely environmental effects on VECs will be minimized. These measures include but are not limited to the following:

- Best practices to prevent soil erosion and sediment control;
- Application of water or other dust suppressants on unpaved roads, as needed;
- Implement a Complaints Response Plan to establish a mechanism to record, address and resolve complaints related to Project activities and phases;
- Design and implement a site Grading and Drainage Plan and direct surface runoff to settling ponds;
- Prepare a Water Management Plan in consultation with the provincial Water Resources Management Division of DOEC that will describe the use and flow of water through and around the mine during all Project phases and the mitigation measures to be implemented to maintain water quality and quantity within each watershed;
- Monitor discharge of settling ponds for suspended sediments;
- Maintain a 25 meter (m) buffer between waterbodies and waste rock, overburden, and topsoil piles;
- Avoid clearing during the breeding bird season (April 1 to September 1), where possible (Environment Canada 2014a);
- Use existing shipping lanes where possible and maintain constant course and vessel speed under 14 knots while operating in the Great St. Lawrence Harbour and in Blue Beach Cove;
- Comply with DFO guidance related to blasting near and in the marine and freshwater environments (i.e., reduce blasting charge size in coastal areas) (Wright and Hopky 1998);
- Implement Marine Fisheries Offseting Plan pursuant to the *Fisheries Act* Section 35(2)(b); and

- Implement progressive rehabilitation measures and a Rehabilitation and Closure Plan as approved by NL Department of Natural Resources (DNR).

Considering the historical land use within the Project area, the extensive planning, the ongoing consultation with stakeholders, and the use of proven mitigation measures, CFI is confident that the Project can be constructed, operated, and rehabilitated and closed, in an environmentally responsible and safe manner.

Acronyms

Acronym	Definition
AAFC	Agriculture and Agri-Food Canada
ABA	Acid Base Accounting
ACCDC	Atlantic Canada Conservation Data Centre
ADT	Articulated Dump Truck
AGS	A. Gordon Stollery
ALTRT	Atlantic Leatherback Turtle Recovery Team
ANFO	Ammonium Nitrate/Fuel Oil
ATV	All-Terrain Vehicle
BATEA	Best Available Technology that is Economically Achievable
BBN	Blue Beach North
BML	Burin Minerals Limited
BPCC	Burin Peninsula Chamber of Commerce
BPHCF	Burin Peninsula Health Care Foundation
BPRSB	Burin Peninsula Regional Service Board
CAD	Computer-Assisted Drafting
CAT	Caterpillar
CCG	Canadian Coast Guard
CCME	Canadian Council of Ministers of the Environment
CDA	Canadian Dam Association
CEA Agency	Canadian Environmental Assessment Agency
CEAA	Canadian *Environmental Assessment Act*
CEO	Chief Executive Officer
CFI	Canada Fluorspar (NL) Inc.
CNA	College of the North Atlantic
COSEWIC	Committee on the Status of Endangered Wildlife in Canada

Acronym	Definition
CPN	Central Pit North
CPS	Central Pit South
CRA	Commercial, Recreational and Aboriginal
CSA	Canadian Standards Association
CWS	Canadian Wildlife Service
DFO	Fisheries and Oceans Canada
DMS	Dense Media Separation
DNR	Department of Natural Resources
DOEC	Department of Environment and Conservation
DMS	Dense Media Separation
DWT	Deadweight Tonnage
EA	Environmental Assessment
EHSMS	Environmental Health and Safety Management System
EIS	Environmental Impact Statement
ELC	Ecological Land Classification
EMS	Environmental Management System
EOSD	Earth Observation for Sustainable Development
EPA	*Environmental Protection Act*
EPP	Environmental Protection Plan
EPR	Environmental Preview Report
EWSR	Environmental Control Water and Sewage Regulation
GNP	Grebes Nest Pit
GPA	Gerald Penney Associates Limited
HADD	Harmful Alteration, Disruption or Destruction
IBA	Important Bird Area
ICS	Incident Command System
IMO	International Marine Organization
JWEL	Jacques Whitford Environmental Limited

Acronym	Definition
LFA	Lobster Fishing Area
LH	Load Haul
LHD	Load Haul Dump
LOM	Life of Mine
LTO	Licence to Occupy
MCTS	Marine Communications and Traffic Services
MEND	Mine Environment Neutral Drainage
MIBC	Methyl Isobutyl Carbinol
MPMO	Major Projects Management Office
MW	Megawatt
MWh	Megawatt Hour
NAFO	Northwest Atlantic Fisheries Organization
NAG	Net Acid Generating
NGSWG	National General Status Working Group
NHS	National Household Survey
NL	Newfoundland and Labrador
NLDF	Newfoundland and Labrador Department of Finance
NLEECD	Newfoundland and Labrador Education and Early Childhood Development
NLRC	Newfoundland and Labrador Refining Corporation
NLSA	Newfoundland and Labrador Statistics Agency
NLWIS	National Land and Water Information Service
NOC	National Occupational Classification
NPR	Net Potential Ratio
NPV	Net Present Value
NRCan	Natural Resources Canada
NTU	Nephelometric Turbidity Unit
OCP	Open Cut Pit
OH&S	Occupational Health and Safety

Acronym	Definition
OVB	Overburden
PAO	Provincial Archaeology Office
RCMP	Royal Canadian Mounted Police
ROM	Run of Mill
RPA	Roscos Postle Associates
RV	Recreational Vehicle
SARA	*Species at Risk Act*
SCH	Small Craft Harbours
SEM	Sikumiut Environmental Limited
SFE	Shake Flask Extraction
TAC	Total Allowable Catch
TC	Transport Canada
TCH	Trans-Canada Highway
TMF	Tailings Management Facility
TSS	Total Suspended Solids
TSX	Toronto Stock Exchange
UG	Underground
US	United States
USA	United States of America
USGPM	United States Gallons Per Minute
USGS	United States Geological Survey
VEC	Valued Environmental Component
VTS	Vessel Traffic Services
WHMIS	Workplace Hazardous Materials Information System
WOH&S	Workers Occupational Health and Safety

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APPENDICES

1.0 INTRODUCTION

Canada Fluorspar (NL) Inc. (CFI) is proposing to develop the AGS Fluorspar Mine (the Project) in St. Lawrence, in the province of Newfoundland and Labrador (NL). The Project will include construction, operation, rehabilitation and closure of a surface and underground Mine, a Mill, a Tailings Management Facility (TMF), ancillary infrastructure, and a Marine Terminal (Project). The proposed Project will be located partly on a brownfield site used historically for mining. The site is located entirely within the municipal boundaries of the Town of St. Lawrence, on the southern tip of the Burin Peninsula in Newfoundland.

The Project is subject to a provincial environmental assessment (EA) under the NL *Environmental Protection Act* (EPA). Over the past few months CFI has consulted with the Canadian Environmental Assessment Agency (CEA Agency), and this agency determined that a federal EA is not required under the *Canadian Environmental Assessment Act,* 2012 (CEAA 2012) (F. Kirstein 2015, pers. comm.).

In 2010, CFI was released from a harmonized provincial and federal EA for the proposed reactivation of two underground mines (Tarefare and Blue Beach North mines) in St. Lawrence, known as Newspar project. This approval included the reactivation of the fluorspar mines, an upgrade to the existing mill, development of a TMF centred on Shoal Cove Pond, and construction of a new marine terminal at Blue Beach.

Shortly after EA release in 2010, CFI partnered with Arkema Spar NL Limited Partnership (Arkema) and formed Newspar in October 2011 as a 50/50 joint venture to develop the Newspar project, however this project is currently on hold. The second of three one-year extensions to the provincial EA release was granted by the NL Department of Environment and Conservation (DOEC) in 2014. If construction does not begin before the last extension expires on October 28, 2016, then the EA release will expire.

In 2012 and while engineering on the Newspar project was underway, CFI began an aggressive exploration program within other parts of its mineral license area. This program resulted in the discovery of a large fluorspar deposit: the Grebes Nest Vein. This vein complex was renamed the AGS Vein following the death of CFI's founder, A. Gordon Stollery. Being a sub-vertical, generally tabular ore body that extends to the surface, the AGS Vein presents itself as an economically attractive fluorspar deposit, with resource estimates comparable to those of the combined Tarefare and Blue Beach North veins. As such, the Project appears to have potentially compelling economics relative to other fluorspar resources on the peninsula.

Accordingly, CFI is exploring the feasibility of developing the proposed Project.

This EA Registration Document for the Project includes the following components:

- Surface and underground mine development of the AGS Vein;
- Mill facility;
- TMF within an area historically used as a tailings lagoon;
- Ancillary infrastructure to support the Mine and Mill; and
- Marine Terminal facility.

The proposed TMF and Marine Terminal were previously approved for the Newspar project and the designs of these two structures in the proposed Project are similar to the ones approved as part of the Newspar project.

1.1 Description of the Proponent

CFI's corporate office is based in St. John's, NL and is majority-owned by investment funds affiliated with Golden Gate Capital of San Francisco, California, USA. CFI was registered as a corporation in NL in 2009.

Name of Corporate Body:

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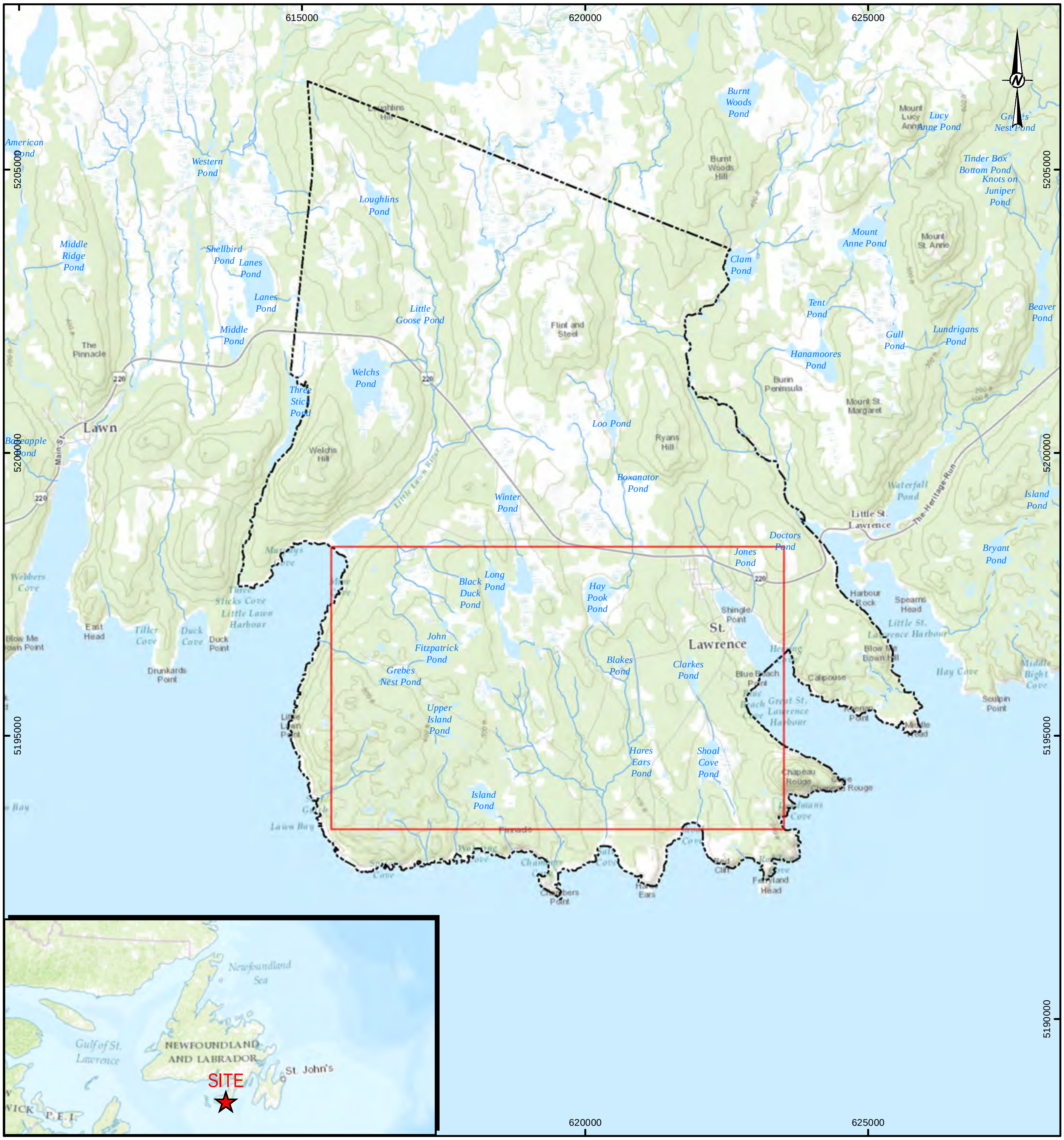
1.2 Project Overview

The proposed Project is located entirely within the municipal boundaries of the Town of St Lawrence, and to the west of the community. The Project site is within an area zoned for mining (Figure 1-1). Recent exploration activities carried out by CFI revealed that the AGS deposit is more favourable for development due to accessibility of the AGS Vein for open pit mining.



LEGEND

- - - - Municipal Boundary

▭ Project Location

1 0 1 2

Kilometres

1:100,000

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL

EA REGISTRATION

TITLE

PROJECT LOCATION AND TOWN OF ST. LAWRENCE MUNICIPAL BOUNDARY

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT	REV	FIGURE
14-07707	0	**1-1**

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; CANVEC+, 1: 50 000 SCALE, NRCAN; WORLD TOPO MAP, ESRI BASEMAPS.
PROJECTION: NAD 1983 UTM ZONE 21N.

The Project includes construction, operation, and rehabilitation and closure of the following primary components:

- Surface and underground mine development of the AGS Vein;
- Mill facility;
- Design and construction of a TMF within an area historically used as a tailings lagoon;
- Ancillary infrastructure to support the Mine and Mill (i.e. access roads, explosives magazine storage, conveyors, administration building, warehouse and maintenance building, employee facilities, concentrate storage building, security building, sewage and water treatment units, and electrical building); and
- Marine Terminal facility at Blue Beach Cove.

1.3 Background

St. Lawrence has a long mining history. The area's mineral potential was recognized in the 1840's, when a reference to fluorspar was recorded by Joseph Jukes, a renowned British geologist, who noted a small vein containing "flurate of lime". In 1928, the Black Duck vein was rediscovered and the first producing fluorspar mine was established in 1933 by the St. Lawrence Corporation and Newfoundland Fluorspar Ltd. These two operators were eventually acquired by Alcan: Newfoundland Fluorspar Ltd in 1940; and St. Lawrence Corporation in 1965. The mine was operated under the name "Alcan, Newfluor Works". Because of depressed global fluorspar prices, low production costs of fluorspar in Mexico, and labour problems in St Lawrence, Alcan closed the St. Lawrence operation in 1978 (CFI 2009).

After an eight year hiatus, mining resumed under a new operator, St. Lawrence Fluorspar Limited, a subsidiary of Minworth Ltd based in the United Kingdom. However, this operation was short-lived: project underfunding forced it into receivership in 1991. With this, almost 60 years of nearly continuous mining came to a close in St Lawrence (CFI 2009).

The legacy left behind was not only one of reduced employment in the region but also a site affected by decades of mining activity. From the mid 1930's to 1957, the St. Lawrence Corporation deposited tailings into Shoal Cove Pond via Clarkes Pond Brook. In addition, when Alcan operated the mine from 1957 onward, mine water from the Director Mine was discharged into an area bordering Salt Cove Brook. The last mine operators, St. Lawrence Fluorspar Limited, constructed a hillside tailings management facility that discharged effluent into Shoal Cove Pond from 1987 to 1990. During this period, the operator reportedly had problems in complying with its effluent discharge limits (CFI 2009).

Three EAs were completed since the mid-1990s to support fluorspar mine reactivation in the St Lawrence area (Table 1-1). In 1995, Burin Minerals Limited (BML, CFI's predecessor) initiated a provincial EA for a proposed tailings management facility in Shoal Cove Pond, and an EPR was prepared and submitted to DOEC as part of the EA process. Release from further requirements under the provincial EA legislation was obtained in 1996. In 1997, BML and the Department of Fisheries and Oceans (DFO) signed a "No-Net Loss Compensation Agreement" for the harmful alteration, disruption or destruction (HADD) of fish habitat associated with the tailings management facility (DFO 1997a). This agreement was the first of its kind in Newfoundland and is still valid. However, the EA approval expired after 6 years as BML failed to bring the project to the construction phase.

Nevertheless, BML continued with an extensive exploration program from 1999 to 2008 to support a prefeasibility study for the Tarefare and Blue Beach North mine reactivation. In 2009, BML went through a corporate reorganization and began trading its shares on the Toronto Stock Exchange Venture (TSX-V) under its new name, Canada Fluorspar Inc (the parent of Canada Fluorspar (NL) Inc). In April 2009, CFI registered the Newspar project for another EA, this time with the provincial and federal governments. A provincial EPR and a federal screening were completed and the undertaking was released from EA in October 2010 by both levels of government. One of the province's release conditions, that stream flows be diverted from Clarkes Pond during heavy rainfall events to minimize flows to the tailings facility, prompted a federal EA amendment to address requirements under the *Fisheries Act* and the *Navigable Waters Protection Act*. A screening report, which focused on a storm flow diversion and fish pass structure at the outlet of Clarkes Pond, was submitted (at this point by Newspar) to the CEA Agency and the undertaking was released in February 2012 (CEA Agency 2012).

Table 1-1: List of Previous Environmental Assessments

Project	Owner	Regulatory Body	EA Process	Dates
Reactivation of the St. Lawrence Fluorspar Mine – Water Diversion Structure, Clarkes Pond, St. Lawrence	Newspar	CEA Agency	Screening	2011-2012
Reactivation of the St. Lawrence Fluorspar Mine	CFI	DOEC and CEA Agency	Provincial Environmental Preview Report and federal Screening	2009-2010
St. Lawrence Tailings Management Facility	Burin Minerals Ltd.	DOEC	Environmental Preview Report	1995-1996

1.4 Approval of the Undertaking

CFI will require approvals and permits from federal, provincial, and municipal governments for all stages of the Project. The anticipated regulatory framework for the EA process is described in the following section. Following EA release, specific permits and approvals will be obtained from federal, provincial and municipal governments, as appropriate. A preliminary list of the anticipated permit requirements from each level of government is provided in the following subsections.

1.4.1 Federal

Federal EA is regulated under the *Canadian Environmental Assessment Act (*CEAA 2012*)*. Submission of a Project Description to the CEA Agency is required for all projects designated in the *Regulations Designating Physical Activities*. Upon review of the designated activities and through discussions with the CEA Agency, it was determined that the Project as currently proposed is not considered a "designated physical activity" and submission of a Project Description is therefore not required under CEAA 2012 (F. Kirstein 2015, pers. comm.).

In the past, authorization and approvals were issued by federal agencies to either BML, Newspar or CFI and are still valid today. These include:

- *Fisheries Act* Authorization: Authorization issued by DFO in 1997 and Fish Habitat Compensation Agreement signed to ensure no net loss of fish habitat of Shoal Cove Pond, Shoal Cove Brook and Clarkes Pond Brook;

- *Navigable Waters Protection Act* Approval (Transport Canada), issued in 2012 for the Cutoff Wall at Clarkes Pond; and
- *Navigation Protection Act* Approval: Approval for the Marine Terminal issued by Transport Canada in 2012 under the *Navigable Waters Protection Act* and reissued in 2015 under the *Navigation Protection Act.*

In 2012, CFI requested an amendment to the 1997 Fisheries Act Authorization and submitted an updated Compensation Plan (now referred to as an Offset Plan) to DFO for offsets related to the TMF and Clarkes Pond cutoff wall and diversion channel. In addition, a marine fish habitat Compensation Plan was submitted to DFO during the same year for offsets related to the Marine Terminal for the St. Lawrence Fluorspar Mine Reactivation Project. The amendment to the 1997 Fisheries Act Authorization and marine fish habitat Compensation Plans were both reviewed and accepted by DFO. While the offset concepts and approaches previously described in the existing plans will not change dramatically, recent revisions to the Fisheries Act as well as design concepts for the Project require a review of the potential serious harm to fisheries, a revision of the offset measures and costs (for generation of letter of credit), and submission of the Request for Project Review to DFO.

Environment Canada confirmed that the Metal Mining Effluent Regulations do not apply to CFI since fluorspar is not classified as a metal (CFI 2009).

In addition to the authorizations received to date, other federal approvals and authorizations that will potentially be required are outlined in Table 1-2.

Table 1-2: Potentially Applicable Federal Permits, Approvals and Authorizations

Agency	Permit, Authorization, Approval	Act/Regulation
Transport Canada	Transportation of Dangerous Goods – Explosives	*Canada Transportation Act*
	Approval for the Marine Terminal (already acquired)	*Navigation Protection Act*
Natural Resources Canada	Magazine Licence Application	*Explosives Act*
	Application for Permit to Transport using a Flatbed Trailer	*Explosives Act*
	Application for Authorization of Explosives	*Explosives Act*
Department of Fisheries and Oceans	Request for Project Review	*Fisheries Act*
	Application for Authorization	*Fisheries Act*
Environment Canada	Compliance to *Canadian Environmental Act*	*Canadian Environmental Act*
	Compliance with the *Wastewater Systems Effluent Regulations*	*Fisheries Act*
Canadian Wildlife Service	Scientific Permit	*Migratory Birds Convention Act*
Industry Canada	Communications Licence	*Radiocommunication Act*
	Radio Station Licence	*Radiocommunication Act*
Canadian Nuclear Safety Commission	Nuclear Substances and Radiation Devices License	*Nuclear Substances and Radiation Devices Regulations*

1.4.2 Provincial

In accordance with the NL *Environmental Protection Act* (EPA) and the *Environmental Assessment Regulations*, all mining projects carried out in NL are subject to EA. The EA process for the Project is initiated via submission of this EA Registration to the NL DOEC. The EA Division of DOEC administers the process, including:

- Consult with interested government departments and the public during the EA process;
- Review and evaluate submissions by proponents and reviewers;
- Advise the Minister of potential environmental effects prior to decisions; and
- Monitor released projects to ensure compliance and effectiveness of mitigation.

Following submission of a Project Registration by the Proponent, DOEC circulates the document to other government agencies and posts it on their website for a 35 day government and public review period. At the conclusion of this review period, the Minister advises the Proponent, within 45 days following submission of EA Registration, whether the undertaking has been released from the EA process, or whether it will require an Environmental Preview Report (EPR) or Environmental Impact Statement (EIS). Once the provincial EA process is completed, provincial permits and approvals will be required for all activities associated with the project from site preparation to mine closure.

Following release from the EA for the Newspar project in 2010, a Certificate of Approval for construction of the Newspar project was issued by DOEC, however, this approval does not apply to the AGS Project. In 2012, an agreement was reached between Newspar and DOEC regarding the total suspended solids (TSS) allowable discharge limit of 30 milligrams per liter (mg/L) + background TSS is still applicable for Mill water that would be taken from Clarkes Pond and discharged downstream of the TMF.

Some provincial approvals have been acquired by Newspar. These approvals do not apply to the proposed Project and will need to be acquired following EA release of the Project, including:

- Certificate of Approval (NL DOEC), issued in 2012 for the construction associated with re-activation of mine and mill facility;
- Environmental Protection Plan;
- Environmental Effects Monitoring Plan;
- Gender Equity and Diversity Plan; and
- Closure Plan.

Other provincial permits and approvals that may be required prior to start of construction are listed in Table 1-3.

Table 1-3: Potentially Applicable Provincial Permits and Approvals

Agency	Permit, Authorization, Approval	Applicable Act/Regulations
DOEC - Water Resources Division	Alteration to a Body of Water	*Water Resources Act*
	Application for Permit for Constructing a Non-Domestic Well	*Water Resources Act*
	Water and Sewage Works	*Water Resources Act*
	Application for Water Use Licence	*Water Resources Act*
DOEC - Pollution Prevention Division	Certificate of Approval for Construction and Operation	*Environmental Protection Act*
	Certificate of Approval –Waste Disposal Facility	*Environmental Protection Act*
DOEC – Wildlife Division	Permit to destroy animal problems	*Wildlife Act*
	Compliance standard	*Endangered Species Act*

Agency	Permit, Authorization, Approval	Applicable Act/Regulations
Department of Natural Resources Forestry Resources Branch	Commercial Cutting/Operating Permit	*Forestry Act*
	Burning Permit	*Forestry Act*
Department of Natural Resources (DNR) - Mineral Lands Division	Approval for Development Plan, Closure Plan and Financial Assurance	*Mining Act*
	Surface Lease	*Mining Act*
	Mining Lease	*Mining Act*
	Quarry Permit	*Quarry Materials Act*
Municipal and Intergovernmental Affairs	License to Occupy Crown Lands	*Crown Lands Act*
Service NL	Certificate of Approval- Storage and Handling of Gasoline and associated products	*Environmental Protection Act*
	Permit for Flammable and Combustible Liquid Storing and Dispensing (Above or Below Ground) and for Bulk Storage (Above Ground Only)	*Environmental Protection Act*
	Storage Tank System	*Environmental Protection Act*
	Building Accessibility Exemption	*Buildings Accessibility Act*
	Statutory Declaration for Registration of Boiler and pressure Vessel Fittings Fabricated in NL	*Public Safety Act*
	Certificate of Plant Registration for Power, Heat, Refrigeration, Compressed Gas or Combined Plant	*Public Safety Act*
	Contractor's Licence- Pressure Piping System	*Public Safety Act*
	Examination and Certification of Propane System Installers	*Public Safety Act*
Transportation and Works	Compliance Standard- Storing, handling and transporting dangerous goods	*Dangerous Goods Transportation Act*
Human Resources Labour and Employment	Compliance Standard- Occupational Health and Safety	*Occupational Health and Safety Regulations*
Tourism, Culture and Recreation	Compliance Standard- *Historic Resources Act*	*Historic Resources Act*

1.4.3 Municipal

The Project is located within the municipal boundaries of the Town of St. Lawrence and as such will abide by all the bylaws and regulations of the town. The Project site is within land use zones reserved for mining, as outlined in the Town of St. Lawrence Municipal Plan (Town of St. Lawrence 2012).

In 2002, the Blue Beach and Blue Beach Point areas were rezoned by the municipality to support the development of the marine terminal at Blue Beach. These amendments were subject to a public consultation process conducted by the Town of St. Lawrence.

The potential municipal approval required for the Project is a Development Permit for Site Development—Quarry and Soil Removal. In addition, CFI will comply with the following municipal regulations, and any other applicable bylaws and regulations:

- Schedule C- Mixed Development Zone- *Town of St. Lawrence Development Regulations* 2012.
- Schedule C- Mining- *Town of St. Lawrence Development Regulations 2012.*

1.5 Project Schedule

The Project will be undertaken in four specific phases, as shown on Figure 1-2:

- Pre-construction (ongoing);
- Construction (Q4 2015 to end of 2017);
- Operations (2017 to 2026); and
- Rehabilitation and Closure (2027 to 2029).

The pre-construction phase is currently ongoing and includes various activities such as metallurgical test work, engineering prefeasibility and feasibility studies, EA and planning studies, and regulatory permitting.

CFI's objective is to initiate construction activities in the fourth quarter of 2015, contingent on receipt of all required approvals, permits, and authorizations. The construction phase is expected to last approximately two years and will be followed by an operations phase projected to last ten years. The length of the operations phase is based on the current resource estimate and may be lengthened should additional resources be identified in the AGS Vein.

A high level Project Schedule is shown in Figure 1-2, and a detailed timeline is provided in Section 2.7.

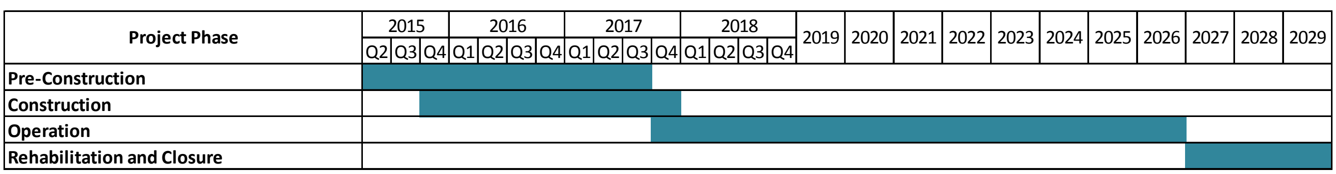


Figure 1-2: Project Schedule

2.0 PROJECT DESCRIPTION

This section defines the Project components and activities, including construction, operation, rehabilitation and closure.

2.1 Project Location

The proposed Project is located partly on a brownfield site on which mining and milling activities have occurred since the early 1930s. The site is located entirely within the municipal boundaries of the Town of St. Lawrence, on the southern tip of the Burin Peninsula in the Province of NL (Figure 2-1). The Project is approximately 350 km by road from St. John's, Newfoundland, and next to the community of St Lawrence. Access to the Project site is by Provincial Highway 220 to St. Lawrence, followed by approximately 8 km of gravel road to the proposed AGS Mine site. The Project is west of the St. Lawrence Harbour, which is ice-free year round.

The coastline located in proximity to the Project area consists of a number of bold headlands, bordering open coves to the south of St. Lawrence Harbour. Prominent natural features include, from west to east, Salt Cove, Hares Ears, Shoal Cove, Red Head, Ferryland Head, Deadmans Cove and Cape Chapeau Rouge (Figure 2-2). This is a rugged shoreline that is open to the sea (Burin Minerals Limited, 2009).

LEGEND

Project Location

0 5 10

Kilometres

1:400,000

REFERENCE

SOURCE(S): CANVEC, 1:50 000 SCALE & NATIONAL TOPOGRAPHIC DATABASES, 1:250 000 SCALE, NRCAN; WORLD TOPO MAP, ESRI BASEMAPS.
PROJECTION: NAD 1983 UTM ZONE 21N.

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE

PROPOSED SITE LOCATION, ST. LAWRENCE, NL

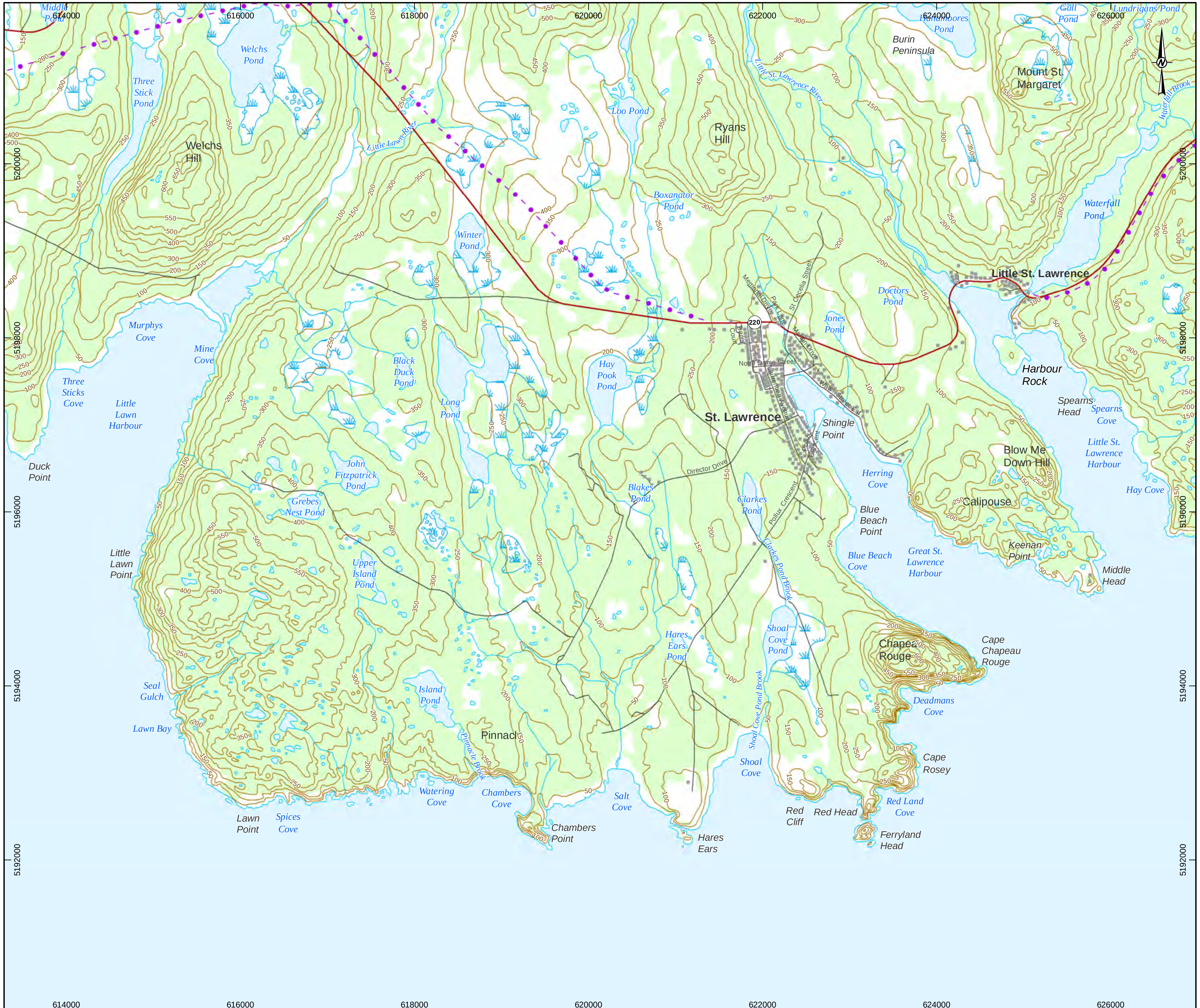
CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT	REV	FIGURE
1407707	0	**2-1**

H:\Projects\Canada Fluorspar\St-Lawrence NL_Mines\PROJECTS\1407707_EA_AGS_Mine_St-Lawrence\MXD\RevA\1407707_Figure_2-1_Proposed_Site_Location_8X11_20150514.mxd



LEGEND

- Building
- Highway
- Road
- Power transmission line (overhead)
- Contour Line (interval: 50 ft/15.2m)
- Watercourse
- Waterbody
- Wetland
- Vegetation Cover

Elevations	
Feet	Metres
50	15.2
100	30.5
200	61.0
300	91.4
400	121.9
500	152.4
600	182.9

0 1 2
Kilometres
1:45,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT
CANADA FLUORSPAR INC.

PROJECT
AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE
TOPOGRAPHY

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT No.	Rev.	FIGURE
14-07707	0	2-2

Several structures and buildings used by previous mine operators remain on site, including tailings disposal areas, the mill and other ancillary buildings (Figure 2-3).

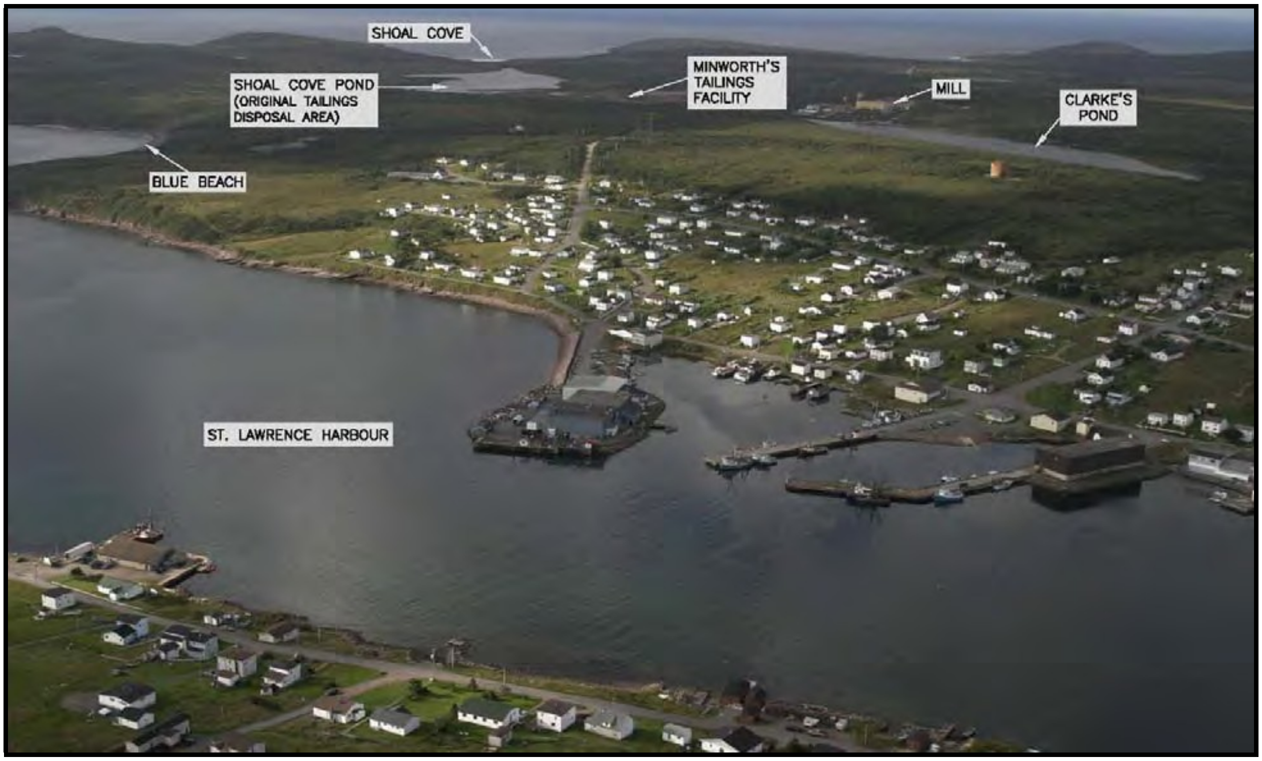
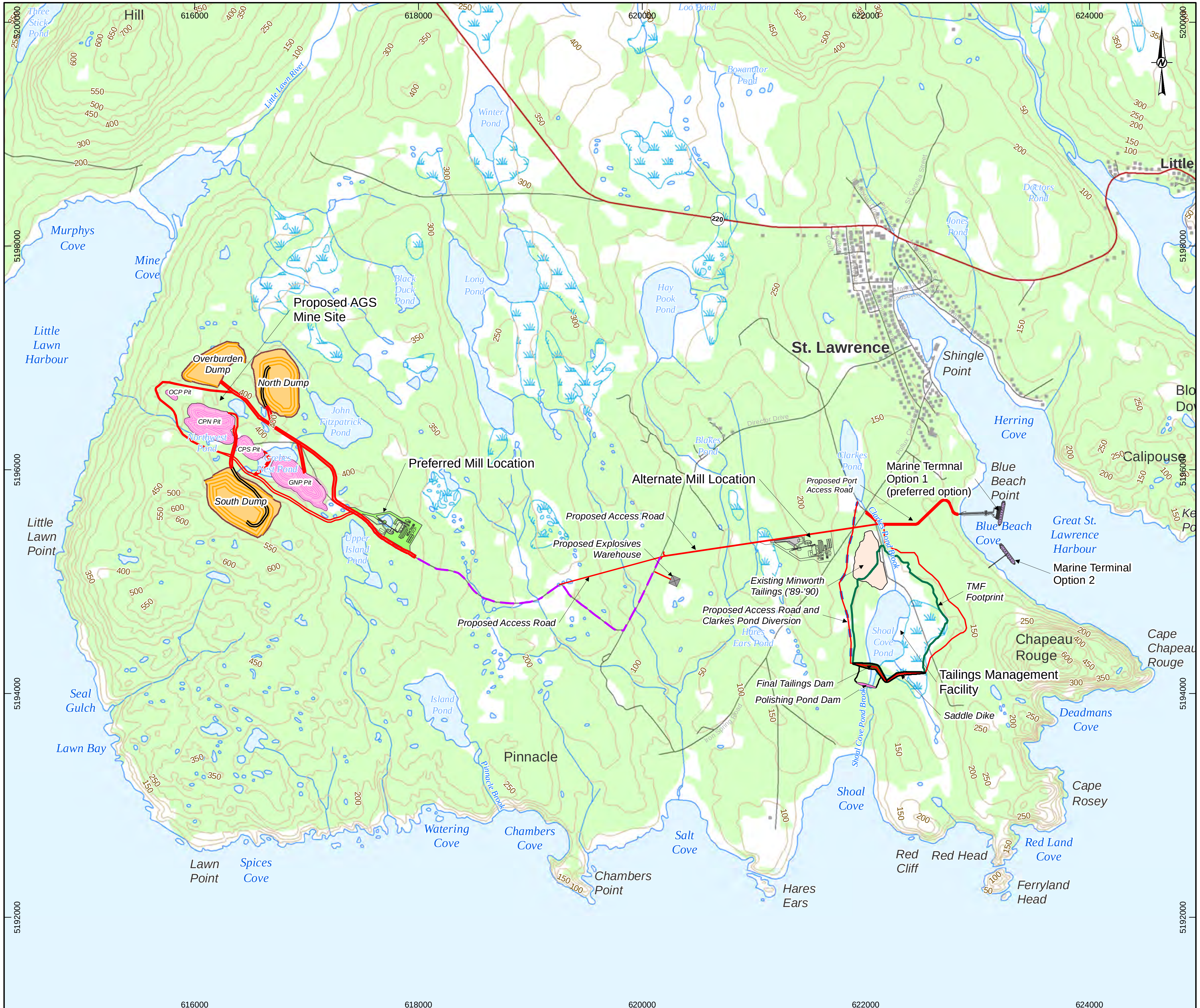


Figure 2-3: Aerial Image of Town of St. Lawrence and Project Site (original photo courtesy of DFO, BML 2009)

2.2 Project Components

The main physical features proposed for the Project are shown on Figure 2-4. These Project components are listed below, and described in the following subsections:

- AGS mine;
- Mill and ancillary buildings;
- Access and haul roads;
- Tailings Management Facility (TMF);
- Water management facilities and general site drainage;
- Existing facilities; and
- Marine Terminal.



LEGEND

PROJECT COMPONENTS

- Clarkes Pond Diversion Channel
- Proposed Road
- Proposed Upgraded Road
- TMF Footprint
- Final Tailings Dam
- Settling Pond Dam
- Saddle Dike
- Existing Minworth Tailings
- Mine Dump Option
- Pit

TOPOGRAPHY

- Building
- Highway
- Existing Road
- Contour Line (interval: 50 ft)
- Watercourse
- Waterbody
- Wetland

0 1 2

Kilometres

1:35,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE

PROJECT SITE PLAN

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-13
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT No.	Rev.	FIGURE
14-07707	0	2-4

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM:

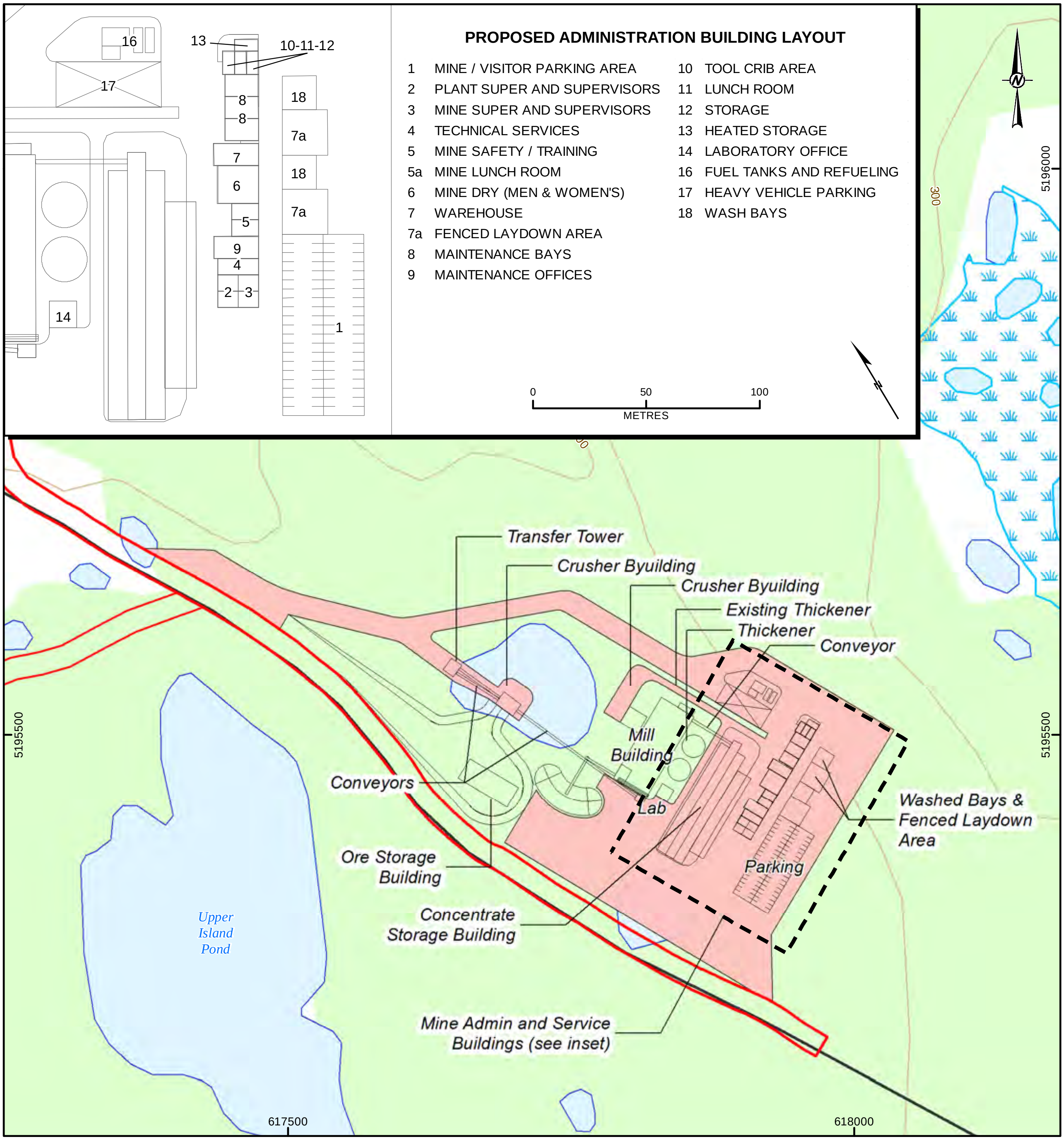
Path: H:\Projects\Canada Fluorspar\St.Lawrence_NL_Mines\PROJECTS\1407707_Figure_2-4_Project_Site_Plan_20150513.mxd

2.2.1 Mill and Ancillary Buildings

Buildings to be constructed at the Mill Site, shown on Figure 2-5, include the following:

- Mill Building;
- Crusher Building;
- Transfer Tower;
- Electrical Building;
- Concentrate Storage Building;
- Administration and Engineering Building;
- Storage Buildings;
- Security Building;
- Flocculent Treatment Building;
- Laboratory Building; and
- Mine/Mill Dryhouse.

The preferred Mill location is near the AGS Mine. Alternative locations, such as to the southwest of Clarkes Pond or in proximity to the Director Vein, are being considered as engineering advances. The Mill will contain all the process equipment needed to produce up to 200,000 tonnes/year of acid-grade fluorspar concentrate. The Mill will also generate approximately 200,000 tonnes/year of Dense Media Separation (DMS) floats, which may be marketed as a high-quality construction aggregate or used as underground backfill. A similar quantity of flotation tailings will also be generated, and this will be conveyed as slurry by pipeline to the TMF for storage/disposal.



0 100

Metres
1:5,000

LEGEND

- Existing Road
- Proposed Road
- Contour Line (interval: 50 ft/15.2m)
- Watercourse
- Waterbody
- Wetland
- Mill (Preferred Location)

REFERENCE

SOURCE(S): VARIOUS DRG, WORLEYPARSONS; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN
PROJECTION: NAD 1983 UTM ZONE 21N

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE

MILL AND ANCILLARY BUILDINGS

CONSULTANT

Golder Associates

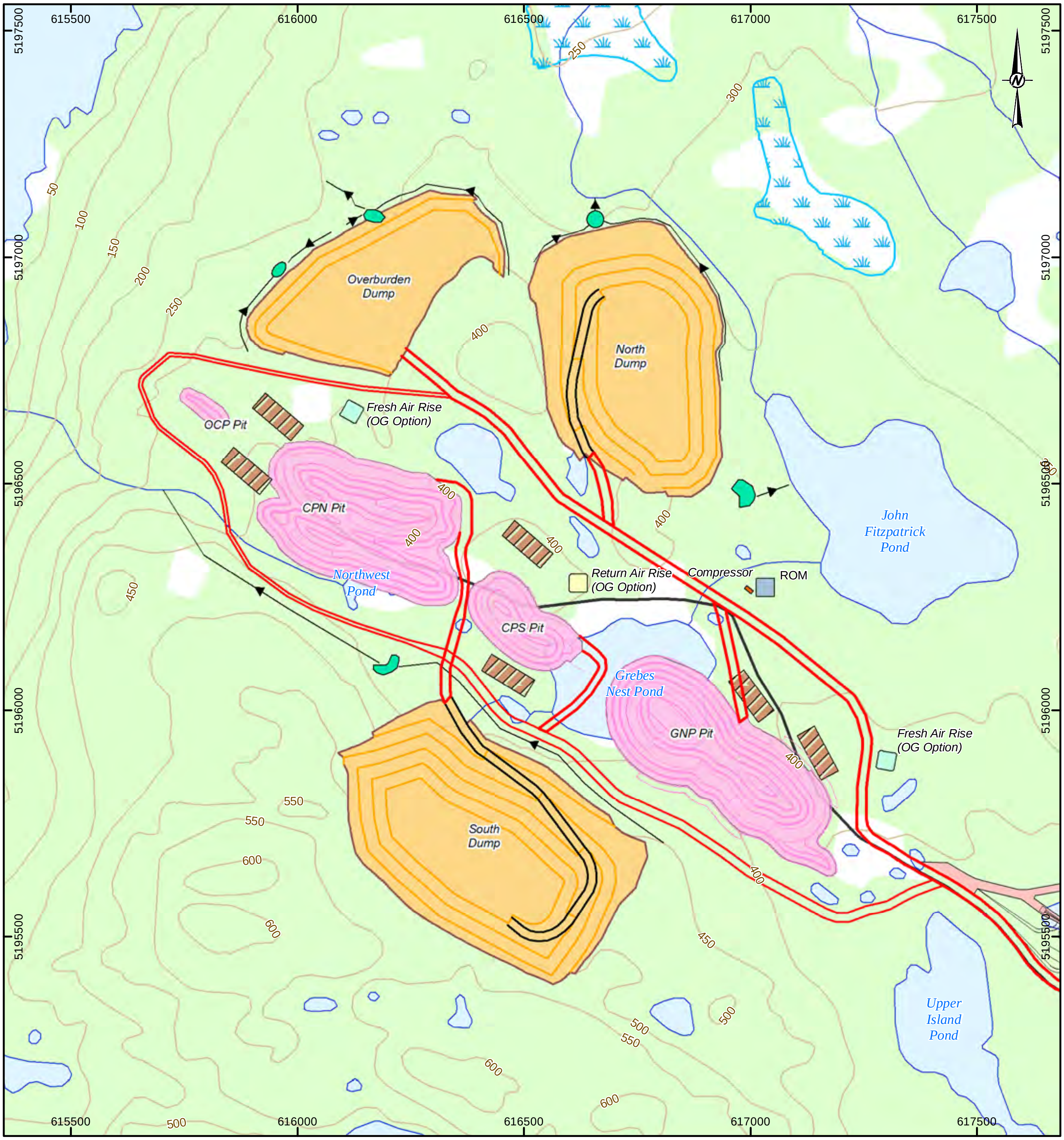
YYYY-MM-DD	2015-05-19
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT	REV	FIGURE
14-07707	0	**2-5**

2.2.2 AGS Mine

The proposed AGS mine will consist of four open pits; future underground mine workings; waste rock, overburden, and topsoil dumps/stockpiles; and haul/access roads (Figure 2-4). The four open pits include: Open Cut Pit (OCP), Central Pit North (CPN), Central Pit South (CPS) and Grebes Nest Pit (GNP). Depth of the open pits will range between 35 m and 145 m. A total of about 27 million tonnes of waste rock will be generated during the life of the Project. This material will be stored in the two waste rock dumps shown on Figure 2-6 and some of it will also be used for construction of infrastructure. In addition, overburden and topsoil stockpiles will be established and used throughout the various Project phases for progressive rehabilitation and final site closure.

Underground mining will be phased in when portal access can be established within the open pits. The conceptual layout of the underground mine is shown on Figure 2-7. One pr two portal entrance(s) will be built at the bottom of Central Pit South and/or Central Pit North. The underground ramp access will be built and will connect the various levels of galleries. Ventilation raises will be constructed at strategic locations. The average depth of the underground mine is approximately 200 m.



0 100 200 300

Metres

1:12,500

LEGEND

	Existing Road		Potential Settling Pond
	Proposed Road		Topsoil Storage
	Water Management Diversion Ditch		Mill (Preferred Location)
	Contour Line (interval: 50 ft/15.2m)		Mine Dump Option
	Watercourse		Pit
	Waterbody		
	Wetland		

REFERENCE

SOURCE(S): VARIOUS DRG, WORLEYPARSONS; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN

PROJECTION: NAD 1983 UTM ZONE 21N

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL

EA REGISTRATION

TITLE

AGS MINE SITE

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-19
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT	REV	FIGURE
14-07707	0	2-6

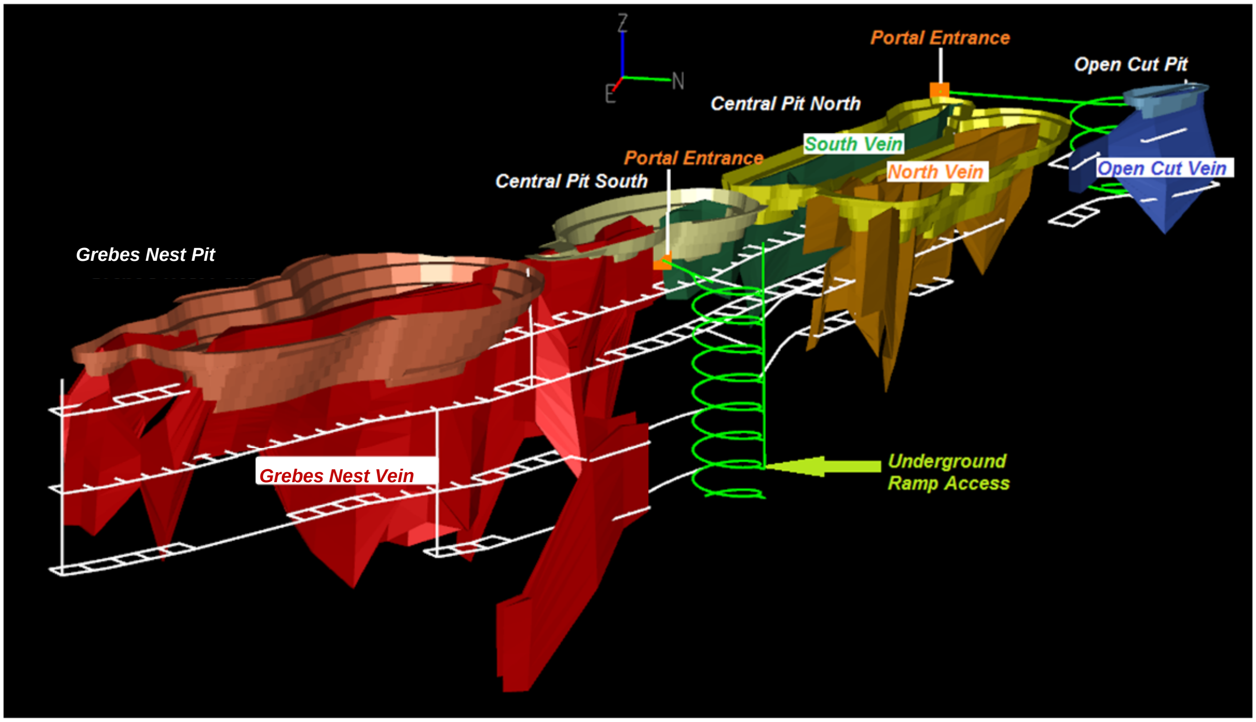


Figure 2-7: Conceptual 3-Dimensional Perspective of Surface and Underground Mine

2.2.3 Access and Haul Roads

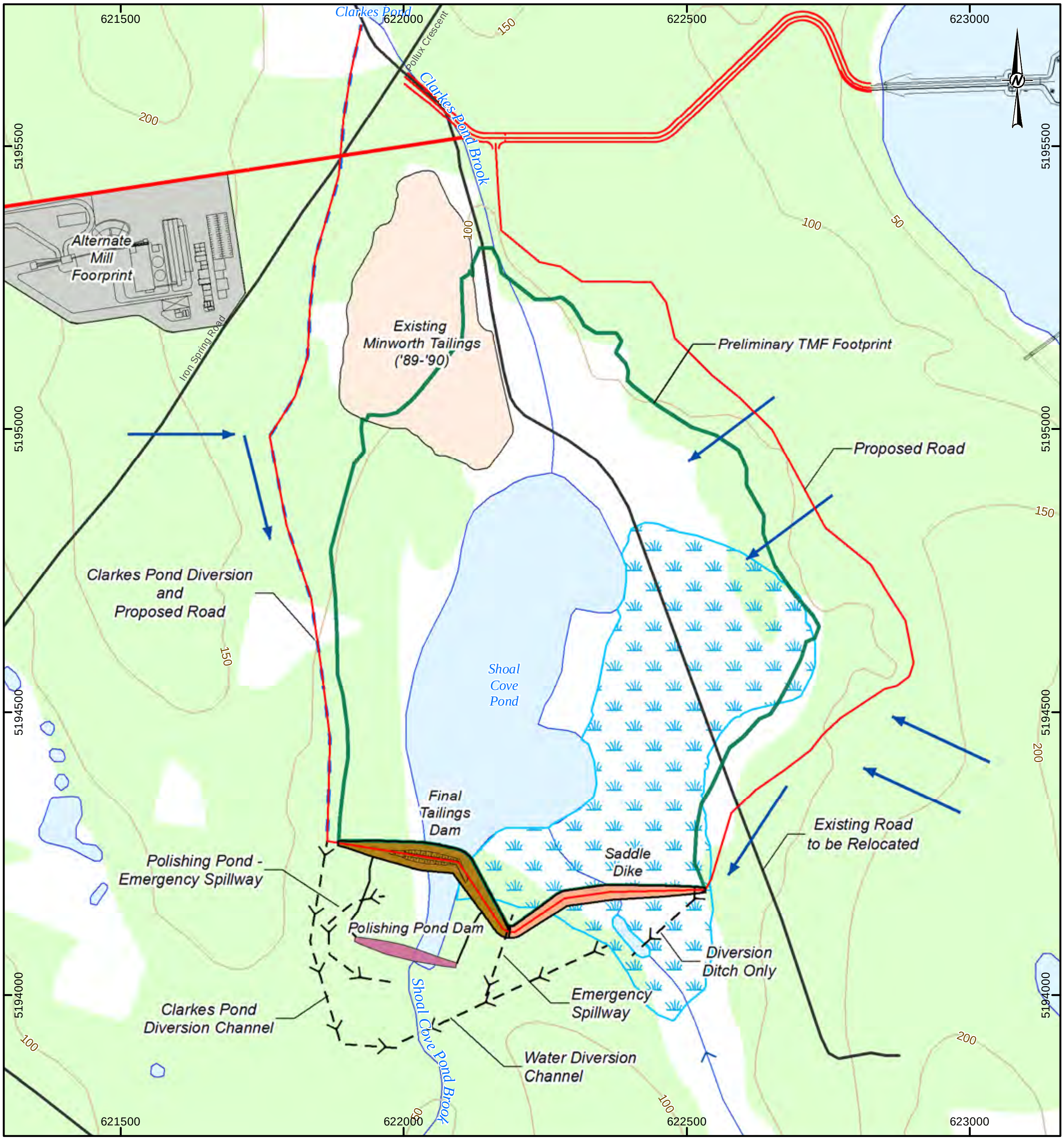
Existing roads, some of which were used historically as mine roads, will be upgraded and used by the Project. In addition, approximately 17 km of new roads are proposed to be built to shorten travel distances, or to provide access to various project areas. Existing and proposed roads are shown on Figure 2-4.

2.2.4 Tailings Management Facility

The TMF is being designed to accommodate 2.8 Million tonnes (or about 2 Million m^3) of flotation tailings generated at the Mill. The TMF will be located at Shoal Cove Pond, where tailings were disposed of from the early 1930s to the late 1950s. This area was selected as a preferred site for tailings disposition, partly because of its historical use during previous mining activities. The TMF at Shoal Cove Pond also can be expanded to accommodate more tailings in the future by increasing the height of the tailings dam should expansion to the Project be considered in the future.

The last active mine in the area deposited its tailings in a hillside facility at the head of Shoal Cove Pond, and the effluent from this facility continues to flow into Shoal Cove Pond. An engineered TMF at this location would provide a greater level of environmental control than that which currently exists.

The proposed TMF consists of a tailings pond and dams. A downstream polishing pond is located to the south of the tailings pond with another, smaller dam at the southern end of Shoal Cove Pond (Figure 2-8).



0 100 200

Metres
1:10,000

LEGEND

- Existing Road
- Proposed Road
- Water Diversion Direction
- Contour Line (interval: 50 ft/15.2m)
- Watercourse
- Waterbody
- Wetland
- Mill (Alternate Location)
- Existing Minworth Tailings
- Final Tailings Dam
- Saddle Dike
- Settling Pond Dam
- TMF Footprint

REFERENCE

SOURCE(S): VARIOUS DRG, WORLEYPARSONS; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN
PROJECTION: NAD 1983 UTM ZONE 21N

CLIENT
CANADA FLUORSPAR INC.

PROJECT
AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE
TAILING MANAGEMENT FACILITY

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT	REV	FIGURE
14-07707	0	**2-8**

The proposed TMF is designed to provide permanent and secure containment of all tailings generated at the Mill within an engineered impoundment complying with relevant regulations and to minimize seepage from the TMF by establishing a low permeability consolidated tailings mass. The TMF is designed to allow storage of up to the 1 in 100 year, 24 hour design flood without discharge. The hydraulic structures are capable of conveying an extreme flood event as per the Dam Safety Guidelines (Canadian Dam Association [CDA] 2007, 2013). Available material will be utilized for dam construction, wherever possible.

At the end of mine life the TMF will occupy an area of about 67 ha. This represents an area slightly larger than that of the approved TMF for the Newspar project. A number of alternatives have been considered and evaluated for the proposed TMF, as presented in Section 3.3.1.

The conceptual TMF design has been slightly modified from that of the Newspar project. The previous design included a central separator berm creating two tailings cells. The Newspar project TMF design was conceived to accommodate all flows (including those during storm events) from Clarkes Pond, as well as the surrounding watershed. The separator berm has not been included as part of the Project's TMF because surface water diversion ditches and reduced flows from Clarkes Pond Brook (as a consequence of the Clarkes Pond cutoff wall and storm flow diversion system) is expected to minimize flows into the facility at all times. Removal of the separator berm also increases the storage capacity of the TMF.

The TMF will function as a tailings storage cell. Supernatant water in this cell will be decanted into the polishing pond located immediately downstream, and effluent from the polishing pond will be discharged into the upper reaches of Shoal Cove Pond Brook. The engineered TMF will introduce, for the first time, an improved level of environmental control at the outlet of Shoal Cove Pond. Effluent monitoring will also be carried out to demonstrate compliance with the regulatory discharge limits.

Perimeter access roads will be bordered by ditches to collect and divert surface flows around the majority of the TMF, particularly during storm events.

The TMF design includes an emergency spillway to safely convey excess water that cannot be accommodated by the facility. The emergency spillway design is in accordance with the guidelines provided by the Dam Safety Guidelines (CDA 2007).

2.2.5 Water Management

Water management will focus on surface and groundwater flows into the open pits, water removed from the Underground Mine, stormwater runoff from the Project site, and water needed by the Project for mineral processing and mining. Water management of the site will be undertaken in accordance with approved practices and with the objective of preventing drainage-related problems surrounding the site.

A detailed Water Management Plan will be developed at an early stage of Project planning. This Plan will satisfy the following objectives:

- Ensure that a reliable, acceptable quantity and quality of water is available to the Project during all phases;
- Reduce the amount of water required by concerted efforts to incorporate conservation during design, construction, and operation phases of the Project;

- Reduce the amount of new water used during construction and operation of the Project through the reuse and recycling of storm water and treated wastewater wherever possible. For example, water pumped from the surface and underground mine may be used by the mill, provided that it is of acceptable quantity and quality;
- Maintain natural drainage paths, to the extent feasible, and restore them if disrupted once mining activities are completed;
- Separate clean and dirty water by diverting runoff from undisturbed areas around disturbed areas, to minimize runoff over exposed erosion-prone areas and the generation of sediment; and
- Implement appropriate measures to reduce erosion in active mining areas and to prevent off-site sediment transport.

2.2.6 Existing Facilities

Much of the infrastructure associated with the previous mining operations has been demolished. Similarly, electrical equipment, power lines, and other mechanical equipment have been removed.

Apart from some smaller facilities that remain, such as the old pump house, the majority of the existing buildings are located at the former mill site. These existing buildings include:

- Process building;
- Administration building;
- Assay Laboratory;
- Warehouses;
- Electrical sub-station;
- Ore storage silo;
- Mine dryhouse, maintenance warehouse/office; and
- Compressor building.

All of this infrastructure, including existing roads, will be either upgraded or replaced as part of the proposed Project.

2.2.7 Marine Terminal

Several alternatives and layout options for a Marine Terminal at Blue Beach Cove are being considered and are presented in Section 3.3.2. The preferred Marine Terminal layout is Option 1, which consists of rock-filled concrete caissons for the Marine Terminal berthing face (Figure 2-9). A 310 m long causeway lined with armour stone will connect the Marine Terminal structure to the shore. The berthing face is composed of four concrete caissons, totaling 100.8 m in length, with fenders to protect the face from berthing loads. Behind the berthing structure is a backfilled area with dimensions of 30.4 m x 80 m which may be used for vehicle turning or as a laydown area. The loading system consists of one Aumund covered ship loading conveyor and one Samson Feeder with a loading rate of 500 tonnes per hour. Fluorspar concentrate, and potentially construction aggregate generated at the Mill as DMS floats, will be delivered from the storage facilities to the feeder system via direct dumping from trucks.

LEGEND

- Existing Road
- Proposed Road
- Water Diversion Direction
- Contour Line (interval: 50 ft/15.2m)
- Watercourse
- Waterbody
- Wetland
- Existing Minworth Tailings
- TMF Footprint

REFERENCE

SOURCE(S): VARIOUS DRG, WORLEYPARSONS; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN
PROJECTION: NAD 1983 UTM ZONE 21N

CLIENT
CANADA FLUORSPAR INC.

PROJECT
AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE
MARINE TERMINAL

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT 14-07707 | REV 0 | FIGURE **2-9**

Bollards will be equally spaced along the Marine Terminal face for breasting and spring lines. The Marine Terminal will be outfitted with the usual marine hardware including fenders, ladders, lighting, power supply, fire protection and environmental emergency response equipment. Minimum water depths at the berth face will be 15 m. The Marine Terminal will be capable of handling vessels from 10,000 deadweight tonnage (DWT) to 65,000 DWT.

Navigation aids will be provided as per DFO – Canadian Coast Guard regulations and Transport Canada regulations.

2.3 Construction Activities

The Construction phase is expected to begin in late 2015 and to be completed in 2017. The main activities to be completed during this phase include:

- site preparation;
- open pit development;
- construction of infrastructure;
- installation of utilities;
- restoration of temporary work areas; and
- commissioning.

CFI will execute the proposed works in an environmentally responsible and safe manner and will obtain all necessary regulatory approvals and permits prior to initiating construction.

2.3.1 Site Preparation

Site preparation activities include vegetation clearing, grubbing, topsoil salvage, site grading and excavation. The general areas requiring site preparation will be the Mine Site, including the overburden, topsoil, and waste rock disposal areas, the Mill Site, and the TMF. Land to be occupied by linear features, such as roads, pipelines, water diversion ditches, and power lines will also require site preparation. Site preparation is essential to support the safe installation of Project infrastructure. This work will be completed with all necessary sedimentation and erosion control measures. These procedures will be detailed in the Project EPP.

Provincial legislation requires approval for activities associated with site preparation. Pre-construction activities will commence immediately upon receipt of environmental approvals and necessary permits. Clearing and grubbing of the access road and site would begin as soon as possible. A cutting permit will be acquired from Service NL prior to start of tree clearing activities. The wood will be cut and stockpiled next to roads for access by the public for firewood. Any residual slash will be stockpiled in windrows. This provides an enhancement to habitat (e.g. birds and small mammals could use it for protection from predators).

Other early site preparation activities include levelling/infilling and installation of temporary offices with associated services (i.e., power, potable water cooler/storage systems, and temporary sanitary facilities) will commence as soon as upgrades to existing roads are completed to allow equipment and personnel to access the site.

Following release from the EA process, and once all the required government permits have been received, the construction team will mobilize, establish a presence at the Project site and begin constructing access roads. The existing office building will be retained and will serve as headquarters for the construction management team. Mobile offices will be added as the team grows, if required. As part of the earthworks, space near the proposed TMF and at Blue Beach will be levelled to provide laydown areas for the staging and storage of construction-related equipment and material.

2.3.1.1 Temporary Sewage Facilities

Sewage generated during site preparation and construction will be collected and transported off-site for treatment and disposal. Portable washrooms and toilets will be used on-site until permanent facilities are completed. Where possible, permanent sewage systems will be installed and maintained to prevent the release of hazardous substances, pathogens and excess nutrients to the environment. All sewage and other wastewaters will be adequately treated prior to release to the environment.

2.3.1.2 Stripping

Grubbing of the organic vegetation mat and/or the upper soil horizons, although they will be kept to a minimum, will be necessary in some areas within the Project footprint. Erosion control techniques and devices will be used to stabilize erosion prone areas. Topsoil and excavated overburden will be stored in separate stockpiles for later use during reclamation. Any material unsuitable for construction purposes 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 in areas prone to erosion, as appropriate.

2.3.1.3 Excavation and Blasting

Excavation and blasting related to mine and site development, access roads, and site preparation for the Marine Terminal will be carried out over approximately six months. In addition, this activity may be required at quarries developed on site to produce sufficient rock fill material for the earthfill/rockfill structures of the tailings management facilities.

Standard earthmoving procedures will be employed at the site (in accordance with the EPP for construction), including drilling and blasting, and mechanical excavation. A large portion of the material to be moved on the site consists of rock. There are lesser amounts of till that also need to be excavated. Hard, sound igneous and metamorphic rock, which typically lies beneath the overburden, will require blasting and mechanical force to free it for excavation. Till can be excavated using conventional mechanical means including excavators, loaders and dozers.

During the construction phase, blasting operations are only required during the site preparation work phase of the Project. Blasting will be undertaken by licensed contractors. They will be responsible for maintaining current permitting with the regulatory agencies for the duration of construction. Explosives and auxiliary materials will be stored by the contractor as stipulated in relevant legislation, CFI Occupational Health and Safety (OH&S) standards, and in compliance with the construction permits. No blasting will take place in the marine environment.

Blasting activities will be co-ordinated and scheduled to minimize the number of blasts required per week. To reduce the seismic effect, blasting procedures will be developed. Time-delay blasting may be used as necessary to control debris scatter. Prior to any blast, the site will be surveyed to identify the presence of any wildlife. Should any wildlife be present, CFI will comply with all applicable regulatory requirements and will follow measures identified in its EPP.

During excavation activities, contractors will be required to limit the footprint of the excavation to the minimum required for pipe trenches.

2.3.1.4 Buildings and Service Roads

Site preparation for building construction will involve the use of compaction equipment, including conventional vibratory rollers. Final site levelling, and service and access road levelling will be done using graders. Concrete trucks will be used to transport concrete to the Project site. Cranes will be used throughout the site for assembling various components. To complete the construction of the Marine Terminal, cranes may be mounted on barges.

2.3.2 Pit Development

Pit Development will occur soon after the start of construction and last for a period of approximately 18 months. Some overburden stripping and topsoil removal is scheduled to be completed within that timeframe. In addition, small quantities of ore and waste rock will be mined towards the end of this period.

Grebes Nest Pond will be dewatered to allow the excavation of a portion of Grebes Nest Pit. Water quantity to be removed from Grebes Nest Pond is estimated at 0.3 Million m^3. While most of that water is expected to be suitable for discharge into John Fitzpatrick Pond, disturbance of the pond bottom is expected to re-suspend sediment, and therefore, the water will be pumped through the nearby settling pond to the north. Prior to proceeding with dewatering of Grebes Nest Pond, fish will be relocated in compliance with regulatory requirements. CFI will obtain approval from DFO for fish relocation through the submission of a Fisheries Offsetting Plan and Fish Relocation Plan as required under the *Fisheries Act*.

During the Pit Development phase, small quantities of ore will be mined on the surface of OCP to accommodate Mill commissioning during the first half of Year 1. Small quantities of waste rock will also be excavated to use as road construction material, and to support construction of the TMF and the Marine Terminal.

2.3.3 Construction of the Mill

Construction of support buildings at the Mill Site will begin during spring of 2016. Buildings will be enclosed before the fall of 2016 to ensure further work (i.e., electrical, mechanical) can continue through the fall and winter, and be completed by the fourth quarter of 2017.

The water supply system will be constructed after a suitable source of freshwater has been identified that will provide sufficient water quantity and quality for Mill processes, and following receipt of all required permits and approvals.

A tailings pipeline will also be constructed from the Mill to the TMF following an alignment that meets the technical, financial, and environmental requirements of the Project. The tailings pipeline will likely be built preferentially along road rights-of-way.

2.3.4 Construction of Tailings Management Facility

TMF construction activities will focus on the impervious tailings and polishing pond dams, and the Saddle Dyke. The TMF design concept is based on a staged development of the tailings dam. The dam height will be raised as the life of mine progresses, in step with the facility's need for increased storage capacity. Dam raises will follow the "Downstream Method" of dam development. Initially, a starter dam will provide a storage capacity of about 0.5 million m^3. At the end of the mining operations, the main dam will have reached its full design height to accommodate 2.0 million m^3 of tailings. The TMF is being designed for 1:100 year, 24 hour storm events, with an emergency spillway to accommodate larger storm flows. The emergency spillway would only be active after the diversion channel capacity is exceeded, along with the additional capacity to store flood water in the TMF. As such, it is very unlikely that the spillway will be used during the life of the mine.

Shoal Cove Pond is located within a natural valley allowing for the tailings to be contained by the surrounding hillsides. Making use of this natural depression will allow embankment (dam) sizes to stay relatively small. The proposed maximum crest height for the dam is 12 m, which would provide a capacity for 8 to 10 years of mine operation. The initial dam will be constructed with a crest height of 6 m (elevation 21 m above sea level [masl]). The dam will be constructed with 2 to 3 m lifts, as required, until the crest height is achieved.

The dam will consist of a till cored embankment with a downstream rock fill shell. When the dam is at its maximum size it will have a crest width of 8 m, with upstream and downstream slopes of 2H:1V, a minimum core thickness of 8 m; a crest elevation of 27.0 masl, a minimum base elevation of 15.2 m, a maximum embankment height of 11.8 m and a started crest elevation of 22.0 m. It is assumed that 1.5 m of peat will be removed as part of the dam foundation preparation. The polishing pond dam and saddle dyke will share a similar design concept with the main starter dam.

Under the Canadian Dam Safety Guidelines (CDA 2007), the main dam's hazard classification is "Significant". This takes into consideration the fact that the TMF is located in a relatively remote area with no major development, infrastructure, and with limited public access, indicating a low risk of third-party economic loss and the low potential for loss of life following the unlikely event of a dam failure.

The water in the tailings pond will be transferred via a central decant tower to the polishing pond. The central decant tower will be located in the approximate centre of the TMF basin and will be accessible via a decant causeway.

The polishing pond is located downstream (to the south) of the main TMF dam. Water will be discharged to the polishing pond prior to being released into the environment after applicable effluent discharge limits have been met, including the limit of 30 mg/L for suspended solids, as stipulated in the NL *Environmental Control Water and Sewage Regulations* (2003). The polishing pond will also collect seepage emerging to the surface under and through the main TMF dam located upstream, to the north.

An open channel system will divert storm water around the TMF and the majority of the storm flows from Clarkes Pond. Low flows from Clarkes Pond will be designed to maintain existing baseflow to support aquatic life in the stream. The Clarkes Pond storm flow diversion system will be constructed to reduce the flow through the TMF during storm events. The storm flow diversion system will consist of a concrete cutoff wall at the outlet of Clarkes Pond, a decant structure integrated into the cutoff wall, a surface channel adjacent to the access road, and an integral fish pass consisting of a concrete box with a single submerged inlet and outlet orifices, for creating hydraulic steps to slow down the flow and allow fish to move freely between the pond and the stream.

2.3.5 Construction of Access and Haul Roads

The Town of St. Lawrence is accessible from the provincial highway system along Route 220. Vehicle traffic accessing the Mine Site must pass through the town and enter the mine property from either the north or south access roadways. Access between the Mill and Mine site entrance will be along a combination of existing and new roads. For the purposes of the Project, it is assumed that the existing roadways will require upgrading such as grading, widening and ditching. Each road will be upgraded to meet the loading and dimensional requirements of the largest design vehicle expected to use the road. Approximately 10 km of new access roads and 7 km of Mine roads will be constructed (Table 2-1).

Table 2-1: Mine Roads

Road Type	Road Location	Construction Type	Classification	Design vehicle	Width (m)	Length (m)
Mine and Haul Roads	In-pit	new	Dual Lane Heavy Vehicle	Caterpillar (CAT) 773G	20	1300
	In-pit	new	Dual Lane Heavy Vehicle	CAT 740B Articulated Dump Truck (ADT)	16	500
	In-pit	new	Single Lane Heavy Vehicle	CAT 740B ADT	11	900
	Surface- Haul road pit exit to dumps and Mill	new	Dual Lane Heavy Vehicle	CAT 773G	20	4000
	Surface- Haul road upgrade existing road to Mill	upgraded	Dual Lane Heavy Vehicle	CAT 773G	20	890
Access Roads	Around the Open Pits	new	Dual Lane Light Vehicle	Light Vehicle	7.35	2000
	From Existing Mill Site to Marine Terminal	new	Dual Lane Light Vehicle	Road Truck	8.75	1000
	Road Around TMF	new	Dual Lane Light Vehicle	Road Truck	8.75	3000
	Bypass Past Director Mill and Tarefare Shortcut	new	Dual Lane Light Vehicle	Road Truck	8.75	2500
	Road to Explosives Warehouse	new	Dual Lane Light Vehicle	Light Vehicle	7.35	1000
	Road From Pit Exit to Dumps	new	Dual Lane Heavy Vehicle	CAT 773G	19.845	4000
	From AGS Site Mill to Existing Mill Site	upgraded	Dual Lane Light Vehicle	Road Truck	8.75	3500
	From Mine to AGS Mill	upgraded	Dual Lane Heavy Vehicle	CAT 773G	19.845	390

2.3.5.1 Main Access Road

There are two main access roads to the Mill and Mine site. Both are existing roadways and commence within the Town of St. Lawrence. Loadout facilities for the previous mining operations were located within the inner waters of St. Lawrence Harbour. This resulted in heavy truck traffic along the town roads, which created a safety concern. With a Marine Terminal proposed at Blue Beach and linked to the Mill by a road system dedicated for mine traffic, these safety concerns will be reduced.

Nevertheless, town roads will have to be used during the construction period to bring heavy equipment, construction materials, supplies, and manpower to the site.

Besides the new roads that are required in and around the Mill and Mine Site, a new road will be constructed to bypass the public road at the Director and Tarefare deposits for trucks hauling concentrate and aggregate to the new Marine Terminal. A new roadway will also be required to access the Marine Terminal at Blue Beach. Guide rails will be provided where fill, embankment, or side-slope heights exceed three metres and in the vicinity of waterbodies.

2.3.5.2 Port Access Road

The development of the Marine Terminal will be within a greenfield area of the Project site. A new access road will be constructed from the TMF site to the port to accommodate the trucks that will be used to transport the fluorspar filter-cake product.

2.3.5.3 Mine Roads

Approximately 7 km of Mine roads will be developed. Roads at the Mine Site include surface haul roads, site roads and in-pit haul roads.

Surface haul roads will be developed to fit 773G mine trucks and to allow for dual lane traffic with a width of 20 m. Haul roads will connect the pit exits with the waste dumps and the crusher at the Mill Site. A site perimeter road will run along the North edge of the pits for light vehicle traffic. The width and length of the various Mine roads is presented in Table 2-1.

The primary crusher feeding the Mill is located approximately 500m from the Mine open pits to shorten the distance the haul trucks need to travel with the ore. Access from the Mine Site to the Mill facility will be along a combination of existing roadways, which will be upgraded, and new Mine roads that will be built specifically for the Project. Upgrades to the existing roadways include ditching, grading, and widening to 20 m will be required on this road to accommodate the large ore haul trucks.

2.3.6 Power

Marystown is the largest town on the Burin Peninsula, with a population of 5,900. It is located approximately 45 km northeast of the Town of St. Lawrence. Electrical power for local operations and the Town of St. Lawrence is obtained from the Newfoundland Power electrical grid, and emergency power is provided by a diesel generator located in the nearby community of Burin. A Newfoundland Power substation is situated on the north side of the Project area. Newfoundland Power has confirmed sufficient power will be available to supply the AGS Project (~12.5 kV) during both construction and operation. Power requirements during the construction phase are estimated at 1,100 kilovolts (kV). The proposed transmission line will run from Newfoundland Power's existing substation in St. Lawrence to the Mill Site. A new substation and metering station will be constructed at the Mill Site to obtain the required voltage for the Mill.

2.3.7 Restoration of Temporary Works Areas

Restoration of temporary work areas will be undertaken during the construction phase to rehabilitate sites to a land use capability similar to that which existed prior to disturbance when the work in a given area has been completed.

Temporary facilities required for construction will be removed following completion of construction activities. Portable trailers for office space and for use by workers for dining and sanitation will be removed from service and relocated by contractors for reuse at other Project sites. Portable water supply equipment and portable sanitary toilets will also be removed and relocated to other project sites.

Temporary oil and fuel storage tanks will be decommissioned and relocated for use at other project sites. All product and vapours will be removed from the storage tanks, which will then be dismantled and removed from site by the supplier/contractor. Any contaminated material that may exist under or around the tanks will be excavated and removed for treatment and disposal. The site will then be returned to a condition that is compliant with regulatory requirements, such as the *Storage and Handling of Gasoline and Associated Products Regulations* under the provincial EPA.

All construction equipment will be demobilized and removed from the site by the respective contractors for storage or reuse on other projects.

2.3.8 Potential Sources of Pollutants

Well-established, approved construction methods and practices will be used throughout the construction phase. Before work commences, construction methodologies will be developed specific to the activities being undertaken. These will focus on avoiding or mitigating likely adverse environmental effects. An EPP will be developed and submitted for regulatory approval prior to the start of construction. This document will define roles and responsibilities of Project personnel and those of its contractors, provide methods to monitor compliance, and identify mitigation measures for various construction activities. During the construction period, all site personnel will be responsible to comply with the procedures and mitigation measures outlined in the EPP.

The potential sources of pollutants during the construction phase include noise, suspended solids, and dust, exhaust gases and greenhouse gases from heavy machinery, vehicles and blasting activities. The spill of chemicals, including petroleum products, represents potential sources of pollutants, as does the use of portable sanitary toilets.

2.4 Operation Activities

The operation phase is anticipated to last approximately 10 years based on the current resource estimate. Various activities associated with mining operations, ore processing and transportation are described below.

2.4.1 Mining

There are two phases planned for mine production: open pit and underground mining. A description of the activities during each of these phases is provided below.

2.4.1.1 Open Pit Mine Production

Mine production will start during the beginning of the first year of operation. Sufficient ore will be mined to accommodate an expected 120,000 tonnes of concentrate production during the first year of operation to accommodate a ramp up of the Mill. Commissioning of the Mill is expected to occur during the first 6 months of operation. During that period, 20,000 tonnes of concentrate will be produced. The remaining 100,000 tonnes of concentrate will be processed once the Mill is in full operation, which is forecasted to occur 6 months after start-up. The Mine will supply adequate ore to meet a production of 200,000 tonnes of concentrate throughout the Life of Mine (LOM). Effort was made to reduce the mining waste rock to lower the stripping ratio during the initial years of mine production to optimize the overall Net Present Value (NPV) of the Project.

Figure 2-10 shows the ore mining schedule for each of the four pits. Ore from the OCP is anticipated to be extracted by the end of 2017. By the end of the first year of operation, the CPS will be completely mined out and this will provide access for the underground portal and ramp development anticipated to commence in Year 2. Additional details of the mine schedule are shown on Figure 2-10, Figure 2-11 and Figure 2-12.

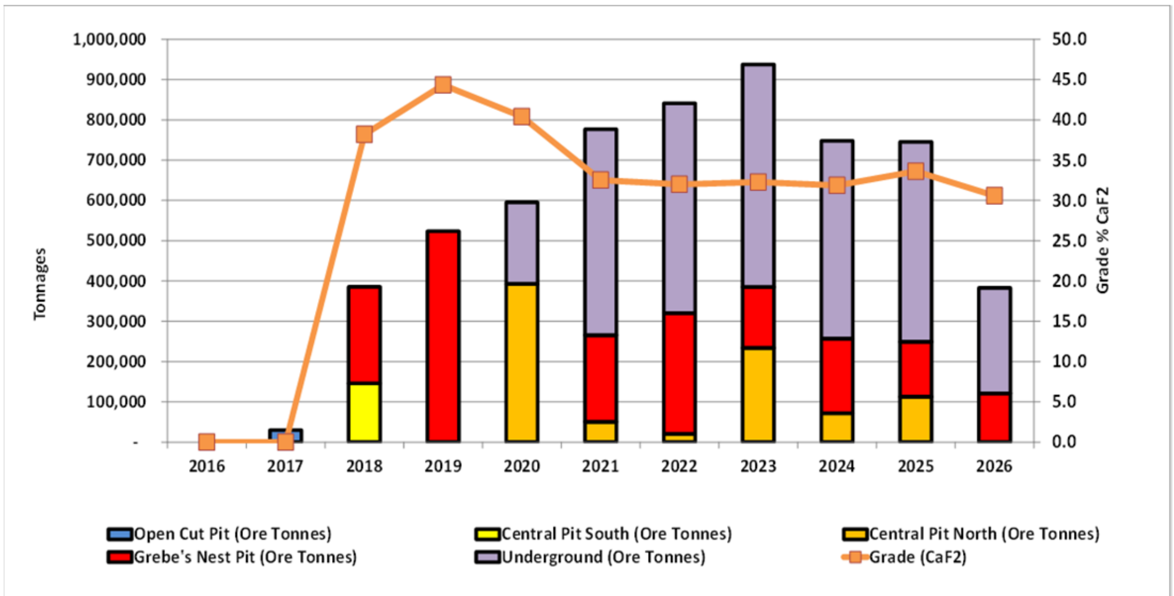


Figure 2-10: Ore Mining Schedule, Tonnages and Grade by Mining Method and by Pit

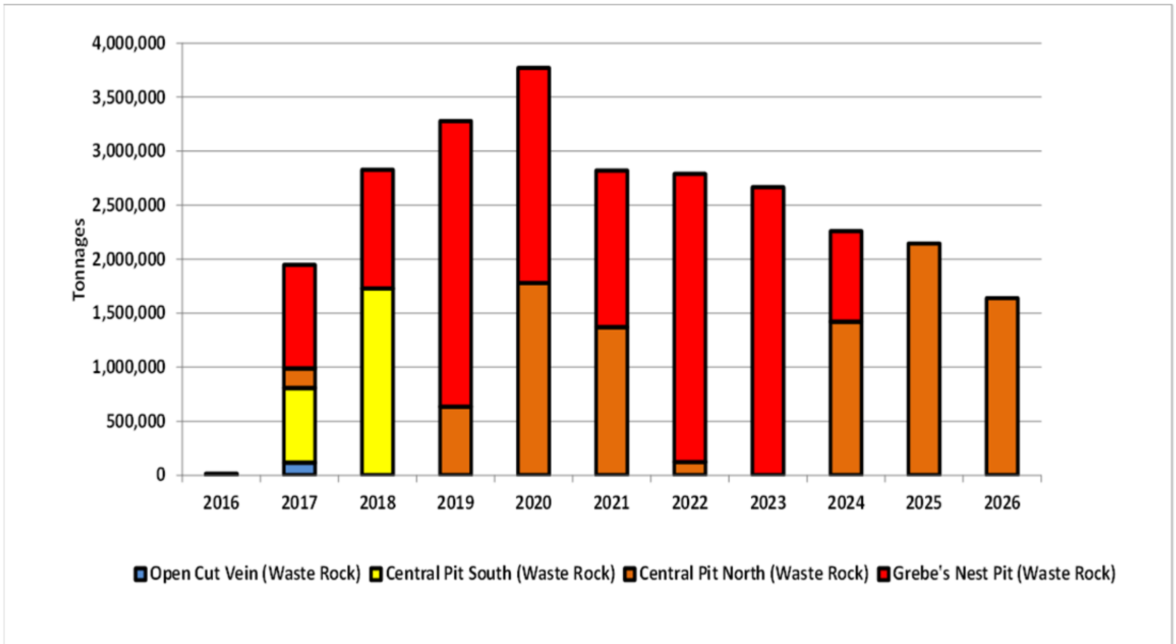


Figure 2-11: Waste Mining Schedule, Tonnages Mined by Pit

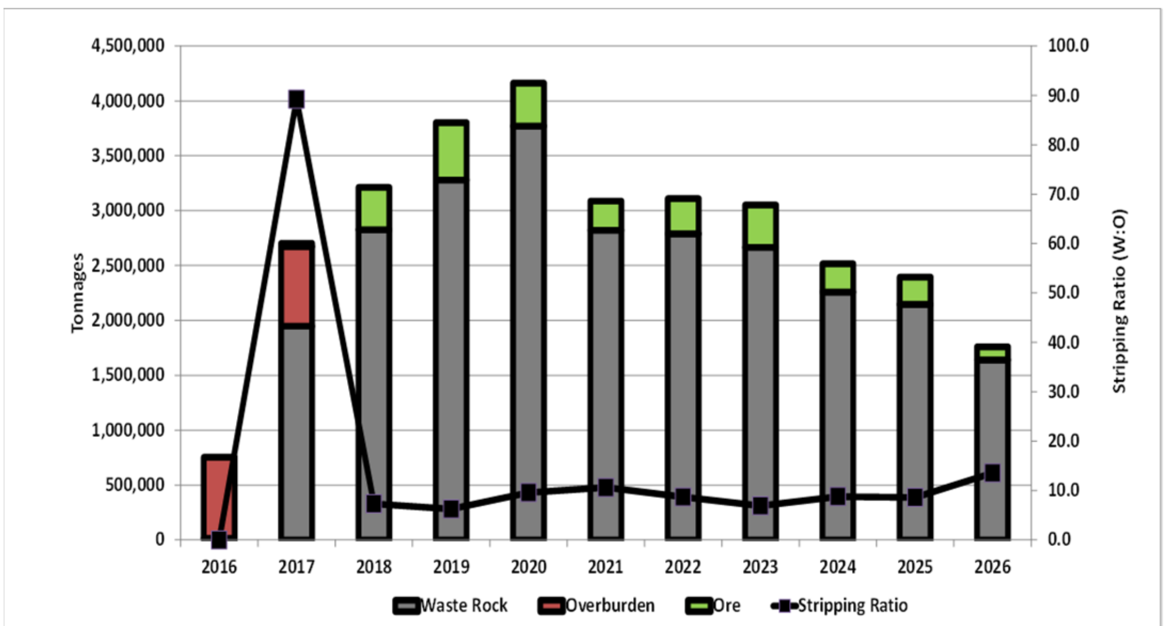


Figure 2-12: Overall Mining Schedule, Tonnages by Material Type and Stripping Ratio

2.4.1.2 Underground Mine Production

Underground Mine production is required to extract the ore that is deeper below ground surface and it would not be economical to use the open pit method to access deeper deposits. The proposed mining method that was proven most effective for the underground resource in the past is the Alimak Mining Method, which uses an

Alimak raise climber unit. This type of mining method reduces the requirement for access levels and requires a lower number of sub-levels. The Underground Mine will have four main underground production levels to access the ore (represented as blue lines on Figure 2-13). These levels will be accessed from the Main Ramp, which will be established at the bottom of CPS in Year 3 of operation.

Small quantities of ore will be extracted during development of the ore drifts; however the first stope mining is planned in Year 4 of operation. The extraction sequence of the stopes will be staggered to allow for backfilling and to provide increased ground stability. Dewatering sumps will be excavated and the pumping system installed prior to mining production commencing.

Production mining of the stopes is expected to last until 2023, based on the current resource estimate. At that point, the Crown Pillars will be extracted between the open pits and the underground workings. They will be drilled and blasted from either the surface or underground, dictated by ground stability.

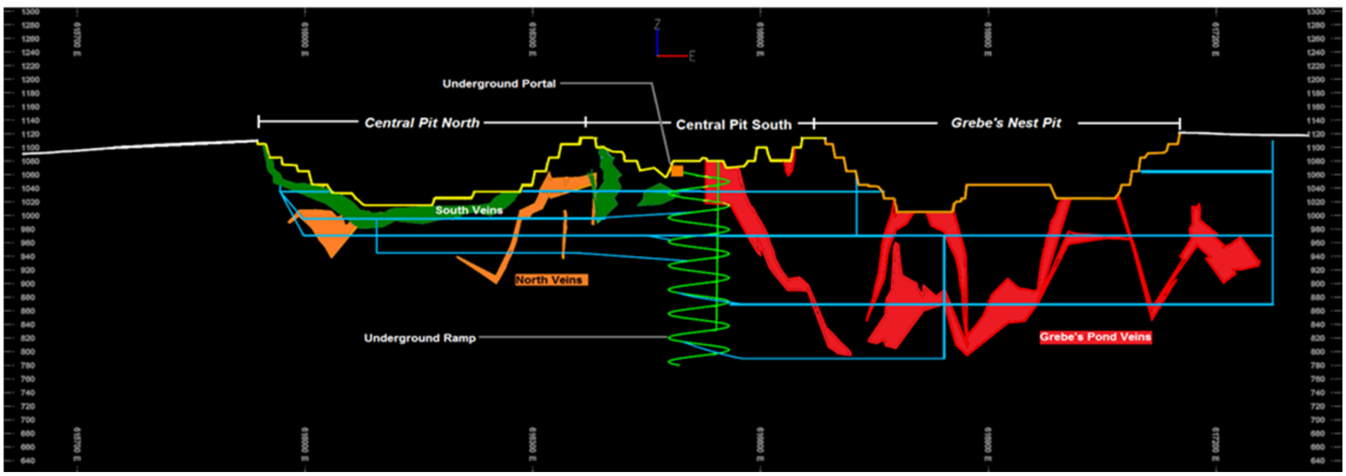


Figure 2-13: Underground Mine Overview

2.4.1.3 Production Schedule

The mine plan was scheduled primarily to accommodate the required annual concentrate production of 200,000 tonnes while respecting the crusher capacity of 750,000 tonnes Run-of-Mine (ROM) ore per year. As a result it was determined that the minimum required head grade will be 32% CaF_2. During the mine planning process, a minimum weight recovery of 26.7% (after application of mine recovery) was utilized to achieve the required constraints.

The average grade of the ore obtained from underground is lower than the required minimum head grade of the Mill. Therefore, a stockpiling strategy will be applied to accommodate ore blending between the open pit and underground to achieve the minimum head grade and to mine out the economic resource.

The stockpile will be utilized during the first year of operation where ore from the OCP mined during the last year of construction and ore extracted during Mill commissioning will be stored for blending. Throughout the operation phase, ore will be stockpiled separately for the open pits and the Underground Mine. The remaining stockpile of ore will be processed during the last year of operation, as shown on Figure 2-14.

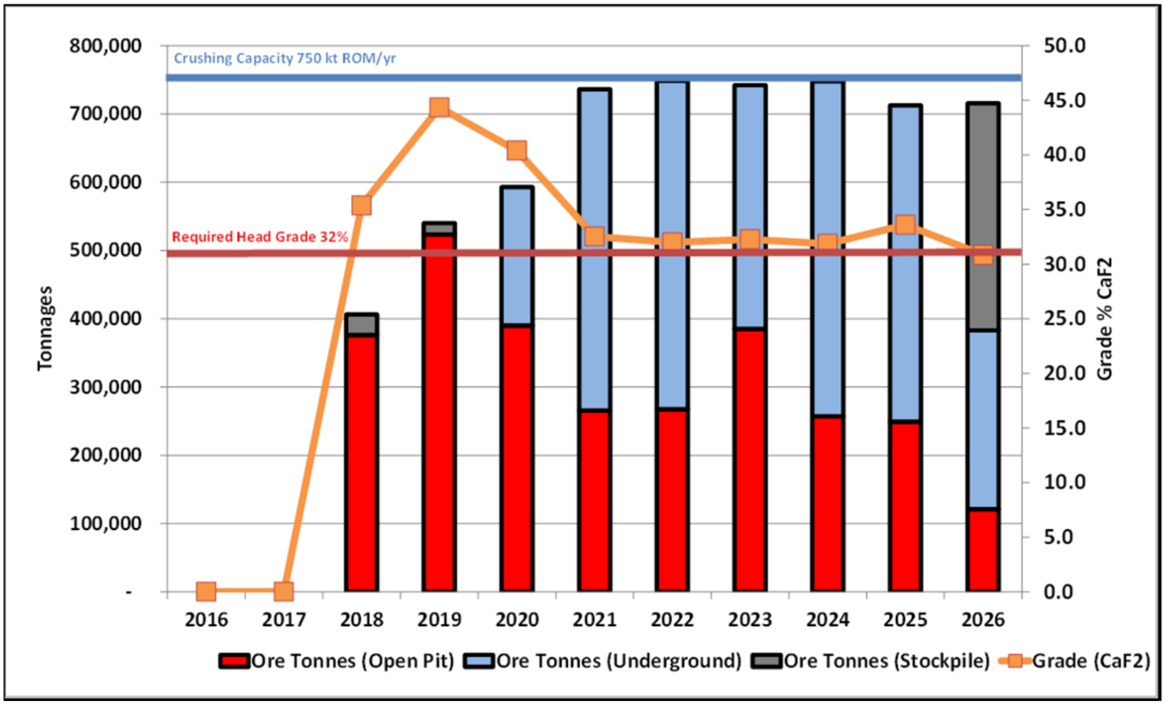


Figure 2-14: Ore Processing Schedule, Ore Tonnages and Grade to Mill

2.4.1.4 Waste Rock Dumps

Two waste rock dumps and one overburden dump are being proposed for the Project (Figure 2-15). The total capacity of the waste rock dumps is 13.1 million m^3 and the capacity of the overburden dump is 1 million m^3. As shown on Figure 2-15, one waste rock dump is located north to the CPS (North Dump) and will capture most of the waste rock mined during operation of GNP. The other waste dump is located to the south of Center Pit South (South Dump). The overburden dump is located west of the North Dump. All dump locations were determined to optimize haul distances to the dumps during the LOM. They were positioned strategically to avoid major surface water congregations or future mining expansion areas. A 25 m buffer was incorporated for all surface water aggregations or main haul roads.

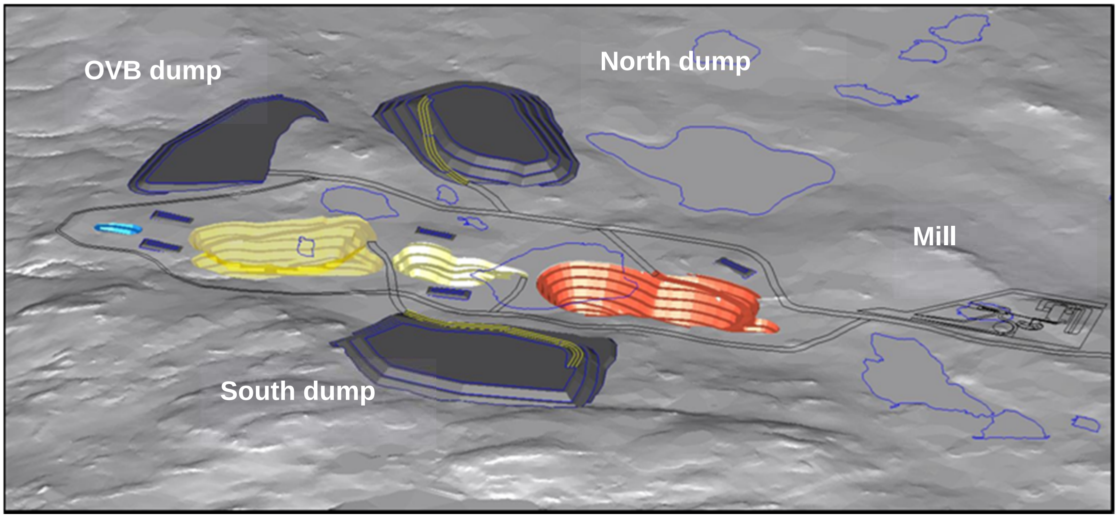


Figure 2-15: Dump Locations at AGS Mine Site

The design capacity, height and footprint area of each of the proposed dumps is provided in Table 2-2.

Table 2-2: Dump Capacity, Height and Footprint Area

Dump	Design Capacity (m^3)	Average Height (m)	Footprint Area (m^2)
North Dump	5,600,000	28.0	200,000
South Dump	7,500,000	29.4	255,000
Overburden Dump	1,000,000	6.5	153,000

Some of the waste rock and overburden will be used as a source for construction material for the TMF dams, Marine Terminal, and Mill. The suitability for that use will be confirmed through testing. If the material is deemed suitable, a mobile crusher will be used to process the rock to an appropriate size. Table 2-3 shows the estimates of waste volumes that will be used for construction purposes or for backfill of the underground mine.

Table 2-3: Materials Used for Construction Activities and Underground Backfill

Activity	Quantity (m^3)
Mill Construction (Waste Rock)	30,000
TMF Construction (Overburden)	58,000
TMF Construction (Waste Rock)	62,500
Marine Terminal Construction (Waste Rock)	258,456
Underground Backfill Void (Waste Rock)	410,000

An estimate of waste rock and overburden volumes from the open pit and underground mining operation is provided in Table 2-4, along with the destination of each type of waste material.

Table 2-4: Waste Volumes per Destination

	North Dump	South Dump	Overburden Dump	Topsoil Storage
Surface Waste (m^3)	**4,260,000**	**5,130,000**		
Overburden (m^3)			**810,000**	
Topsoil (m^3)				**60,000**
Underground Waste (m^3)		**214,750**		
Swell factor	35%	35%	20%	20%
Compaction factor	5%	5%	10%	10%
Dump Volume (m^3)	**5,460,000**	**6,850,000**	**870,000**	**60,000**
Dump Tonnage (t)	**11,590,000**	**14,540,000**	**2,200,000**	**160,000**

The dump capacity calculation considers that a part of the surface waste will be used as backfill material underground. Approximately 40% of the empty stope capacity is planned to be transported from within the mine or from surface, leaving the rest of the stopes empty. In the event that a lesser amount of waste backfill is required, there is capacity for this waste rock to be stored on the South and North Dumps.

2.4.2 Processing

The process flowsheet uses proven methods which are widely used in the fluorspar industry. The processing route will consist of primary, secondary and tertiary crushing, screening, fine ore storage, dense media pre-concentration, grinding and froth flotation followed by concentrate thickening, filtration and storage (Figure 2-16).

ROM ore will be dumped onto a stationary grizzly screen in which the screen undersize is conveyed by an apron feeder to a vibrating grizzly while the oversize feeds the jaw crusher. Discharge from the jaw crusher falls onto the same conveyor as the vibrating grizzly undersize and is transported to a double deck screen. The screen undersize is conveyed to a fine ore bin while the coarser oversize material from the top deck feeds a secondary cone crusher while the finer bottom deck material feeds a tertiary cone crusher. Product for the cone crushers are conveyed back to the double deck screen. Final product size is approximately 12.5 mm.

Material is conveyed from the fine ore bin to the dense media circuit where the ore is pre-screened at 0.5mm to remove fines. The coarser material enters the dense media separator which produces a float and sink product. The float product is collected as an intermediate by-product, aggregate, and stockpiled for future shipment. The sink product feeds a ball mill for further size reduction.

Figure 2-16: Ore Processing

The material in the ball mill is reduced to a product size of P_{80} of 100 microns with the aid of two stages of cycloning. This ensures that the finer product size is removed from the ball mill to minimize overgrinding of the ore. The pre-screened fines are added to the grinding circuit at the ball mill discharge sump and consequently fed to the hydrocyclones. The coarser hydrocyclone undersize product enters the ball mill for further size reduction. A baghouse dust system will be used to collect dust from various transfer points within the crushing circuit. Dust extracted from the baghouse dust system will be deposited onto the screen product conveyor.

Hydrocyclone overflow material from the second stage is sent to the sulphide/slime circuit to remove sulphide material. Recovered sulphide concentrate is discarded to the final tailings box while the tailings are sent to the fluorite flotation circuit. The fluorite flotation circuit consists of a series of flotation cells that produces a concentrate that follows another seven stages of cleaning. Tailings generated from the scavenger circuit and first cleaner cell are sent to the final tailings pump box for disposal to the TMF.

Slurry (tailings) consisting primarily of carbonate and silicate gangue minerals will be pumped to the TMF for disposal. Tailings from the process will be collected in a common tailings pump box for disposal to the TMF. The tailings are mixed with flocculent to help settling of fine particles. As the tailings are likely to be considered non-hazardous, based on preliminary geochemical analysis, clear solution will be discharged into the environment as effluent from the TMF. Effluent discharge quality will be monitored to meet regulatory requirements.

Final concentrate generated from the cleaning circuit is sent to a concentrate thickener for removal of water. The thickened underflow from this thickener is sent to drum filters operating in parallel to further reduce the water content in the concentrate to a moisture content of between 8 and 10%. This material, which contains 97% fluorspar, is conveyed to a concentrate storage building capable of holding 20,000 tonnes of final concentrate. Filtered acid-grade fluorspar concentrate is hauled by truck to the Marine Terminal, loaded onto an ocean vessel, and sent to market.

Total concentrator requirement for process water is estimated at 218 m^3/h with several potential sources of process water. No process water is reclaimed from the TMF because its quality would interfere with effective processing at the Mill. All process water is sent to the process water tank located near the concentrator.

A fire protection system will be provided throughout the plant site consisting of a separate water line supplied from an insulated plant water/firewater storage tank. The processing plant will be covered by a ring main system serving fire hose reels and will cover the entire area including mezzanines. Normally occupied locations, such as offices, will also have sprinkler coverage. Hose reels and portable fire extinguishers will be installed in accordance with the local building codes and regulations pertaining to fire protection.

The requirement for fresh water in the Mill is estimated at 2 m^3 per hour. Fresh water in-take pumps are used to supply the water taken from wells or surface ponds, which is in turn pumped into a fresh water tank located near the process plant. Fresh water will be used to feed the potable water treatment plant which will then distribute to various potable water users such as showers, eye wash stations and the boiler unit.

During the various stages of ore processing various reagents will be used, including dry reagents, liquid reagents and flocculant (Table 2-5). Reagent transport and preparation will be handled to meet health, safety and environment standards.

Table 2-5: Reagents Required During Ore Processing

Reagent	Type	Addition point	Approximate Quantity (grams per tonne [g/t] of flotation feed)
Soda Ash	Dry Reagent	Ball Mill inlet	200
Copper Sulphate	Dry Reagent	Ball Mill outlet	10
Xanthate	Dry Reagent	Ball Mill outlet	50
Methyl Isobutyl Carbinol (MIBC)	Liquid Reagent	Sulphide Rougher Feed Box	10
Soda Ash	Dry Reagent	Conditioner #1	90
Quebracho	Dry Reagent	Conditioner #2	100
Caustic Dextrin	Dry Reagent	Conditioner #2	150
Sodium Silicate	Liquid Reagent	Conditioner #2	25
Emulsified Collector	Liquid Reagent	Conditioner #3	350
Soda Ash	Dry Reagent	Conditioner #3 outlet	150
Quebracho	Dry Reagent	Head Cleaner #1	100
Caustic Dextrin	Dry Reagent	Head Cleaner #1	150
Flocculant	Flocculant	Tailings Discharge Line	10-15 ppm

2.4.3 Water Management

CFI will protect the environment by addressing waste management and water management at all phases of the Project. To prevent harm to the environment, a detailed EPP will be developed and implemented. All employees will be trained to prevent environmental harm during work activities. The Project will also be designed and prepared to respond to environmental emergencies. Environmental monitoring will be concurrent with Project activities to foster continuous environmental consciousness, protection and control.

A Rehabilitation and Closure Plan will be developed in anticipation of Project decommissioning and abandonment after operation. The Plan will aim to restore the Project site to support a comparable land use capability to what existed prior to the Project.

2.4.3.1 Site Drainage

Surface water throughout the Project area currently drains overland into a system of man-made and natural drainage channels and ponds, primarily within the Shoal Cove, Salt Cove and Grebes Nest watersheds, which are 4.1 km^2, 24.7 km^2 and 5.5 km^2 in area, respectively.

Alteration of natural drainage patterns during the Project life is possible. A Site Grading and Drainage Plan, to be developed during the design phase, will be implemented during construction and operation. The plan will be designed to maintain natural drainage patterns where feasible.

A stormwater management system will be designed to ensure that clean runoff is diverted around Project facilities to minimize potential adverse effects of Project activities on water resources. Runoff water from the Project site will be intercepted, collected and treated in a manner appropriate to the potential contaminants and sediment loadings, prior to discharge back into the environment.

Where mining activities and facilities are located, there will be a system of perimeter cut-off ditches to intercept and divert runoff so that potential adverse effects on surface water resources can be minimized or eliminated. Interceptor ditches near the waste rock dumps will carry water to settling ponds, where suspended solids will be allowed to settle-out naturally from the water column, ensuring that only clear water discharges into the receiving environment. A buffer of at least 25 m will be maintained between all natural waterbodies and waste rock dumps to control sedimentation of these waterbodies.

At various facilities, roof drainage will discharge onto the ground via splash pads or directly from eaves. Runoff from the site will be conveyed to main outlets through a combination of subsurface drainage and roadside ditches, and stored in the stormwater capture ponds for possible treatment prior to discharge to the environment.

2.4.3.2 Dewatering

Mine dewatering and Mine water discharge will be undertaken in accordance with approved practices and with the objective of avoiding and reducing likely adverse effects on nearby surface waterbodies. Mine water discharge will be treated in settling ponds prior to discharge to prevent siltation of natural waterbodies.

Open pit dewatering will be described in the Water Management Plan. Generally, runoff from the pit walls, benches, pit bottom, and groundwater seepage through open fractures and faults will be collected in a sump in the bottom of the open pit. Collected water will be pumped to the surface settling pond, prior to discharge into a natural water body. Monitoring of water prior to discharge will be implemented to meet all regulatory requirements.

Water pumped from the underground mine will come from a series of sump/pump stations established on the lower levels. Water from individual levels will be collected in main drainage ditches, which transfer the water to the main sump. Additionally drain holes will connect the levels to aid in dewatering the ore body before stoping begins.

All water from underground workings will be pumped straight up to the tank or sump located at the bottom of the open pit for settling and then pumped to a surface sedimentation basin to allow further settling of suspended solids. Based on preliminary engineering design, it is anticipated that two main pumps will be required, with another pump to be used as a backup during maintenance and emergency use during any increased inflow.

2.4.3.3 Water Supply

The Mill will be supplied with domestic water from a pond located near the Mill Site. This water will not be used for drinking purposes but will be treated for use in showers, water closets and lavatories. The drinking water requirements at the Mill, Mine, and Marine Terminal will likely be served by bottled water brought on site. At this stage in the Project's conceptual development, the firewater supply has not been identified.

A number of water supply sources are currently being considered, such as Long Pond, Upper Island Pond, AGS Pit Dewatering, and groundwater from shafts of the former Tarefare and Director underground mines. All process water will be directed to the process water tank located near the concentrator. As engineering advances through the Feasibility Study, further hydrological and hydrogeological assessments are planned to evaluate potential water sources for the Project. These studies will evaluate water quality to ensure it is acceptable for mill processes, as well as the possible environmental effects of water withdrawal from these sources.

2.4.4 Tailings Management Facility

A 6 m high starter dam will be constructed to contain the tailings pond. This will be able to retain approximately 0.7 million tonnes of tailings over the first 2.5 years of operation. The starter dam will be designed such that it can be raised to accommodate further tailings disposal, as required. After several dam raises completed in 2 to 3 m lifts, the facility will eventually store 2.8 million tonnes of tailings after approximately eight to ten years of production. The final dam will have an embankment height of 12 m.

Water management systems will be developed to accommodate and control runoff as part of the construction/access road system around the perimeter of the TMF. The TMF is designed to accommodate 1 in 100 year, 24 hour storm events. Flows exceeding this would be conveyed through an emergency spillway designed in accordance with the Canadian Dam Safety Guidelines (CDA 2007).

The TMF will receive tailings from the Mill by slurry pipeline. Flocculent will be added to the tailings stream to promote settling of solids. The polishing pond is located downstream of the main TMF embankment (to the south). Water will be discharged to the polishing pond prior to being released to the environment, Shoal Cove Pond Brook, after the applicable effluent discharge limits have been met, including the limit of 30 mg/L of suspended sediments. The polishing pond will also collect seepage emerging to the surface under and through the main TMF embankment located upstream (north). The tailings will be discharged at the south end of the TMF along the Main Embankment.

Settling of suspended solids will be accelerated through the use of flocculants, as required, to meet regulatory limits of the effluent. The tailings dam will be founded on competent glacial till and/or bedrock. Materials used for construction of the dam and spillway will include non-acid generating waste rock, glacial till from a borrow pit in the TMF area, and sand and gravel manufactured from crushed waste rock.

The TMF will be designed such that most runoff from the watershed surrounding the TMF will be intercepted and diverted around the facility. Interception ditches will be excavated in bedrock or glacial till lined with rock to mitigate erosion. These interceptor ditches will be constructed on the upslope side of the access roads.

Surface runoff in approximately 85% of Clarkes Pond watershed outside of the perimeter access roads will be intercepted and diverted around the TMF. In addition, storm flows originating in Clarkes Pond will be conveyed along with a diversion channel and discharged to Shoal Cove Pond Brook downstream of the TMF.

On the east side of the TMF it is not technically feasible to intercept the flows in the area bordering the northeast quadrant of the TMF (approximately 31 ha in area) due to the watershed’s unfavorable topography. Excessive deep ditching would be needed to achieve meaningful diversion, while maintaining a minimum gradient of 1% for effective drainage.

On the southeastern side of the TMF an interceptor channel will pick up flows from the brooks which currently flow from the eastern drainage areas into Shoal Cove Pond. The Saddle Dyke will prevent flows from entering the TMF and the diverted flows on the eastern side will be discharged into the polishing pond, prior to discharge to Shoal Cove Pond Brook.

Stability analyses were conducted for the main embankment at full design capacity.The results of the analyses indicated that no significant embankment deformations are expected to occur during earthquake or seismic events for a "significant" classed dam, and that the embankment is not dependent on tailings strength to maintain overall stability and integrity.

2.4.5 Waste Rock Disposal Areas

Waste rock generated during the Project will be stored in the waste rock disposal areas located to the northeast and southwest of the AGS mine site. Some of the waste rock will be used during construction to develop access roads and other infrastructure around the Project area. During operation, some waste rock will likely be placed into excavated stopes to minimize both material transfer to surface and the size of the waste rock dumps. It is anticipated that waste rock will also be used to build the tailings and polishing pond dams. Waste rock from underground development will be loaded into dump trucks and trammed either to the surface via the haulage drifts and ramp, or trammed and tipped into a completed stope.

A geochemistry program is ongoing to characterize the potential for acid rock drainage and metal leaching, which includes testing of waste rock samples. Only non-acid generating waste rock will be reused on the surface. If waste rock is identified as having the potential for acid generation or metal leaching, a waste rock management program will be developed to handle, store, and appropriately dispose of the material.

2.4.6 Power

Power to the Mill will be supplied by a proposed transmission line (to be built by Newfoundland Power), which will be connected to the existing grid. A substation will supply power from the main line to supply electrical power to the entire Mine Site, for both the open pit and underground mine operations. Total operating power for the Mill has been estimated to be 4.3 megawatts (MW) and operating power at the Mine is estimated to 1.2 MW.

At the Mill Site, a new substation and metering station will be constructed, where the distribution voltage will be stepped down to the required level of utilization for Mill equipment and operation. The power grid will supply 120 kV. This will be stepped down to 12.5 kV for primary redistribution within the process plant.

The following distributed voltage level shall be used throughout the process plant:

- Primary distribution level
  - 12.5 kV, 3 phase, 60 hertz (Hz) (resistance grounded)
  - 5.0 kV, 3 phase, 60 Hz (resistance grounded)
- Secondary distribution level
  - 600 volts (V), 3 phase, 60 Hz (solidly grounded)
- Control level
  - 120 V, 1 phase, 60 Hz

The new distribution system will be built to Canadian Standards Association (CSA) and Newfoundland Power standards consisting of overhead aluminium conductors on wooden poles. The conductors will be sized for the power required with contingency for future growth. Wind and ice loading conditions incorporated in the design will be based on geographic and climate criteria and relevant Codes and Standards (B. Keating 2015, pers.

comm.). The new overhead distribution lines will likely run adjacent to site roads to minimize tree clearing and facilitate line installation and maintenance. Provision will be made for the attachment of communication lines.

Electrical supplies at other locations will be required for site facilities, such as the Marine Terminal and new pump house. There is an existing distribution line in close proximity to the pump house. At this location a new service and metering station will be installed. A short span of new distribution line as a branch off the adjacent grid will be required for the Marine Terminal, a new service and metering station will be installed at this location as well. Other Project infrastructure may require additional electrical services at different locations pending site design and development.

The preliminary electrical load list has indicated the requirement for emergency power for critical equipment in the Mill, such as heat trace, water and tailings pumps. Emergency power is also required for communications/controls and life safety systems. In the event of power failure, emergency power will be supplied by diesel generator(s) and will require a total operating load of approximately 270 kilowatts (kW). The generators will be tied-in to the system via automatic transfer switches, a suitable switching method will be chosen as per Newfoundland Power requirements. Generator sizing and fuel tank capacity will be determined during detailed Project design. Only essential equipment will be connected to the emergency power supply. This includes process water pumps, tailings pumps, gland seal pumps, thickener underflow pumps, thickener drive mechanisms, conditioning tank agitators, and lighting.

It is anticipated that power factor correction equipment would be required for the Mill to meet Newfoundland Power requirements as well as to reduce energy costs.

2.4.7 Transportation

The Project will require transportation of goods, materials, products, and personnel by road and marine vessels during all Project phases. CFI commits to developing and implementing a Traffic Management Plan that will restrict public road access to areas used by the mining operation. The Traffic Management Plan will identify safe corridors for public access to recreational areas, such as Shoal Cove Beach, Chambers Cove, and the trail to Chapeau Rouge. Restricted access to some existing and newly built roads will consist of security gates and other features to prevent unauthorized entry. This will provide a measure of control intended to protect the general public while maintaining efficient flow of mine traffic.

Road traffic will include commuters, internal traffic, and the delivery of materials and supplies. Given the nature of the operation, site workers, contractors and visitors will create moderate vehicle traffic into the site and within the Project area. Internal traffic will include haul trucks and load haul dump (LHD) trucks that haul ore from the Mine Site to the Mill. In addition, small trucks and rubber-tired machinery such as forklifts will be used at the Mill. Underground operations will be supported by dedicated vehicles that will work and could be serviced underground.

Materials delivered to the site and waste shipments from the site will be transported by various types of trucks operating on municipal roads and the provincial highway system. The Transportation of Dangerous Goods will carried out by properly trained individuals who will follow all related regulations and CFI policies.

During operation, fluorspar concentrate will be shipped from the proposed Marine Terminal. This will result in bi-weekly traffic of marine vessels ranging in size from 10,000 to 65,000 DWT. In addition to shipping fluorspar concentrate, CFI is exploring the export of construction aggregate, which would be generated at the Mill as a DMS floats by-product at a rate of 200,000 tonnes per year.

2.4.8 Marine Terminal

Ship loading at the Marine Terminal will be through a covered conveyor with a loading rate of 500 tonnes per hour. A feeder will feed the mobile ship loader continuously without the need for an intermediate storage area. Fluorspar concentrate will be delivered from the storage facilities at the Mill Site to the feeder system via direct dumping from trucks.

2.4.9 Potential Sources of Pollutants

An EPP will be developed for the construction and operation phases. This document will define the roles and responsibilities of site personnel, provide methods to monitor compliance, and identify mitigation measures for various operation activities. All CFI employees and those of its contractors will be responsible for complying with the provisions of the EPP.

During the operation phase, potential adverse effects may arise from excessive noise, suspended solids in water, dust, exhaust emissions and greenhouse gases from heavy machinery, vehicles and blasting activities. Accidental releases of chemicals, including petroleum products, may also occur. The EPP will identify appropriate mitigation measures to avoid or reduce adverse effects on the environment.

2.5 Rehabilitation and Closure

Once the operation phase of the mine has ended, the facilities will be properly closed and rehabilitative measures will be taken to ensure that the site and surrounding areas are returned to an environmentally appropriate condition. This section outlines the basic elements of the proposed Rehabilitation and Closure Plan, which is designed to restore, to an acceptable state, the biological, chemical and physical quality of the environment that may have been affected by the Project.

2.5.1 Progressive Rehabilitation

In keeping with its Environmental Health and Safety Policy, CFI is committed to progressive rehabilitation during the operation phase. Progressive rehabilitation will form an integral part of the operating plan and will be implemented progressively over the life of the Project. Rehabilitation planning will begin prior to construction when considerations such as delineating and limiting the area of disturbance are incorporated into construction planning. Progressive rehabilitation will be implemented as components or phases of the Project have concluded. For example, at any phase of the Project, disturbed areas no longer required will be reclaimed and revegetated. Closure and reclamation of borrow pits and quarries will be done progressively. Finally, after a few lifts on the dumps are completed and when it is safe to proceed, vegetation of the waste rock benches will be carried out.

2.5.2 Decommissioning and Mine Closure

A Rehabilitation and Closure Plan will be prepared and submitted to the Government of NL under the *Newfoundland and Labrador Mining Act*. The plan will meet regulatory requirements for rehabilitation, and will include closure and rehabilitation of the infrastructure at the Mine Site, Mill Site, TMF, Marine Terminal and quarries and borrow sources. The rehabilitative measures have generally been developed at a conceptual level for the purpose of the prefeasibility study and this EA Registration. The closure plan will evolve through subsequent Project phases, becoming more detailed as the environmental monitoring database is built-up, enabling refinement of the technical basis for the closure design.

Decommissioning, closure and rehabilitation work is anticipated to take up to two years followed by post-closure monitoring activities. The exact length of the monitoring period will be determined at decommissioning and following an assessment of the site, in consultation with the appropriate regulatory authorities.

Rehabilitation and Closure Plans are part of CFI's Environmental Health and Safety Management System (EHSMS). CFI views the development and implementation of its EHSMS from a life-of-Project perspective, to be revised and updated regularly and on an as-needed basis as the Project moves through the various phases. EHSMS development and implementation is consistent with CFI's commitment to continuous improvement, pollution prevention and stakeholder consultation. This will be accompanied by regular document review, revision and update.

Specific objectives of the Rehabilitation and Closure Plan are:

- Restoration of disturbed slopes to a stable and safe condition, which will protect public health and safety;
- Reduction or elimination of potential adverse environmental effects associated with each phase of the Project;
- Re-establishment of conditions that permit a comparable land use of the Project area, to that which existed prior to the Project; and
- Reduction of the need for long-term monitoring and maintenance by establishing, as quickly as practical, effective physical and chemical stability of disturbed areas, including revegetation.

The decommissioning principles that will guide the overall development and implementation of these objectives include:

- Establishing adequate background information to determine the extent and type of adverse effects resulting from the Project, if present;
- Developing effective strategies and techniques for conducting reclamation; and
- Conducting audits of procedures and documentation of results to satisfy regulatory and corporate requirements.

The Rehabilitation and Closure Plan will be subject to a general review annually and a detailed review every five years. The annual review will be conducted by the facility's next level of management. Revisions will be made based on the results of these reviews.

Upon decommissioning or rehabilitating a site or facility, a final report containing conclusions of the post-reclamation site assessment will be prepared and distributed for review and approval to facility management, corporate legal and corporate Environment Health and Safety departments. CFI will plan and implement reclamation and rehabilitation activities in compliance with all applicable legislation. Provincial and federal statutes and regulations that will guide rehabilitation practices include:

- *Mining Act;*
- *Canadian Environmental Protection Act;*
- *Environmental Control Water and Sewage Regulations;*

- *Waste Management Regulations;*
- NL *Environmental Protection Act;*
- *Quarry Materials Act;*
- *The Occupational Health and Safety Act;*
- *Water Protection Act;*
- *Migratory Birds Convention Act;*
- *Fisheries Act;*
- *Lands Act;*
- *Forestry Act;* and
- *Navigation Protection Act*.

Closure and rehabilitation of the Project will include:

- Closure and rehabilitation of the four open pits including construction of safety berms, revegetation of the crest rim, flooding and water management structures;
- Closure of the underground mine, including cleaning of non-salvageable equipment, removal of salvageable equipment, flooding, backfilling of the ramp portal and capping of air rises;
- Closure and rehabilitation of the waste rock piles, including grading horizontal surfaces for drainage, overburden application and revegetation;
- Closure and rehabilitation of the tailings management facility and Clarkes Pond storm flow diversion system, including establishment of a permanent pond, construction of a spillway, revegetation of the tailings beach, breach of the polishing pond dam, revegetation of the polishing pond floor, and restoration of Clarkes Pond flow to Clarkes Pond Brook;
- Dismantling of all buildings, including the Marine Terminal and concrete foundation levelling to 1 m below the final seabed;
- Rehabilitation of new roads, including culvert removal and revegetation;
- Rehabilitation of surface water management infrastructure, including revegetation of settling ponds and ditches;
- Removal of aboveground pipelines;
- Removal and appropriate disposal of all hazardous material, chemicals and fuel;
- Removal and appropriate disposal of all non-hazardous demolition debris;
- Environmental site assessment and implementation of appropriate remediation measures to address contaminated areas identified;
- Closure and reclamation of borrow pits and quarries; and

- Post-closure monitoring.

2.5.2.1 Tailings Management Facility

The closure objectives for the TMF have been developed as part of the prefeasibility study and include the following:

- Permanent and secure containment of all solid waste material within the engineered impoundment;
- Limit the dust generation from the TMF footprint to comply with the environmental regulated levels;
- Reclamation of the facility with a vegetated surface around the perimeter of the facility and establishment of a permanent pond within the vegetated rim; and
- Reclamation of the polishing pond.

The main embankment is expected to require modifications at the time of closure in order to obtain the desired strength and to ensure compliance with the closure objectives outlined in the Technical Bulletin, Mining Dams: Application of 2007 Dam Safety Guidelines Draft September 2013 (CDA 2013). The main embankment will be considered closed after it has demonstrated performance consistent with a steady state condition, experience has been gained with the structure, and the main embankment has been monitored (i.e., crest settlement, slope deformations, groundwater and peizometric levels) to establish that no further intervention is required. In addition, water treatment should not be required and no interventions should be required to manage the water level in the TMF.

The permanent pond and perimeter vegetated surface are expected to remain in a self-sustaining state and not require operating personnel on site or regular surveillance. A spillway will be left in place to passively release water from the system to the environment. The exterior surface of the main embankment will be covered with coarse, durable rock to reduce the potential for erosion.

The maximum water level in the TMF will be controlled by setting the sill elevation of the spillway below the crest elevation of the main embankment to provide sufficient freeboard for the spillway to safely convey the probable maximum flood. A layer of soil (till) will be spread over the exposed tailings and a vegetated cover would be established. The majority of the spillway alignment would be located on or close to bedrock to minimize erosion.

Full flow is expected to be restored from Clarkes Pond to Clarkes Pond Brook, allowing natural flows from this watercourse into the TMF. The polishing pond dyke is expected to be breached with a drainage channel to drain seepage from the main embankment toe through a drainage channel. Runoff also will be directed to the lower portion of the Shoal Cove Pond Brook stream. Any sediment deposits within the polishing pond will be allowed to dry and will be followed by grading and revegetation.

2.5.3 Post-Closure Monitoring

Post-closure monitoring activities will be conducted to determine the effectiveness of decommissioning. Post-closure monitoring activities will include surface and groundwater quality monitoring with testing of standard water quality parameters and metals, treatment of water until quality reaches applicable standards (estimated 2 years), biophysical monitoring, and stability monitoring on open pits and the tailings dam.

The cessation of operation of the mine will bring a change to the workers, their families, and the residents and businesses in nearby local communities. To help those facing change, CFI will work with employees in advance of Closure to identify other employment opportunities.

2.6 Occupations

CFI is committed to maximizing local benefits and hiring locally or provincially as much as possible. The Project's construction and operation phases will generate employment and associated socio-economic benefits. The following sections present an overview of the estimated labour force requirements during the construction and operation phases. CFI is committed to local employment, to maximizing local benefits, both through direct employment, training and by giving assistance and preference to local suppliers.

2.6.1 Construction Employment

The construction of the Project will result in a peak employment of approximately 340 workers during the construction period. In the fourth quarter of 2015, it is estimated that 138 workers will be on site as construction ramps up. In 2016, there will be 336 workers and the employment peak is expected to occur in 2017. Table 2-6 provides an estimated average number of construction workers by type of occupation for each year of the construction phase. The construction workforce will include a wide range of occupations which are anticipated to be full-time in nature. Human resource planning for the construction phase is in progress and consideration will be given to the development and implementation of employment equity, apprenticeship and training, and entry requirement strategies. It is reasonable to assume that a large number of individuals in the general Project area will also benefit from indirect employment.

Table 2-6: Estimated Occupational Requirements for the Construction

Position (NOC Code)	2015	2016	2017
	Yr 1	Yr 2	Yr 3
Pipefitter (7252)	1	6	6
Millwright (7311)	1	8	8
Sheet Metal Workers (7261)	2	8	8
Construction Management (0711)	4	6	6
Scheduler (1473)	1	1	1
Construction Trades Helpers and Labourer (7611)	16	30	30
Electrician (7242)	2	4	4
Equipment Operators (7421)	24	24	24
Pipe Welder (7265)	0	6	6
Roofers (7291)	0	4	2
Insulator (7293)	0	0	2
Painter (Industrial) (9496)	0	2	4
Carpenter (7271)	4	8	12
Surveyors (2154)	2	2	2
Plumbers (7251)	0	4	4
Ironworker (7264)	0	12	12

Position (NOC Code)	2015	2016	2017
Welder- Structural (7265)	0	6	6
Concrete Finisher (7282)	0	4	4
Drywall Installers (7284)	0	0	4
Heavy Duty Equipment Mechanics (7312)	6	6	6
Crane Operators (7371)	4	4	4
Drillers & Blasters (7372)	6	6	6
Commercial Divers (7382)	4	4	4
Truck Drivers (7411)	12	12	12
Electrical Power Line and Cable Workers (7244)	4	4	1
Telecommunications Line and Cable Workers (7245)	4	4	1
Other Trades and Related Occupations (7383)	4	12	12
Construction Inspectors (2264)	2	4	4
Engineering Inspectors (2262)	2	4	4
Construction Supervisors – Electrical (7212)	1	2	2
Construction Supervisors – Pipefitters (7213)	1	2	2
Construction Supervisors – Metal Workers (7214)	1	2	2
Construction Supervisors – Carpentry (7215)	1	2	2
Construction Supervisors – Mechanic (7216)	1	2	2
Construction Supervisors – Heavy Construction (7217)	1	2	2
Construction Supervisors – Other Trades (7219)	2	4	4
Mining Personnel for Pit Development (8231/8411)	25	125	125
Total	**138**	**336**	**340**

2.6.2 Operation Employment

Employment during the 10 year operation phase will result in the creation of 164 full-time positions. In the first year of operation, the number of employees is expected to be lower since underground mine development will not be started. However, the employment numbers are expected to reach 164 in the second year of operation and this number of employees will be maintained throughout operation. These positions are anticipated to be direct employees of CFI that will likely work full-time on the Project, although some positions might be hourly while others will be salaried. Table 2-7 provides an estimated average number of construction workers by type of occupation during each year of the operation phase. Human resource planning for operations will occur and consideration will be given to the development and implementation of employment equity, apprenticeship and training, and entry requirement strategies. The Project will result in additional benefits in the area, and the direct-to-indirect labour ratio associated with this Project is estimated to be 1:3.

Table 2-7: Estimated Occupational Requirements for the Operation Phase

Position (NOC Code)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
	Yr 1	Yr 2	Yr 3	Yr 4	Yr 5	Yr 6	Yr 7	Yr 8	Yr 9	Yr 10
Mill Workforce										
Mill Manager (8221)	1	1	1	1	1	1	1	1	1	1
Senior Metalurgist (9211)	1	1	1	1	1	1	1	1	1	1
DMS Operator/Grinding Operator (9411)	4	4	4	4	4	4	4	4	4	4
Day Crew Dewatering Equipment Operator (9411)	2	2	2	2	2	2	2	2	2	2
Flotation Operator (9411)	4	4	4	4	4	4	4	4	4	4
Shift Laboratory Technician (2212)	2	2	2	2	2	2	2	2	2	2
Laboratory Supervisor (2212)	1	1	1	1	1	1	1	1	1	1
Laboratory Technician (2212)	2	2	2	2	2	2	2	2	2	2
Crushing Operator (9411)	2	2	2	2	2	2	2	2	2	2
Loader Operator (7421)	2	2	2	2	2	2	2	2	2	2
Reagent Operator (9411)	2	2	2	2	2	2	2	2	2	2
Operations General Foreman (2212)	1	1	1	1	1	1	1	1	1	1
Maintenance Planner (2212)	1	1	1	1	1	1	1	1	1	1
Maintenance Foreperson (0721)	1	1	1	1	1	1	1	1	1	1
Instrumentation Tech (7242)	2	2	2	2	2	2	2	2	2	2
Maintenance Fitter Mechanic (0721)	6	6	6	6	6	6	6	6	6	6
Electrician (7242)	2	2	2	2	2	2	2	2	2	2
TOTAL MILL	**36**	**36**	**36**	**36**	**36**	**36**	**36**	**36**	**36**	**36**
Mine Workforce										
Mine Superintendent (0811)	1	1	1	1	1	1	1	1	1	1
Mine Foreman (8221)	1	1	1	1	1	1	1	1	1	1

Position (NOC Code)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Open Pit Shift Foreman (8221)	1	1	1	1	1	1	1	1	1	1
Underground Shift Foreman (8221)	0	1	1	1	1	1	1	1	1	1
Underground Mine Captain (8221)	0	1	1	1	1	1	1	1	1	1
Dispatcher (1525)	1	1	1	1	1	1	1	1	1	1
Mine Clerk/Secretary (1523/1241)	1	1	1	1	1	1	1	1	1	1
Surveyor (2154)	1	1	1	1	1	1	1	1	1	1
Geologist (2113)	2	2	2	2	2	2	2	2	2	2
Mine Technician (2212)	1	1	1	1	1	1	1	1	1	1
Maintenance Superintendent (0714)	1	1	1	1	1	1	1	1	1	1
Maintenance Planner (0714)	1	1	1	1	1	1	1	1	1	1
Engineer Open Pit (2143)	3	3	3	3	3	3	3	3	3	3
Engineer Underground Mine (2143)	0	2	2	2	2	2	2	2	2	2
Shovel Operator Open Pit (7421)	6	6	6	6	6	6	6	6	6	6
Truck Operator Open Pit (7411)	9	9	9	9	9	9	9	9	9	9
Mechanics/Electricians Open Pit (7612/7241)	8	8	8	8	8	8	8	8	8	8
Mechanics/Electricians Underground Mine (7612)	0	6	6	6	6	6	6	6	6	6
Drill Operators OP (7372)	6	6	6	6	6	6	6	6	6	6
Auxiliary equipment operators (9241)	4	4	4	4	4	4	4	4	4	4
Miner Underground Stoping (8231)	0	12	12	12	12	12	12	12	12	12
LHD Operators (8231)	0	9	9	9	9	9	9	9	9	9
UG truck operators (8231)	0	12	12	12	12	12	12	12	12	12
Underground Mine Development (Drill, Faceman, Raise Miner, Alimak Trainer) (8614)	0	25	25	25	25	25	25	25	25	25

Position (NOC Code)	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027
Underground Mine Services (Construction, Pumpman, Grader) (8614)	0	3	3	3	3	3	3	3	3	3
TOTAL MINE	**47**	**118**	**118**	**118**	**118**	**118**	**118**	**118**	**118**	**118**
Administration										
General Manger (0811)	1	1	1	1	1	1	1	1	1	1
Comptroller (0111)	1	1	1	1	1	1	1	1	1	1
Receptionist/Clerk (1411 / 1414)	1	1	1	1	1	1	1	1	1	1
General Accountant (1111)	1	1	1	1	1	1	1	1	1	1
Accounts Payable (1431)	1	1	1	1	1	1	1	1	1	1
Payroll, Accounts Receivable/other (1431)	1	1	1	1	1	1	1	1	1	1
Wharehouse, Buyer (1225)	1	1	1	1	1	1	1	1	1	1
Human Resources Manager, Trainer (0112)	1	1	1	1	1	1	1	1	1	1
Health, Safety and Environment Manager, Trainer (2263)	1	1	1	1	1	1	1	1	1	1
Environment Technician (2263)	1	1	1	1	1	1	1	1	1	1
TOTAL ADMINISTRATION	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**	**10**
GRAND TOTAL	**93**	**164**	**164**	**164**	**164**	**164**	**164**	**164**	**164**	**164**

2.6.3 Rehabilitation and Closure Employment

An estimate for employment during the two year rehabilitation and closure phase of the Project is not currently available. Following preparation of the Rehabilitation and Closure Plan, it will be possible to estimate the number and type of employment opportunities during this Project phase.

2.7 Project Schedule

Pre-construction activities are currently ongoing and include Project engineering, EA, permitting and procurement (Figure 2-17). Provided that EA and permitting requirements are completed in 2015, construction activities would begin in the fourth quarter of 2015. The construction activies, spanning over a two year period, would consist of site preparation activies, open pit development, construction of site infrastructure such as Mill, roads and site buildings, installation of utilities and commissioning. Temporary work areas will be rehabilitated throughout the construction phase once activities in a certain area are completed.

Operation is schedule to start in late 2017. Open pit mining will first take place. Within two years of mine operations, the underground mine development will be initiated. Underground mine operation is expected to begin in 2020. Progressive rehabilitation activities will take place throughout all phases of the Project. Based on the current resource estimate, operation of the open pits and underground mine would be completed by 2026, at which time rehabilitation and closure activities would take place (Figure 2-17).

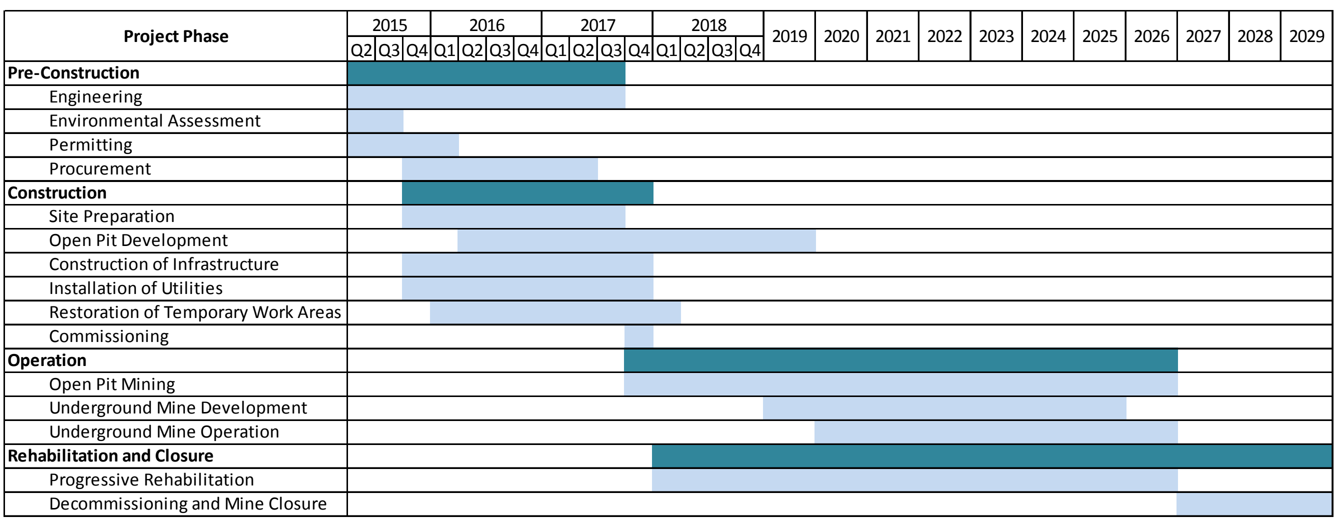


Figure 2-17: Project Schedule

2.8 Emissions, Discharge and Waste Management

Information on the main mitigation measures to be implemented to minimize discharges and emissions in the environment is provided in the following sections.

2.8.1 Tailings Management

Flotation tailings generated at the Mill will be discharged into a proposed TMF centred on Shoal Cove Pond. Over the anticipated LOM of eight to ten years approximately 2.8 million tonnes of tailings will be deposited as slurry. A polishing pond will allow settling of solids present in water and as required, a flocculent will be added to the tailings stream, as required, to promote settling of solids. Clarified water will be monitored regularly to ensure its quality meets effluent discharge limits to be established by the NL DOEC prior to start of operation. The treated effluent will decant over the polishing pond dam into the receiving environment of Shoal Cove Pond Brook.

2.8.2 Atmospheric Emissions

Several sources of atmospheric emissions will result from the proposed Project including: exhaust from fuel burning equipment, fugitive emissions from storage tanks, greenhouse gas emissions from fuel burning equipment, and dust generated during mining, processing, material handling and transport.

During the construction and mine development phases, air emissions will be mainly from diesel powered equipment and dust generated during site preparation, building construction, and hauling. During operation, dust produced by crushing in the Mill will be filtered in a dedicated baghouse dust system before being exhausted to the environment in compliance with all regulatory requirements. Gaseous emissions will be generated by mechanized equipment, and fugitive emissions will be generated from various reagent storage reservoirs. A list of equipment to be used during the operation phase of the Project is provided in Table 2-8.

Table 2-8: Equipment List for Operation Phase

Project Activity	Description	Type	Engine Power kW	Estimated Number of Units
Open Pit Operation	Hydraulic Shovel	CAT 390FL	391	1
	Hydraulic Shovel	CAT 374FL	352	1
	Rigid Haul Truck	CAT 773G	578	3
	Articulated Haul Truck	CAT 740B	365	1
	Drill Rig	AC DTH	403	2
	Wheel Loader	CAT 980K	303	1
	Wheel Dozer	CAT 844H	468	1
	Track Dozer	CAT D9	325	1
	Motor Grader	CAT 14M	193	1
	Water/Sander Truck	CAT 773G body	578	1
	Compactor	CP54	97	1
	Tow Truck	CAT 773G body	578	1
	Tow Low Boy	LPM (120-48-20)	578	1
	Hydraulic Excavator	CAT 320E L	114	1
	Fuel/ Lube Truck	CT660	269	1
	Service Truck	CT660	269	1
	Tire Handler/ Forklift	Kalmar DCD200-12lb	269	1
	Bulk Ammonium Nitrate/Fuel Oil (ANFO) Explosives Truck		269	1
	Mini Bus	Ford E series	150	1
	Pick Up Truck	4x4 crew cab Chevrolet	150	3
	Light Tower (including diesel generator)	MLT3060	7.8	4

Project Activity	Description	Type	Engine Power kW	Estimated Number of Units
Underground Operation	LHD	Sandvik Load Haul (LH) 307	150	2
	LHD	Sandvik LH410	220	1
	Trucks	Sandvik TH430	310	5
	Jumbo Drill	Sandvik DD321-40	135	2
	Bolter	Sandvik DS311D	93	2
	Explosives Loader	Getman A 64	183	1
	Cassette Carrier	AARD Mining UV100	101	1
	Personnel Carrier	Getman A 64	129	1
	Scissorlift	Getman A 64	101	2
	Shotcrete Sprayer	Getman SST Shotcrete	129	1
	Fuel/Lube Truck	Getman A 64	129	1
	Utility vehicle	Toyota landcruiser	45	1
	Grader	AARD Mining LP	92	1
	Pallet Handler/ Tractor	BT3	101	1
	LHD	Sandvik LH 307	150	2
	LHD	Sandvik LH410	220	1
Ore Transportation from Mill to Marine Terminal	Road Trucks Concentrate and Float Aggregate	CAT CT660	269	14
	FEL Concentrate	CAT 980	303	1
Auxiliary	Diesel Emergency Power Generator (Mill)		250	1
	Stand-by Generator (UG Mine)		1 MW	1

Potential sources of air emissions will be identified and controlled through various means (e.g. engineered systems, operational and maintenance controls, and industry best practices that will form the Project's environmental management system) to ensure that regulatory requirements are met. Mitigation measures will be identified during various Project phases and noted in the Project's EPP, which will be developed for both construction and operation. These measures may include:

- Application of water or water-based dust suppressants on gravel roads;
- Use of manufacturer-recommended dust control equipment in the crushing plant;
- Covered-conveyor systems used to deliver crushed ore from the crusher building to the Mill storage bin, concentrate from the Mill to the storage building, and from the storage building to the ship loader and the ship. Where trucks are used to transport concentrate covers will be used on the trucks;
- Proper building ventilation systems, complete with appropriate filters to reduce exhaust emissions; and
- Indoor storage of fine AG concentrate and periodic moistening of concentrate to reduce dust dispersion by wind and over-drying in the storage building.

CFI is committed to reducing its emissions of greenhouse gases. Preliminary design is underway and opportunities to reduce these emissions are being explored. Potential methods to reduce greenhouse gas emissions include:

- Use of mine water for milling processes: mine water would not have to be heated to the same extent as freshwater during winter months, thus reducing energy consumption and greenhouse gas emissions;
- A TMF centred on Shoal Cove Pond. Shoal Cove Pond is located in a natural topographic depression and will result in a smaller footprint than a series of hillside storage areas. The smaller footprint disturbs less natural vegetation on the hillsides which act as a "carbon sink"; and
- Design and construction of a Marine Terminal to handle ships of up to 65,000 DWT. The proposed Marine Terminal would allow large ships to stop and replace some of their ballast water with AG fluorspar concentrate and thus increase their payload. This would reduce fuel consumption and greenhouse gas emissions associated with transporting the product to buyers, as the alternative of hiring dedicated, smaller ships would add appreciably to the cost of CFI's product and generate far more greenhouse gases per tonne of product delivered.

2.8.3 Mine and Process Water

CFI commits to doing the necessary engineering, hydrological, and hydrogeological studies to further its understanding of the area's freshwater resources. CFI commits to mitigating likely adverse effects on water resources through focused engineering studies to identify appropriate sources of water to meet the Project's needs. The applicable regulatory requirements will be satisfied and permits obtained, as required.

A Water Management Plan is being developed as part of the Project design. This Plan will identify how water will be managed on site during the various Project phases and how it will be treated prior to release to the environment. Effluent discharge criteria will be set by NL DOEC through the issuance of a Certificate of Authorization prior to start of construction. Effluent will be treated prior to being discharged to the receiving environment to comply with all applicable regulatory requirements.

Water will be required by the Mill for processing the ore. The source(s) of this process water will be identified during the detailed engineering design phase, and pumped to the Mill. Mill wastewater will be mixed with flotation tailings, amended with a flocculent, and discharged to the TMF for settling. Based on preliminary discussions with NL DOEC, it is understood that treated effluent must meet effluent quality limits for some parameters established in Schedule A of the Environmental Control Water and Sewage Regulations, 2003.

Total concentrator requirement for process water is estimated at 218 m^3/hr (960 USGPM), with several potential sources of process water being considered:

- Clarkes Pond;
- Long Pond;
- Upper Island Pond;
- Water obtained from dewatering operations at the proposed open pits and underground mining operations;
- Water pumped from the former Tarefare underground mine; and
- Water pumped from the former Director underground mine.

Monitoring and treatment of mine water prior to surface discharge is expected to be addressed during the Project's detailed engineering and permitting phase. At this time, before completion of the feasibility study and metallurgical testwork, it is premature to speculate on any treatment requirements and systems. A water monitoring/treatment program will be developed following EA release and Project sanction that will comprehensively address all regulatory requirements to ensure that permitted limits are not exceeded.

2.8.4 Site Drainage

Alteration of natural surface drainage patterns will be a consequence of the construction of the Project given the required size of the Project footprint. A site grading and drainage plan will be developed during the detailed engineering phase and implemented during construction and operation. All permanent drainage control features will be in place and functioning upon completion of construction. The site engineer will be responsible for ensuring that these features are stabilized and functioning as designed.

Nevertheless, minor rehabilitation of surface drainage patterns may be required upon completion of the construction phase.

The effectiveness and stability of all temporary and permanent ditches, culverts, and other drainage control features will be monitored for one year (i.e., one full seasonal hydrologic cycle) following completion of the construction phase. Repairs, revegetation, revetment, or other corrective measures will be applied as directed by the site engineer.

A water diversion concept has been approved by the CEA Agency for the diversion of storm flows from Clarkes Pond to Shoal Cove Pond Brook, downstream of the TMF (CEA Agency 2012). The purpose of this was to limit inflows into the TMF while still preserving fish habitat in Clarkes Pond Brook during low-flow periods. This, together with a plan to collect overland flows from areas surrounding most of the TMF footprint, and discharging this water to Shoal Cove Pond Brook located downstream of the TMF, will reduce inflows into the TMF.

2.8.5 Waste Management

CFI will develop an Environmental Management System (EMS) to guide Project activities and reduce adverse environmental effects. A Waste Management Plan will be developed as part of the EMS and will include procedures to manage the various waste streams generated during all phases of the Project. This plan will be developed prior to the start of construction. The key waste streams include waste rock, sewage, solid waste and hazardous waste.

Waste rock generated by the Project will be stored in the waste rock disposal areas located to the northeast and southwest of the AGS mine site. Some of the waste rock will be used during construction to develop access roads and other infrastructure around the Project area. During operation, some waste rock will likely be placed into excavated stopes to minimize both material transfer to surface and the size of the waste rock dumps. It is anticipated that waste rock will also be used to build the tailings and polishing pond dams.

A geochemistry program is ongoing to characterize the potential for acid rock drainage and metal leaching, which includes testing of waste rock samples. Only non-acid generating waste rock will be reused on the surface. If waste rock is identified as having the potential for acid generation or metal leaching, a waste rock management program will be developed to handle, store, and appropriately dispose of the material.

New sanitary sewage systems will be constructed at the Mine Site and Mill Site to collect and treat sanitary wastes from site buildings. These systems will include septic tanks and leaching fields. The septic systems will be designed to handle sewage quantities anticipated for projected numbers of Project personnel, and in accordance with government guidelines. Sewage sludge accumulating in the septic tanks will be removed periodically and hauled to an off-site treatment/disposal facility by an approved waste disposal contractor. The clarified effluent from the septic tanks will be discharged to their associated septic fields for aerobic treatment.

Solid waste will be generated during all phases of the Project. Waste management practices will be established in compliance with all applicable regulatory requirements. During all Project phases, waste management options will be considered to minimize the waste generated by Project activities, and to reuse and/or recycle wastes when feasible. A construction phase waste management plan will be developed prior to the start of construction to identify applicable waste management options. This plan will be updated prior to the start of operation and will be further revised during the Project's life to reflect the evolving nature of the region's waste management infrastructure and services.

Hazardous waste generated through Project activities will be managed in compliance with all applicable legislation. Hazardous waste sources and quantities will be identified during detailed design, construction and operation phases. The Waste Management Plan will include a section with procedures identifying appropriate hazardous waste disposal options.

2.9 Accidents, Malfunctions and Emergency Response Planning

The effects of potential accidents and malfunctions on workers, the public and environmental, socio-economic and cultural resources are considered in this EA Registration. Accidents and malfunctions could occur during all Project activities during the construction, operation, and rehabilitation and closure phases. The Project has been designed and will be constructed and operated following applicable standards, industry best management practices, Project-specific mitigation measures identified in this EA Registration, and the Project's EPP. These measures are expected to reduce the risk of an accident or malfunction during Project construction, operation, and rehabilitation and closure.

CFI has a goal of zero accidents. Accident prevention will be given priority within CFI's EHSMS. Anticipating potential accidents and malfunctions, and implementing proactive measures aimed at preventing such incidents will be a guiding principle in CFI's EHSMS. In addition, this system will require that a high level of response capability be maintained throughout all phases of the Project. Mine personnel will maintain constant vigilance, undergo regular safety training, and be thoroughly familiar with the EPP, the Occupational Health and Safety Plan, the Emergency Response Plan (ERP) and all Contingency Plans to prevent and mitigate workplace accidents and malfunctions. Third-party contractors will be screened for compatibility with CFI policies and procedures, and contractors will be required to submit health and safety policies and plans to CFI for review and approval prior to any onsite activities.

Accidental events can be generally categorized as either spills or releases to the environment (e.g., fuel and hazardous materials, concentrate or wastewater), or failure of engineered systems resulting in material spills or releases to the environment. The following list of accidents and malfunctions cover all Project phases (construction, operation, and rehabilitation and closure):

- mine failure (e.g., above ground failure [open pit slope failure] or underground failures [ventilation system failure, rock bursts, mine flooding]);
- mill failure (e.g., processes and equipment);

- marine terminal failure (e.g., processes and equipment);
- TMF dam failure;
- erosion or sediment control failure;
- stockpile slope failure;
- vehicle and vessel collisions;
- spills or leaks of hazardous substances (terrestrial and marine); and
- fires and explosions.

The accidents and malfunctions that could occur over the life of the Project are described below, including mitigation measures to prevent their occurrence, and response procedures to be implemented in the case of such an event. The potential adverse effects resulting from accidents and malfunctions are analysed in Section 7.8.

2.9.1 Mine Failure

Mine failure is broken down into open pit slope failure and underground mine failure.

2.9.1.1 Open Pit Slope Failure

Slope failures in an open pit could occur during operations with potentially adverse effects on human health, resulting from failure of the bedrock faces. Slope failures, in some cases, are the result of mine design errors and/or omissions and operational procedures issues.

Four open pits will be excavated through bedrock to a maximum depth of about 145 m below ground surface. The pit design parameters have been reviewed and revised where necessary by CFI's Rock Mechanics consultant, Itasca Consulting Group, Inc., and best management and accepted engineering practices have been used. The final as-built design of the open pits will be engineered and approved at the regulatory stage prior to construction.

In general, the pit benches will be approximately 20 m in height with 7.5m wide safety berms. The pit optimization shell was generated using a constant overall slope angle of 45 degrees. Itasca's geotechnical analysis confirmed this and had recommended an overall slope of 51 degrees. This overall slope angle includes 2 full ramp "wraparounds" each being 20m wide. As a safety factor for design purposes, ramp placement and other factors during the pit design process; the design angle was reduced to 45 degrees. Working benches will have face angles of 70 to 75 degrees. Slopes will be continually inspected and monitored and design modifications will be made to the pit slopes to prevent unstable conditions.

2.9.1.2 Underground Mine Failure

There are inherent risks involved in an underground mining operation with potentially adverse effects on human health (e.g., interruptions to mine ventilation flows, potential for rock bursting, water inflows into the mine).

Ventilation systems are designed to provide fresh air for the mine personnel and reduce the hazards from air contaminants generated during mining operations. These systems reduce the risk of exposure to and the potential for worker inhalation of hazardous substances, such as dust, contaminants produced from equipment exhaust, and harmful gases such as radon. Thus, failure of such systems due to improper design or operation could result in health and safety issues for workers. Functioning backup systems, should the primary ventilation systems fail, will be incorporated into the Project design. Workers will be trained and equipped with personal protective equipment to use in the event of such a failure.

Rock mass instability associated with underground excavation may result in rock bursts and associated mine failures. Measures to prevent such failures begin with a good understanding of rock mass quality and the proper design of mine openings. Monitoring of stresses and strains at various locations will be critical to ensure stable mine workings. Such monitoring will be carried out as required for the Project.

Given the expected large quantity of water that must be continuously pumped to keep the underground mines dry, failures of the pumping systems may result in flooding of underground openings if backup systems are not available or functioning properly. Backup systems will be in incorporated into Project designs to ensure continuous pumping in the event of a primary system failure.

2.9.2 Mill Failure

Failures associated with mill processes and equipment during Project operation may be the result of malfunctioning equipment or poor operational procedures, or may occur over time as joints loosen or metal becomes worn, weakened or corroded. Mill failures may result in the unplanned release of hazardous substances to the environment, such as liquid reagents, unacceptable dust and gaseous emissions, and untreated effluent. These releases will be prevented by proactive design where possible, as well as maintenance programs and monitoring to ensure that all emissions and discharges are in compliance with all relevant government requirements. Any structure or equipment found to be damaged will be repaired immediately and any other remedial action taken as necessary. Should mill failure occur, corrective measures will be implemented immediately to reduce the extent of potential adverse effects.

2.9.3 Marine Terminal Failure

Structural failure of the shiploader at the marine terminal during Project operation may be the result of improper design or operational procedures, or may occur over time as joints loosen or metal becomes worn, weakened or corroded. Marine terminal failures may result in the unplanned release of fluorspar concentrate to the environment (discussed in Section 2.9.8 Spills and Leaks of Deleterious Substances) or possibly human injury. Failures will be prevented by proactive design where possible, as well as maintenance programs and monitoring. Any structure or equipment found to be damaged will be repaired immediately and any other remedial action taken as necessary. Should marine terminal failure occur, corrective measures will be implemented immediately to reduce the extent of the effect.

2.9.4 Tailings Management Facility Dam Failure

TMF dams will be designed and constructed to stringent standards in accordance with probable maximum precipitation events. In the unlikely event of a dam failure, tailings solids, and surface waters covering the tailings, could be released into the environment. The material released to the environment would essentially consist of fine grained silicate and carbonate minerals and water, giving rise to elevated suspended solids concentrations. The severity of the consequences would depend on the volume of this material released to the environment and the time of year.

A total dam failure scenario is considered as a worst case event; however, total dam failure is considered to be highly unlikely. All dams will be built to meet the design criteria for the Canadian Dam Safety Guidelines (CDA 2007). It should be recognized that dam failures are avoidable by proper design, routine inspection, and maintenance. Inspections and monitoring will occur during and after extreme precipitation events. Any structure found to be damaged will be repaired immediately and any other remedial action taken as necessary. Should a dam failure occur, corrective measures will be implemented immediately to reduce the extent of potential adverse effects. Such measures would include additional dam development, stream diversion, removal of displaced solids, and storage and clean-up, as required.

2.9.5 Erosion or Sediment Control Failure

Failure of erosion and sediment controls could result in silt-laden runoff being released to the environment. Erosion and sediment control measures installed on-site over the life of the Project will be regularly inspected and monitored, particularly during and after extreme precipitation events. Erosion and sediment control structures found to be damaged will be repaired immediately and any other remedial action will be taken as necessary. Fines storage areas will be confined to areas within the site, so that any control failures would not result in an off-site release of material.

2.9.6 Stockpile Slope Failure

Stockpile slope failure could result in materials being released to the environment. Overburden, topsoil and waste rock stockpiles will be formed in three dump areas surrounding the AGS Mine, as discussed in Section 2.4.5. Stockpiles will have a maximum height of about 30 m and will be designed with slope angles that promote stability through the establishment of a vegetation cover. Stockpiles will be regularly inspected and monitored, particularly during and after extreme precipitation events. Stockpiles found to be in poor condition (e.g., unstable) will be repaired immediately and any other remedial action will be taken as necessary.

2.9.7 Vehicle and Vessel Collisions

Vehicle collisions may occur during any phase of the Project (construction, operation, decommissioning and rehabilitation), with potentially adverse effects on human health. Vehicle collision has little potential to lead to significant environmental damage (e.g., terrestrial small volume spills of fuel or other chemicals). Vehicles operating at the site will primarily be Project-related mining equipment, bulldozers, haul trucks, loaders, service vehicles (pick-up trucks) and workers' cars. Vehicles accessing the site will be required to check-in at the security office. Traffic patterns, speeds, and right-of-way signage will minimize the risk of vehicle collisions. Operators of mobile equipment will receive training on safe equipment operation, and spill kits will be provided for all vehicles to recover and contain small spills and leaks.

There is also the potential for Project-related vessel collisions in the marine environment, but the limited amount of marine activity reduces this risk. During Project construction and operation, considerable vessel activity by multiple ships and boats may occur for limited periods of time around the Marine Terminal. Given this, there is potential for Project-related vessel collisions, primarily between transport ships used for the fluorspar concentrate and either tugs, pilot vessels or nearby recreational or fishing vessels. Other accident types may include collisions with the terminal during bad weather or due to pilot error and grounding of the vessel on submerged rocks. Navigational error, malfunctioning of navigation equipment, engine malfunction and poor weather conditions may all contribute to these incidents.

The management of marine traffic is the responsibility of the Canadian Coast Guard. It is mandatory for large vessels to report to the Coast Guard at specified points and may take local pilots on board. The potential for collisions will be minimized by controlling vessel speed, scheduling and coordinating activities with other marine users, as well as Transport Canada and the Coast Guard, and posting Notices to Mariners, as necessary. The Marine Terminal will have navigational aids to provide early warning of collision hazards. Weather reports and wind speed information will also be used to monitor changing weather conditions that could increase the risk of collisions during vessel navigation to or from the Marine Terminal.

Emergency response in the event of a vessel collision is coordinated by the Canadian Coast Guard with support from local land based emergency responders, as needed. The Coast Guard will be naturally aware of the timing and type of activity associated with Project operation and will be informed of the construction schedule before work begins. The ERP will contain a section regarding response to incidents at sea; however, the ship's Master is ultimately responsible for the safe operation and emergency response in case of an incident.

2.9.8 Spills and Leaks of Hazardous Substances

Spills and leaks include terrestrial and marine spills and leaks of fuels or other chemicals, and spills and leaks of fluorspar concentrate in the marine environment.

Terrestrial and Marine Spills and Leaks of Fuels or Other Chemicals

All phases of the Project (construction, operation, rehabilitation and closure) will include the use and storage of fuels (e.g., diesel and gasoline), equipment maintenance and use and storage of servicing fluids (e.g., hydraulic oils, oils and lubricants, greases, antifreeze, brake and steering fluids, solvents), and the use and storage of blasting agents. Therefore, the potential for spills and leaks of any of these materials exists during all phases of the Project.

Spills and leaks could result from equipment failure, damage to storage or piping systems, mobile equipment accidents, or failure to follow proper procedures related to fuel and other bulk material transfers or equipment maintenance activities. In the event of a spill or leak of a deleterious substance, the severity of the environmental consequences will depend on the location and volume of the spill/leak, and the time of year. In the event of a large spill or leak, soil, groundwater and surface water contamination may occur. It is unlikely that a spill or leak would adversely affect the quality of habitats and/or result in ingestion or uptake of contaminants by vegetation and/or wildlife, as working areas of the industrial Project site will be largely devoid of vegetation. CFI will take all precautions necessary to prevent spills and leaks of hazardous substances.

All Project equipment and vehicles will meet industry standard requirements and be safety certified and fit for their intended use. Regular pre-shift inspections and maintenance programs will ensure the continued reliability and integrity of Project equipment. Necessary critical spares will be maintained in the event that change out of parts or equipment is required.

Storage tanks at various on-land locations could fail as a result of spontaneous rupture or explosions; however, the likelihood of any substance escaping to the environment as a result of a tank failure is low. On-site bulk materials will be stored in above ground storage reservoirs with secondary containment in compliance with provincial regulations. Any spillage inside the containment will be recovered and managed in accordance with provincial waste management regulations.

Spills could also result from human error during delivery of materials to the storage tanks (e.g., overfilling, leaving valves open). CFI will continue to enforce strict procedures for the safe transportation and handling of all deleterious (hazardous) materials on-site. Storage tanks and facilities will be designed to conform to the government regulations and quidelines, as required. Workers will use best practices during material transfer operations including monitoring and oversight of the transfer activities and verification to ensure that the receiving container has adequate capacity prior to beginning the transfer procedure. Such spills, in the event that one occurs, would prompt notification, emergency response, and clean-up procedures.

Onshore refueling of mobile equipment will need to be conducted on-site on a regular basis. Refueling will take place in designated areas where any spills can be contained and recovered. Equipment operators will ensure that they remain with the equipment at all times during refueling.

Most spills or leaks would be localized near the source and be addressed by site personnel using available spill response equipment. All deleterious substances will be handled in a manner that minimizes or eliminates the risk of spillage and accidents. Contingency planning will be in place to enable a quick and effective response to a spill/leak. Personnel will be trained in response measures, and spill response equipment (e.g., absorbents, pads, socks and booms) will be readily available in the event of an accidental spill/leak.

In the case of spill or leak of a deleterious substance, emergency response and clean-up procedures will be implemented. Immediate action will be taken to stop the leak and contain the spilled material. All contaminated material will be collected and stored in an appropriate manner so as to not re-release to the environment until such time that it can be transported to an approved treatment/disposal facility. The procedures and requirements of the Workplace Hazardous Materials Information System (WHMIS) program and other applicable government regulations will also be enforced.

The severity of the adverse effects resulting from a spill or leak of a deleterious substance in the marine environment (e.g., damage to a ship's hull sufficient to rupture a fuel tank, bilge water tank, or other ships structure), depends on the spill volume and composition, wave, current and wind conditions, and the promptness and effectiveness of response efforts. In the unlikely event of a large spill or leak, damage to fisheries, effects on aquatic flora, fauna and waterfowl, as well as coastal effects from residual material coating the shoreline may occur.

All shipping and offshore activities will be conducted in compliance with the *Canada Shipping Act* requirements for vessel inspection and certification, and training and appropriate certificates of competency for operators. The risk of a spill or leak of a hazardous substance into the marine environment is limited given that the Marine Terminal will not be transferring fuel, ballast water, sewage, waste or other materials apart from fluorspar concentrate between the shore and the ship. Ships will arrive ballasted and ballast water will be discharged in accordance with the Canadian *Ballast Water Control and Management Regulations* (SOR2011-237; Government of Canada 2011) and the International Marine Organization (IMO) *International Convention for the Control and Management of Ships' Ballast Water and Sediments* (IMO 2004).

Collisions between marine vessels are considered unlikely to occur given the paucity of large vessel traffic in the area of the Marine Terminal, and a collision with a fishing vessel would not likely result in damage severe enough to cause a release. The potential for collisions will be further reduced by using tug and pilot assist for docking at the Marine Terminal, and ensuring that the Marine Terminal is properly lit.

All vessels will have spill mitigation and clean-up equipment on board to respond to any deck spills or leaks, including booms, absorbent pads and dry chemicals. These measures will reduce the potential of spilled material entering the water. Spills to the marine environment will be infrequent and are likely to be small in quantity and will disperse rapidly. In the event of a spill, the ERP will be implemented to respond to and investigate the occurrence and follow up with corrective actions to reduce the likelihood of repeat spills.

Marine Spills of Fluorspar Concentrate

Fluorspar concentrate will be conveyed by truck to the Marine Terminal for transfer by a ship loader to marine vessels docked at the Marine Terminal. In the unlikely event that a ship or any loading systems are damaged, fluorspar concentrate may be released to the environment. The concentrate would tend to slowly settle to the seabed due to its density. Currents in the area would likely disperse some material from the spill site. The majority of the material would sink in place and remain. Should an accident occur at the loading facility, large quantities of fluorspar concentrate could enter the St. Lawrence Harbour, potentially smothering localized benthic communities. However, the loading system is operated by an individual and equipped with an automatic shut-off that would limit the amount of fluorspar concentrate released. Accidental releases of concentrate into the marine environment could also occur along the shipping route, but this is not expected.

In all cases, the response will conform to CFI's ERP. The procedures will be designed to reduce, contain, and recover spilled material to ensure that adverse effects are at most short-term and localized.

2.9.9 Fires and Explosions

A fire could occur at the Project site during any phase of the Project, caused by lightning, forest fire, human error or electrical/equipment malfunctions. The extent and duration of a fire depends on meteorological conditions and the success of the response effort. The immediate concern for a fire is human safety and damage of property. As well, in addition to the alteration or loss of habitat or direct loss of wildlife, emissions, particulate matter, and other contaminants may be generated.

Smoke from fires may contain particulate matter, CO2, CO, NOx, SO2, volatile organic carbons, poly-cyclic aromatic hydrocarbons or other contaminants. Total particulate matter would increase and contribute metals to the aquatic environment. Runoff would contain ash and sediment and increase alkalinity and total suspended solids. A fire could also increase stream bank erosion and alter the temperature of small waterbodies. A large fire could create air contaminant levels greater than the ambient air quality standard over distances of several kilometres; however, the likelihood of such a large fire is considered low and if such a fire was to occur, the duration would likely be short.

Mitigation and prevention of naturally occurring fires is difficult. CFI has taken and will continue to take all precautions necessary to prevent fire hazards including proper management of fuel and other flammable materials, and through appropriate operational procedures such as industry standard storage, handling and transfer techniques. Contingency plans will be in place to enable a quick and effective response to an on-site fire. Personnel will be trained in fire prevention and response, and appropriate fire-fighting equipment will be readily available in the event of a fire. This capability will also serve to minimize the environmental effects of fires caused by lightning and other natural phenomena in the vicinity.

Fire protection systems will be installed at the Project site. The ERP will be implemented immediately upon the detection of a fire. Firefighting equipment and an emergency response vehicle equipped with firefighting equipment will be deployed immediately. The appropriate Forest Management Unit office and RCMP office will also be notified immediately, and in the unlikely event of a large fire, local emergency response and firefighting capability will be called to respond, reducing the severity and extent of damage and to protect the safety of workers.

Explosions at the Mill, Mine or Marine Terminal could result from an accident, failure of process equipment, over-pressure, sabotage, or as the result of a fire. A comprehensive leak and gas detection system will be in place to detect possible sources of ignition. A permit-to-work system will be implemented in all areas of the Mill and "hot work" will be strictly controlled in areas with a potential to have an ignition source. Site security will control access to the site (i.e., limited to approved personnel). The fire detection and alarm system will be monitored from the central control room to reduce response time so that small fires are detected and extinguished before developing into a major incident.

2.9.10 Emergency Response Plan

As part of CFI's EHSMS, an ERP will be developed and implemented during all phases of the Project. The EPR will provide an appropriate and consistent response to emergency situations that may occur during the construction, operation, and decommissioning and rehabilitation of the Project.

The main purpose of the ERP is to ensure the protection of life, environment and property/equipment and to identify predetermined courses of action for Mine failure, Mill failure, TMF dam failure, erosion or sediment control failure, vehicle and vessel collisions, spills or leaks of hazardous substances, fires and explosions, medical emergencies or other emergency situations. This plan defines the responsibility of key personnel and outlines the general procedures to be followed when responding to emergencies in a way that will avoid or reduce health and safety risks, minimize trauma, safety hazards and environmental damage, reduce cleanup cost and minimize property damage.

The ERP will apply to all personnel working at the Project site, and describes the emergency procedures that will be implemented immediately upon the discovery of a situation that may endanger:

- safety and/or health of individuals;
- environment; and
- property and/or equipment.

The CSA Emergency Preparedness and Response standard (CAN/CSA-Z731-03; CSA 2014) will be used to guide CFI response planning process. The Standard provides advice on planning, administration, training, resource utilization, auditing, and other aspects of emergency preparedness and response. Also the Environmental Emergency Regulations (SOR/2003-307) (Government of Canada 2003), pursuant to section 200 of the *Canadian Environmental Protection Act* will be used.

The Project operation will use an Incident Command System (ICS) structure to organize the response to each emergency situation. For each emergency event, an incident management team will be activated along with an Emergency Operations Centre (or command centre).

2.10 Potential Resource Conflict

Potential interactions between the Project and the environment (both adverse and positive) during construction and operation may include those associated with:

- Fish and Fish Habitat (freshwater and marine);
- Resource Harvesting (fisheries, berry picking);
- Birds and Wildlife;
- Species at Risk (if present in the general area of construction); and
- Socio-Economic Environment.

Potential resource conflicts arising from these interactions may be identified as consultations continue throughout the EA process. An analysis of these Project-environment interactions and potential resource conflicts is provided in Section 7.

2.11 Sustainability

As stated in its Health, Safety, Environmental and Social Responsibilities Statement (Appendix A) and in CFI's Design, Construction and Operations Guiding Principles (Appendix B), CFI is committed to incorporating the principle of sustainable development into all phases of the Project through planned integration of environmental, social and economic considerations.

CFI is committed to implementing appropriate environmental management in all phases of the Project. To reduce or avoid adverse environmental effects during construction and operation of the Mine, Mill and Marine Terminal, the Best Available Technology that is Economically Achievable (BATEA) will be integrated into the Project when practical. All measures will be taken to avoid or reduce adverse environmental effects resulting from Project-related activities.

Environmental management planning provides CFI with the tools to implement environmental protection measures and monitor discharges and emissions to the environment. A sound environmental management strategy and suitable mitigation measures can eliminate or reduce adverse effects on the environment.

CFI is committed to prevent pollution and to continually improve the integration of environmental protection practices in all its activities (i.e., adaptive management). CFI will ensure that Project activities are carried out in full compliance with all applicable environmental, health and safety laws and regulations by applying the best available technologies and highest standards. CFI's commitments and guiding principles for the proposed Project are outlined in their mission statement and guiding principles.

3.0 PROJECT RATIONALE AND ALTERNATIVES ASSESSMENT

The following sections present the Project's purpose and rationale, a description of the alternatives to the Project and a description of alternatives means of carrying out the Project for several Project infrastructures, including the TMF, Marine Terminal, Mill, mining methods, storage location and water use.

3.1 Project Purpose

The Project's purpose is to mine fluorspar ore from the AGS Vein near St. Lawrence, NL, to process it to produce acid-grade fluorspar concentrate, and to export this product to domestic and international markets. The fluorspar deposits of St. Lawrence are recognized for their accessibility, relatively high grades, and absence of impurities such as arsenic. The location of the Project, with an ice-free, deep water harbour close to major North Atlantic shipping routes provides a strategic advantage.

In the US, production of hydrofluoric acid is by far the leading use for acid-grade fluorspar. Hydrofluoric acid is the primary feedstock for the manufacture of virtually all fluorine-bearing chemicals and is also a key ingredient in the processing of aluminum and uranium. Fluorspar is also used in iron and steel casting, primary aluminum production, glass manufacture, enamels, welding rod coatings, cement production, as a flux in steelmaking, and in other applications (United States Geological Survey [USGS] 2015). Various products such as refrigerants, Teflon®, fire retardant clothing, toothpaste, plastic, and lithium batteries typically require fluorspar.

There are few known deposits of fluorspar in Canada and the US that can be mined economically. In Canada, there are currently no producing mines. In the US, only 119 tonnes were produced in 2014 (USGS 2015). In 2013, the volume of the global fluorspar market was approximately 7 million tonnes. Fluorspar production and demand was growing at a rate of approximately 5% in the past decade. Given the current economic conditions, the market is currently in a slowdown period but still maintains a healthy growth that is estimated at 3% per year. Based on these growth projections, it is expected that the demand for fluorspar will increase to approximately 8.4 million tonnes by 2020. China holds a large portion of the fluorspar market and in 2020, it is speculated that China will have a consumption rate that will be higher than its production rate; therefore, it will need to import or mine additional fluorspar resources to meet its demand. Experts also note a recent price drop for fluorspar, but price is expected to follow a moderate growth going forward (Bain & Company 2013). The current status of the global fluorspar market justifies the need for an additional supply of fluorspar.

In addition to the status of the global market, the recent downturn in the economy reinforces the need for infrastructure projects and economic development in the St. Lawrence area. There is a strong community support for the Project. The proposed Project would directly create approximately 340 jobs (at peak) during construction and approximately 164 full-time jobs during operations. The proposed Project presents an opportunity for significant economic benefits to CFI, local communities, the Burin Peninsula and the province.

3.2 Alternatives to the Project

The alternatives to the Project are the no-go scenario or the reactivation of the underground mines at Tarefare and Blue Beach North, as previously proposed by Newspar. The no-go scenario is an alternative that will be evaluated upon completion of the prefeasibility and feasibility studies in 2015. Project viability will be assessed based on a number of factors, including economic and technical feasibility, and predicted environmental and socio-economic effects. Part of the Project area, namely the proposed TMF location at Shoal Cove Pond, has been affected by past mining activity. A no-go decision will therefore mean that appropriate environmental controls in the pond may never be constructed, that the economic benefits to the community, region, province, and country may not be realized, and that construction of a Marine Terminal in St. Lawrence, of which other users may benefit in the future, may not take place.

A decision not to proceed with the Project will leave another alternative: the reactivation of the underground mines at Tarefare and Blue Beach North. Following issuance of environmental approvals in 2010 and 2012, this project is on hold.. Based on the data available to date, CFI believes that the reactivation of underground mines is not as economically feasible as the open pit and underground mining of the AGS Vein, which is currently being proposed. Reactivation of underground mines might be more feasible following completion of the proposed Project because the infrastructure will be in place. This option will be assessed at a later stage.

3.3 Alternative Means of Carrying Out the Project

The following subsections present alternative means of carrying out the Project, with a focus on the TMF, Marine Terminal, mining methods, waste rock and overburden storage, and water use.

3.3.1 Tailings Management Facility Alternatives

During the EA of the Newspar project, several alternatives were examined for the disposal method and siting of the TMF. These alternatives have been reassessed as part of the proposed Project and are presented below. During its operational life, the proposed TMF will receive about 40% more tailings than the TMF designed for the Newspar project. However, additional storage capacity for the proposed Project's TMF will be created by modifying the design concept of the Newspar project's TMF as follows:

- Removing the separator berm;
- Slightly increasing the tailings dam height; and
- Marginally augmenting TMF footprint at the end of mine life.

Based on the proposed design and a review of the various alternatives, the same preferred alternative has been selected for the Project, which is to locate the TMF within the area historically used for tailings deposition at Shoal Cove Pond.

3.3.1.1 Tailings Disposal Methods

Six methods of tailings disposal were considered:

- Surface Paste;
- Backfill Paste;
- Dry Stacking;
- Thickened Tailings;
- Sub-aerial Slurry Disposal; and
- Sub-aqueous Slurry Disposal.

Based on the evaluation of alternative methods for disposal of tailings, the preferred option is sub-aerial slurry disposal.

Surface Paste

Surface paste tailings are tailings that have been dewatered to the point where they do not have a critical flow velocity when pumped, do not segregate as they deposit, and produce minimal bleed water when discharged from a pipe.

This method was short listed as a disposal option in the 2010 EPR Addendum (CFI 2010a). The advantages of this method are the reduced water storage requirements, smaller retention dams, and smaller tailings footprint. The disadvantages are the higher costs with designing, building and operating a paste plant, higher end pumps (positive displacement), and limited distance for pumping.

This method was screened-out after a comparative evaluation of the short listed alternatives was conducted in 2010 (CFI 2010a).

Backfill Paste

Backfill paste tailings are the same as surface paste tailings except they are deposited in underground openings from the mining workings. This method was screened out during the 2010 EPR Addendum (CFI 2010a) due to the potential stability problems of the underground workings during mine operations, particularly in areas that may be re-mined if fluorspar concentrate prices increase. A binder could be added to the paste to increase stability but that increases disposal costs.

The disadvantages of this option include the cost to construct and operate a paste backfill plant, transporting the paste backfill for approximately 3 km into the underground workings, storing the paste backfill. In addition, only one third of the tailings would be stored underground as paste fill, the other two-thirds would need to be disposed of in a TMF.

Given that tailings would be generated by surface mining during initial years of the Project's operations, underground disposal would not be an option.

Dry Stacking

Dry stacking is a method where dewatered tailings have solids content greater than 80%. The process forms dry tailings, or dry cake, which is normally transported by conveyor or truck, deposited, spread and compacted to form an unsaturated tailings deposit.

This method was short-listed as a disposal option in 2010 (CFI 2010a). The advantages of this method are that retention dams are not needed at disposal sites, dry cake has greater geotechnical stability than paste or slurry, and water extracted during the processing can be recycled for other uses. This method is more suitable in dry or arid environments; however, St. Lawrence is a wet coastal marine environment that receives approximately 1400 millimeters per year (mm/year) of precipitation.

The disadvantages of this method include the installation, operation, and maintenance of thickeners and vacuum filtration systems to remove the excess water from the fluorspar tailings, which would increase capital, operating, and maintenance costs. It would be necessary to build a containment pond or large tank to settle out suspended solids in the pore water removed by the thickeners. Dry stacking would require undisturbed land for dumping of the tailings. A containment berm would be required if dry stacked tailings were stored at the surface to contain and direct any runoff from the tailings pile to an engineered polishing pond to regulate the TSS. Dry stacked tailings are difficult to revegetate due to the formation of a hard crust, making rehabilitation and closure more challenging. For closure, the tailings would have to be re-contoured and overlain with the vegetated soil cover, which would increase closure costs. The dry stacked tailings could be deposited underground; however, there would still be costs incurred to store and treat the tailings' pore water. In addition, the same stability issues that apply to the backfill paste option apply to dry stacked tailings deposited underground.

This method was screened out after a comparative evaluation of the short-listed alternatives was conducted in 2010 (CFI 2010a).

Thickened Tailings

Thickened tailings are tailings that have been dewatered to a point where they will form a homogeneous non-segregated mass when deposited from the end of a pipe. This method was screened out due to it being a more suitable option in arid climates where water is a limited resource. Capital and operating costs are higher with thickened tailings in comparison to the other options due to the dewatering process that requires a combination of thickeners and filter presses. The costs were not considered viable for a small mining operation, such as the current undertaking (CFI 2010a).

Sub-aerial Slurry Disposal

Slurried tailings are tailings composed of milled waste combined with water. The solid content of the fluorspar tailings is low, suggesting this to be a favourable option. Sub-aerial disposal is appropriate in cases were acid rock drainage is not a concern. This method requires substantial containment dams to retain the material as its high water content allows the material to flow.

This method was short-listed as a disposal option in 2010 (CFI 2010a). The advantages of this method are the lower capital and operating costs, and minimal adverse environmental and socio-economic effects. The capital costs are reduced compared to the other options considered due to dewatering equipment and pumps not being required. By locating the process plant uphill from the proposed TMF, the slurried tailings could be conveyed to the TMF by gravity. If the process plant is not located uphill, the slurry can be pumped through pipelines to reach the TMF. However, the cost of pumping would be less than transporting tailings with lower water contents.

The main disadvantage of this option is a larger tailings footprint and greater volume of runoff water to manage.

This method was selected as the preferred option after a comparative evaluation of the short-listed alternatives was conducted in 2010 (CFI 2010a). This method continues to be the preferred option should on-going geochemical testing confirm the tailings are non-acid generating and non-metal leaching.

Sub-aqueous Slurry Disposal

This method involves the deposition of slurried tailings beneath a cover of water to reduce the waste's exposure to oxygen. This method is suitable for sulphide bearing wastes that are susceptible to acid rock drainage. Acidic water can cause metals to leach as it percolates through the waste, natural overburden and bedrock.

This method was screened out in 2010, due to the low-sulphide content of the ore in the Tarefare and Blue Beach North veins. The trace amount of sulphides present would be removed in the milling process; therefore, sub-aqueous slurry disposal was considered unnecessary.

For the proposed Project, further geochemical testing of the tailings will be performed to determine its sulphide content, and to characterize its acid-generating and metal-leaching potential. Based on the results of this geochemical program, sub-aqueous slurry disposal may be identified as the preferred option.

3.3.1.2 Disposal Locations

Seven tailings disposal locations were considered in the 2010 EPR Addendum. The locations and the rationale regarding their evaluation are considered to apply to the proposed Project. The locations were evaluated on the basis of environmental, technical and socio-economic considerations. The following disposal locations were considered:

- Shoal Cove Pond;
- Hillside Option 1;
- Hillside Option 2;
- Clarkes Pond;
- Director's Watershed;
- Underground; and
- Marine.

Shoal Cove Pond

Shoal Cove Pond was selected as the preferred TMF location. Shoal Cove Pond was used as a tailings lagoon from the 1930s through the 1950s; therefore, its brownfield nature lends itself for use as a tailings facility engineered to modern standards. In addition, future use of the pond as a TMF has been formally agreed to between DFO and BML when a No-Net-Loss Habitat Compensation Agreement was signed in 1997 (DFO 1997a). This agreement was the first of its kind in the province to be signed and it is still in effect.

The Shoal Cove Pond location achieved the highest score for technical considerations. The advantages technically for this location included it being the most favourable option for the potential for increased tailings deposition capacity, flexibility with regard to technical operational and environmental uncertainties, limited post-closure risks and uncertainties, and limited risks associated with construction (CFI 2010a).

The Shoal Cove Pond location scored the most favourable ranking with respect to the socio-economic considerations. These included the lowest operational costs, limited economic risks and most benefits, less time for regulatory review and construction timeline and costs, fewer safety considerations, and most favourable in terms of the public's acceptance of the various options based on survey results and information collected at public meetings.

Hillside Option 1

The Hillside Option 1 would involve four cells located in the hillside surrounding Shoal Cove Pond. Cell 1 and Cell 2 are located on the northeast hillside of Shoal Cove Pond and have a capacity of 400,000 cubic metres (m^3) and 700,000 m^3, respectively. Cell 3 and Cell 4 are located on the western hillside of Shoal Cove Pond and have capacities of 410,000 m^3 and 200,000 m^3, respectively. The total tailings volume for this option is 1,710,000 m^3, with a total dam volume of 570,000 m^3 (CFI 2010a).

This option was screened out due to the need to construct large rock fill dams on the hillsides above Shoal Cove Pond to contain the tailings material. The cost of constructing such dams is also considered prohibitive. Environmentally this option would involve affecting a large area of relatively undisturbed land. This option still requires the use of Shoal Cove Pond as a polishing pond prior to final discharge.

Hillside Option 2

The Hillside Option 2 would involve two cells located on the eastern hillside of Shoal Cove Pond. Cell 1 is located on the northeast hillside of Shoal Cove Pond and has a capacity of 950,000 m^3. Cell 2 is located on the eastern hillside of Shoal Cove Pond and has a capacity of 900,000 m^3. The total tailings volume for this option is 1,850,000 m^3, with a total dam volume of 370,000 m^3 (CFI 2010a).

This option was screened out due to the same reasons described for Hillside Option 1. The large volume of rock fill needed to construct the dam is considered cost prohibitive and the use of Shoal Cove Pond as a polishing pond renders this option unfavourable on the basis of environmental and socio-economic considerations.

Clarkes Pond

The Clarkes Pond option involves a single cell in Clarkes Pond with one dam on the north end of the pond and another dam on the south end of the pond. The cell would have a tailings volume of 1,850,000 m^3, with a total dam volume of 70,800 m^3.

This location has the advantage of being close to an alternative Mill Site. The disadvantages are that this location is relatively undisturbed and the deposition of tailings in the pond would mean that Clarkes Pond could not be used as a source of water for the Project. The expandability of this option is limited and costly. Should the TMF be located in Clarkes Pond there may be issues with extra water in the underground workings in Blue Beach North, should this area be developed in the future (CFI 2010a). Due to the disadvantage of the technical and environmental considerations for this location it was screened out.

Director's Watershed

The Director's Watershed option involves a single cell in the Director's Watershed, with two dams on the southwest and southeast sides of the tailings cell. The cell would have a tailings volume of 1,914,000 m^3, with a total dam volume of 92,500 m^3 (CFI 2010a).

This option was screened out due to environmental considerations. The watershed around Director's Creek is undisturbed. From a social standpoint it is also undesirable to adversely affect an undisturbed watershed for tailings disposal. This option is also unfavourable from an economic standpoint as the cost of the two dams are greater than the Shoal Cove Pond option.

Underground

The option of disposing of the tailings underground has the advantage of eliminating the need for a surface TMF. However, a large polishing pond would still be required to deal with the sediment-laden water from the underground tailings deposition. Significant costs would be incurred to transport the tailings into the underground workings and store them (CFI 2010a). The economic considerations of the cost of transporting and storing tailings rendered this option unfavourable. Underground disposal for the Project would not be possible for several years following the start of operations.

Marine

This method was not considered as it would contravene the Federal *Fisheries Act*, and as such, would not be permitted by law.

3.3.2 Marine Terminal Alternatives

Two options for the location of the Marine Terminal were considered for the Project: one on the north side and the other on the south side of Blue Beach Cove. Each wharf location had two variants that were evaluated. The preferred alternative is Option 1, which is located on the north side of Blue Beach Cove.

Other locations than Blue Beach were previously assessed for the Newspar project. Given the amendments made to the Town of St. Lawrence municipal plan to allow construction of a new marine terminal at Blue Beach, this area located in the outer Great St. Lawrence Harbour was selected as opposed to areas within the inner Great St. Lawrence Harbour (CFI 2009).

3.3.2.1 North Side of Blue Beach Cove

Option 1 is a gravity based structure with concrete caissons used for the wharf berthing surface. A 310 m long rock fill causeway will connect the wharf structure to the shore. The berthing face comprises four rock-filled concrete caissons, totaling 100.8 m long, with fenders to accommodate berthing loads. Behind the berthing structure is a backfilled area with dimensions of 30.4 m x 80 m which may be used for vehicle turning or as a laydown area. The loading system consists of one Aumund covered ship loading conveyor and one Samson Feeder with a loading rate of 500 tonnes per hour. Fluorspar concentrate or dense media separation (DMS) float is delivered from the storage facilities to the feeder system via direct dumping from trucks.

The advantages with this option are: provision of a laydown area; continuous wharf design gives the ability to offload materials and equipment from a vessel to the wharf; warping is not required for the design vessels; ship loading equipment is the least expensive of all options; load rate can be increased by introducing more mobile equipment; a telescopic chute with rotor and sligner head could be used to give added placement control; and construction could proceed from land making it less susceptible to unfavourable seas.

The disadvantages of this design are: the mooring arrangement has the potential for health and safety and operational risk; the load rate is capped by the efficiency of the mobile system; some warping may be required to fill the fore and aft holds depending on the vessel configuration and type; limited contractors with experience to construct and install caissons results in reduced competitiveness in quotations; rock mattress and scour protection is required to provide a suitable foundation for caisson placement; and there is a substantial adverse effect on the sea floor.

3.3.2.2 South Side of Blue Beach Cove

The location selected on the southern edge of Blue Beach Cove has a steeper gradient on the shoreline resulting in the design depths for the berthing vessels to be obtained closer to shore. This location also allows berthed vessels to take waves bow-on rather than broadside, as they would at the Option 1 location, as the Marine Terminal line would be perpendicular to the prevailing wave direction at Option 2. The berthing structure is designed to consist of steel piles for Option 2. Option 2 includes two variants consisting of different loading schemes, a radial quadrant loader and a fixed point conveyor.

The radial quadrant loader option, Option 2a, proposes to use a conveying system attached to a mobile quadrant loader. Materials are stockpiled on shore and fed directly to the loader via truck on the shoreline. The loading rate for this design option is 500 tonnes per hour.

Option 2a has the following advantages: warping is not required for design vessels, mooring and berthing operations are fully supported by fenders and bollards, load rate into vessel can be potentially increased if load rather to conveyor can be increased, potential to increase load rates by small equipment upgrades, fully enclosed telescopic chute gives dust and moisture control, rotor and slinger head can provide more trimming control when loading, and, less adverse effects on the sea floor than Option 1.

Option 2a has the following disadvantages: no ability to offload materials/equipment from ship to shore, loading of material from shore to ship is permitted; however, designed to load 400,000 tonnes total of fluorspar/DMS float, ship loading equipment is the most expensive of all options, lead-in time for the design, fabrication and shipping of the quadrant loader system may be more than a year, majority of construction work is offshore, and radial support is required for the quadrant loader arm.

The fixed point conveyor Option 2b proposes to convey material from shore to a fixed point at the berthed vessel wharf line. Materials are stockpiled on shore and fed directly to the loader via truck on the shoreline. This arrangement is only capable of loading a single fixed point on the berthing vessel; therefore to load the entirety of break bulk vessels, warping of the vessels will be required. Therefore, the loading rate is lower at 400 tonnes per hour.

The advantages of Option 2b are: mooring and berthing operations are fully supported by fenders and bollards; simple conveyor design is less expensive than Option 2a; telescopic chute fully enclosed gives moisture and dust control; and the rotor and slinger head can provide more trimming control when loading.

The disadvantages of Option 2b are: warping is required for large design vessels; tugs are required during warping operations; no ability to offload materials/equipment, designed to load 400,000 tonnes total of fluorspar/DMS float; lower load rate; majority of construction is off shore; and extra breasting and mooring dolphins are required to enable support to the vessel during vessel operations.

Upon review of the various Marine Terminal options described, the conclusions are:

- Option 2b is potentially the most cost-effective solution depending on the type and format of shipping contracts and which stakeholder is responsible for incurred costs;
- Option 1 would provide the most flexibility for use in the future; and
- Option 2a provides the most flexibility for increasing material throughput.

The flexibility of use is the determining factor for CFI when selecting a Marine Terminal location. Therefore, Option 1, located on the north side of Blue Beach Cove, was selected as the preferred alternative, as it represents the most flexible option.

3.3.3 Mill Siting Alternatives

Four potential sites for the proposed Mill were evaluated by CFI. The locations reviewed were:

1) near the AGS Mine;
2) near the former Director underground mine;
3) at the former mill location near Clarkes Pond; and
4) at a location close to the proposed Blue Beach Cove Marine Terminal.

Various criteria were used to evaluate each alternative, including technical, economic, and environmental considerations.

The location close to the AGS mine is the preferred alternative, primarily because of the high cost of hauling ore from the mine together with potential adverse effects on the environment such as increased dust generation by haul trucks traveling mine roads with increased hauling distances; increased use of fuel and consequential increase in greenhouse gas emissions and diesel exhaust; and, increased physical footprint of haul roads to accommodate larger vehicles over longer distances.

As engineering concepts evolve through the feasibility study phase, the preferred Mill Site will be confirmed through a detailed analysis of technical, economic, and environmental considerations.

3.3.4 Alternative Mining Methods

CFI has evaluated the costs and benefits of surface mining versus underground mining. The AGS deposit is a sub-vertical vein complex that extends to the surface; however, it underlies a few ponds and streams, the largest one being Grebes Nest Pond. Drainage of these water bodies is an unavoidable consequence of mining the area's fluorspar resources near the surface, which, because of its relatively higher grade and access, makes the AGS Vein attractive economically.

CFI carried out a trade-off study to determine the optimal geometry of the surface mine with respect to technical and economic criteria. An open pit shell was designed to maximum depths reaching approximately 145 m below the existing ground surface, with underground mine workings extending below the surface pits to 350 m depth, with present resource data, as shown in Figure 2-13.

Given that the affected water bodies would need to be drained, a field program was completed to evaluate the fish populations and habitat within these ponds and streams (SEM 2015). CFI will work with DFO to ensure the loss of fish productivity is appropriately offset by the creation and/or enhancement of productivity elsewhere in the area. In addition, at the end of the Project's life, the surface mines will be allowed to fill with water and larger ponds will be created as part of the rehabilitation and closure activities.

3.3.5 Alternative Sites for Waste Rock Dumps and Overburden Storage

CFI evaluated the technical, economic, and environmental aspects for the selection of the waste rock and overburden dump sites. With up to 26 million tonnes of waste rock to dispose of over the life of the Project, and smaller quantities of overburden to store, the cost and technical feasibility of transporting this material and selecting a disposal location were considered. Several locations near the Project's open pits were evaluated, and the land's topography was considered in designing these dumps to ensure their stability and ease of construction.

Because of the relatively large footprints of these dumps and stockpiles, some streams would necessarily have to be diverted. However, several areas were evaluated and the ones selected were chosen partly because they would result in fewer streams being affected. Where possible, buffer zones of at least 25 m were established between the dumps and water bodies.

During the operation phase of the Project, as progressive rehabilitation takes place, and at the end of the Project's life, overburden will be used to rehabilitate areas affected by the Project. Therefore, this stockpile will either be entirely removed or significantly reduced in size by the end of the Project's life.

With respect to the waste rock dumps, CFI is researching the market potential of processing the waste rock to produce high quality construction aggregate for export to the southeastern US market. Although this undertaking is not part of the proposed Project, it would offer an opportunity to further enhance the Project's economic viability and environmental performance by converting waste rock into a marketable product. If feasible, this undertaking would also remove or significantly reduce the size of the Project's waste rock dumps.

3.3.6 Water Use

The Project will require water for mining, processing, and for other minor uses. It is estimated that approximately 218 m^3/hr, or 960 US gallons per minute (USGPM), will be needed by the Mill to process the ore. Various sources have been considered for this purpose, including:

- Upper Island Pond;
- Long Pond;
- Mine water from the Project's open pits and underground mine;
- Existing shaft near the inactive Director underground mine;
- Existing shaft near the inactive Tarefare underground mine; and
- Clarkes Pond.

In the past, mill process water was taken from Clarkes Pond to feed the nearby mill. However, in the late 1980s/early 1990s, during Minworth's operations, the Pond's water level was observed to drop despite the fact that the dewatering operation of the Blue Beach North underground mine discharged the water at surface and into Clarkes Pond.

As the feasibility study progresses, CFI will evaluate the various sources, or combinations of sources, through additional hydrological and hydrogeological investigations. At this time, the shafts at Tarefare and Director offer promising alternatives, given that historical pumping rates of between 5.68 and 12.52 m^3/hr (1,500 and 3,300 USGPM) from these two mines, respectively, has been documented with no observable effect on nearby watercourses (Cooper 2012).

4.0 ENVIRONMENTAL EFFECTS ANALYSIS METHODOLOGY

The proposed AGS Fluorspar Mine Project requires submission of a Project Registration Document in accordance with the NL *Environmental Protection Act* (EPA) and the *Environmental Assessment Regulations.* There are no requirements for assessment of the Project under the *Canadian Environmental Assessment Act,* 2012. This section describes the approach and methods used to carry out the analysis of environmental and socio-economic effects which are likely to occur as a result of the Project.

In general the analysis involved the following steps:

- determining the valued environmental components (VECs) that may interact with the Project;
- describing and studying the existing environmental setting in which the Project will be constructed and operated;
- conducting a preliminary identification of likely Project-environment interactions;
- establishing the temporal and spatial boundaries of interactions between the Project and the VECs;
- identifying the Project-specific effects, including identification of likely Project effects and recommended mitigation measures; and
- describing the likely cumulative effects for the Project in combination with other physical activities that have been or will be carried out.

The approach and methodology used in this EA Registration Document are based on accepted EA practice, focusing on environmental and socio-economic issues of greatest concern. It is generally acknowledged that an EA is a planning tool and should focus on those components of the environment that are valued by society and/or serve as indicators for environmental change. These components are known VECs and include physical, environmental and socio-economic components.

The Project components and activities that are considered in this EA have been described in Section 2.0 of this EA Registration. This description facilitated the identification of key issues and the selection of spatial and temporal boundaries used in the analysis. The following subsections provide more information on the scoping and methodology involved in this EA.

The scope of this EA Registration was determined by the Proponent and Golder, their consultant, and is based on the proposed Project components and activities, the professional judgment and expert knowledge of the EA team, consultation with the public and regulatory authorities, and the results of field studies conducted in support of this EA.

4.1 Valued Environmental Components (VECs)

This EA evaluates the likely environmental effects of the proposed Project components and activities, throughout all Project phases, with regard to each VEC. By analyzing the likely effects on VECs within the study boundaries, a meaningful evaluation of project effects on relevant environmental aspects can be achieved. The following VECs were identified based on government guidance, consultation with stakeholders, and understanding of the proposed Project:

- Physical Environment (Soil and Geology);
- Atmospheric Environment (Climate, Air and Noise);
- Water Resources (Groundwater, Surface Water and Freshwater Fish and Fish Habitat);
- Terrestrial Environment (Vegetation Communities and Habitat Types, Wetlands and Species at Risk);
- Wildlife (Birds [Terrestrial and Marine] and Species at Risk);
- Marine Environment (Fish and Fish Habitat, Marine Mammals and Species at Risk); and
- Socio-economic Environment (Human Health, Employment and Economy, Infrastructure and Services, Quality of Life, Historic Resources, Navigation, Commercial Fisheries and Tourism).

4.2 Existing Environment

The existing environmental setting includes the environmental or socio-economic elements that were considered when determining likely effects that could occur as a result of the Project. The environmental baseline, describing the existing environment and socio-economic elements as they are at the time of the preparation of this EA Registration, is the basis for determining the potential change and likely environmental and socio-economic effects associated with the Project.

The EA methods and the existing environmental and socio-economic setting in which the Project will be constructed and operated are described in Section 6.0 Existing Environment. All elements referred to as VECs in this analysis are described in Section 6.0; however, only those identified as having possible interactions with the Project were scoped into the analysis and discussed in further detail in Section 7.0 Environment Effects Analysis.

Information from the following sources was reviewed and used to describe the existing environment:

- publicly available topographic and resource maps, aerial imagery, databases, scientific papers, technical reports, government websites, interactive websites, information letters, and fact sheets;
- Project-specific field investigations;
- previous environmental applications prepared for the proposed reactivation of the St. Lawrence Fluorspar Mine;
- environmental applications prepared for other projects in the area; and
- communication with local land users, representatives from local and regional governments, local, provincial and federal regulators, and the general public.

In addition, Ecological Land Classification (ELC) was completed to describe the vegetation and wildlife habitat at the local level, and field surveys were conducted for specific resources. Field surveys completed in support of this analysis are summarized in Section 6.0. Additional surveys required to support the Project, and related Project planning and approvals, are described in Section 7.0.

The results of environmental field surveys conducted for the Project have been included in this EA Registration to the extent that they were available for meaningful analysis and interpretation at the time of writing. The timing, scheduling, and coordination of field surveys conducted to date, and those to be completed in support of detailed

Project planning and other approvals, have been subject to the following limitations and considerations: preferred and optimal season and timing window for various surveys (e.g., fish and fish habitat assessment); and weather.

4.3 Preliminary Identification of Likely Project-Environment Interactions

A preliminary identification of likely Project-environment interactions was undertaken to focus the analysis on the issues of key importance. All relevant Project works or activities were analyzed individually to determine if there was a plausible mechanism for an effect on each VEC during normal Project conditions. A detailed description of the undertaking is provided in Section 2.0 Project Description.

The results were summarized in a matrix illustrating when the Project could interact with each VEC and when adverse effects are likely or possible (Table 4-1). The interactions identified in the matrix were used to focus the description of the existing environment (Section 6.0) and the analysis and mitigation of likely effects (Section 7.0).

Table 4-1: Preliminary Project Interactions with Valued Environmental Components

Valued Environmental Components (VECs)		Project Phase		
		Construction	Operation and Maintenance	Decommissioning and Rehabilitation
Physical Environment	Soil	•	•	•
	Geology[(a)]	—	—	—
Atmospheric Environment	Climate[(b)]	—	—	—
	Air	•	•	•
	Noise	•	•	•
Water Resources	Groundwater	•	•	•
	Surface Water	•	•	•
	Freshwater Fish and Fish Habitat	•	•	•
Terrestrial Environment	Vegetation Communities and Habitat Types	•	•	•
	Wetlands	•	•	•
	Species at Risk	•	—	—
Wildlife	Birds [Terrestrial and Marine]	•	•	•
	Species at Risk	•	•	•
Marine Environment	Fish and Fish Habitat	•	•	•
	Marine Mammals	•	•	•
	Species at Risk	•	•	•

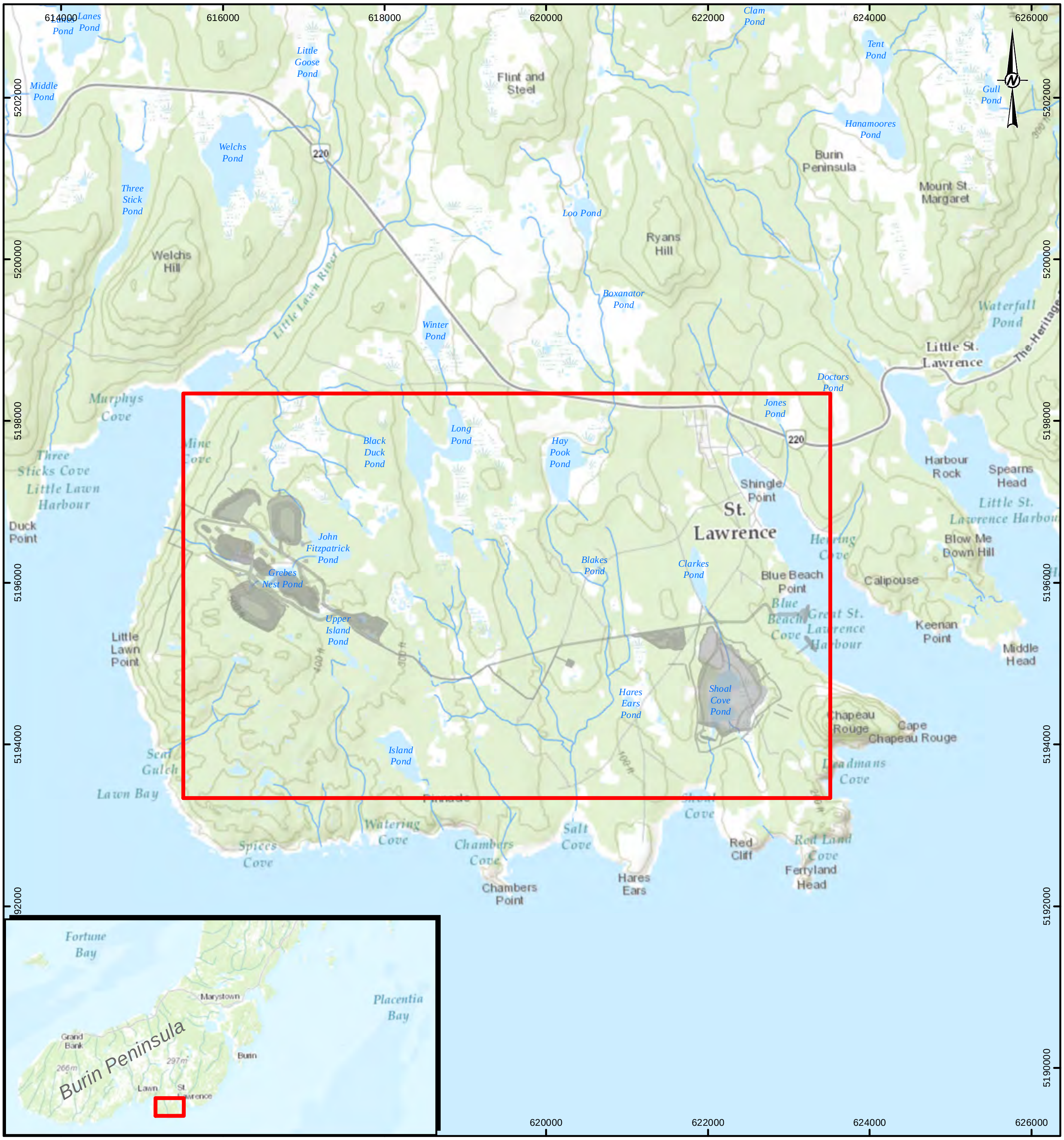
Valued Environmental Components (VECs)		Project Phase		
		Construction	Operation and Maintenance	Decommissioning and Rehabilitation
Socio-Economic Environment	Human Health	●	●	●
	Employment and Economy	●	●	●
	Infrastructure and Services	●	●	●
	Quality of Life	●	●	●
	Historic Resources	●	●	●
	Navigation	●	●	●
	Commercial Fisheries	●	●	●
	Tourism	●	●	●

(a) Geology is described in the existing environment Section 6.1.2 and is considered in the effects analysis in Groundwater (Section 7.3).
(b) Climate is described in the existing environment Section 6.1.1 and is considered in the effects analysis in Air and Noise (Section 7.2).
● = A likely Project-environment interaction could result in an environmental or socio-economic effect.
— = No plausible interactions were identified.

No further analysis beyond baseline setting description is necessary for elements where interactions between the Project component and a VEC are not predicted. Most identified VECs are predicted to interact with the Project during construction, operation and maintenance, and/or decommissioning and rehabilitation, except for geology and climate. All VECs carried in at least one on the Project phases are, addressed in Section 6.0 (Existing Environment) and are carried forward in the effects analysis (Section 7.0). Climate and geology VECs are only described in the existing environment (Section 6.0) and are not carried forward in the effects analysis.

4.4 Temporal and Spatial Boundaries

Establishing boundaries provides a meaningful and manageable focus for the analysis. Temporal and spatial boundaries encompass those periods and areas within which the VECs are likely to interact with, or be influenced by, the Project. Spatial boundaries for this EA Registration are generally limited to the immediate Project area unless otherwise noted. The Project area covers an area of 40 km^2 and includes the Project footprint, the Town of St. Lawrence and the surrounding environment, as shown on Figure 4-1. Some spatial boundaries may extend beyond the Project area (e.g., Water Resources, Terrestrial, Wildlife, Socio-Economic Environment). The study area is defined for those VECs in Section 7.0. Temporal boundaries are generally limited to the duration of, and for a period of time after, the Project activities, which in this case include the entire lifetime of the Project including decommissioning and rehabilitation activities (e.g., >14 years). Temporal boundaries also address other temporal issues such as seasonal sensitivities (e.g., bird breeding).



LEGEND

- Project Area
- Project Footprint

1 0 1 2

Kilometres
1:70,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; WORLD TOPO MAP, ESRI BASEMAPS.
PROJECTION: NAD 1983 UTM ZONE 21N.

CLIENT
CANADA FLUORSPAR INC.

PROJECT
AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE
PROJECT AREA

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT	REV	FIGURE
1407707	0	**4-1**

H:\Projects\Canada Fluorspar\St-Lawrence_NL_Mines\PROJECTS\1407707_EA_AGS_Mine_St-Lawrence\MXD\RevA\1407707_Figure_4-1_Project_Area_8X11_20150514.mxd

4.5 Project Effects Analysis

The Project-specific effects analysis evaluated the environmental and socio-economic effects of the construction, operation and maintenance, and decommissioning and rehabilitation phases of the Project. A step-wise process was used to analyse the environmental effects of the Project in a systematic and transparent manner once the relevant Project works and activities, assessment boundaries, and relevant environmental and socio-economic VECs were identified. The methodology included the following steps: identifying likely environmental and socio-economic effects; and developing technically and economically feasible mitigation.

The effects analysis considers the possible interactions between the Project infrastructure components and activities and the VECs, within the identified spatial and temporal boundaries. Project interactions may be direct (i.e., as a result of a Project infrastructure component or activity affecting a VEC), or indirect (i.e., as a result of a change to one VEC affecting another VEC). Likely effects of the Project on VECs are determined by comparing the baseline conditions to those which are expected to result from the introduction of the Project.

Project activities that were considered in this analysis include the following:

- Construction
  - stripping;
  - excavation and blasting;
  - construction activities and equipment mobilization;
  - water management;
  - energy consumption;
  - transportation;
  - waste management; and
  - staging and storage of construction-related equipment and materials.
- Operation
  - ore extraction;
  - ore processing;
  - transportation;
  - water management;
  - energy consumption;
  - waste management;
  - site and equipment maintenance; and
  - tailings management.

- Rehabilitation and Closure
  - rehabilitation and closure.

Development of mitigation measures to reduce or avoid likely effects on VECs begins with the engineering design phase, and continues throughout the Project planning, EA, and consultation activities for the Project. Refinements are made as specifics are identified and the Project and cumulative effects analysis is conducted. Mitigation is outlined in the effects analysis (Section 7.0) with reference to the Project EPP, and other industry standard practices and regulatory requirements.

4.6 Cumulative Effects Analysis

In addition to the analysis of environmental or socio-economic effects of the Project by itself, the analysis also considered the environmental effects of the Project in combination with those from other projects and activities that have been, or will be, carried out in the foreseeable future, and which may interact with the likely effects of the Project. The cumulative effects analysis aims to determine the interaction of these individual developments to determine how a given project will influence not only the project site or area, but the cumulative effects study area.

Consideration of other physical facilities or activities that have been or will be carried out within the defined spatial and temporal boundaries must, at a minimum, include the following:

- existing projects and activities; and
- those physical facilities or activities for which formal plans or applications have been made or are likely to occur.

Regarding future projects and activities, attention is focused on those that are certain to proceed (e.g., approved) or are reasonably foreseeable, as well as related future development assumptions.

If Project effects on a VEC were predicted, the VEC was carried forward into the cumulative effects analysis. For a VEC where no Project effects were predicted, the VEC was not carried forward for further analysis.

Typically, the likely effects of malfunctions and accidents are not included in the cumulative effects assessment because these events are hypothetical and have a low probability of occurrence.

In this EA Registration, cumulative effects are identified, analyzed and assessed in Section 7.9. The method of cumulative effects analysis follows the same general approach used for the Project effects analysis.

5.0 CONSULTATION AND ISSUES SCOPING

In 2010, the provincial and federal governments released the St. Lawrence Fluorspar Mine Reactivation Project from the EA process. As part of the Newspar project, consultation activities were completed and feedback received from the community was generally supportive. The proposed Project will build on previous environmental studies and design plans completed in support of the Newspar project. Meaningful and respectful consultation is important to CFI in building productive relationships with community members and interested stakeholders, and to improve the Project based on their input. CFI has worked to establish open and transparent communication with potentially interested or affected individuals, organizations and regulatory agencies.

Consultation approach and activities conducted to date are outlined in the following section. An overview of the feedback received from consultation activities is also presented.

5.1 Consultation Approach and Activities

CFI's public participant list includes potentially affected and/or interested stakeholders from several groups outlined in Table 5-1.

Table 5-1: Key Stakeholder Groups

Stakeholder Category	Stakeholder Group
Municipal	Town of St. Lawrence
	Burin Peninsula
	Town of Marystown
	Town of Burin
	Town of Lawn
	Town of Lord's Cove
	Town of Lamaline
	Town of Fortune
	Town of Grand Bank
	Town of Garnish
	Town of Winterland
Regulatory Agencies	NL Department of Environment and Conservation
	NL Department of Natural Resources
	Canadian Environmental Assessment (CEA) Agency
	Major Project Management Office (MPMO)
	Transport Canada
	Fisheries and Oceans Canada
	Environment Canada
	Canadian Wildlife Services
	Health Canada
Economic Development	Burin Peninsula Chamber of Commerce
	Fish, Food and Allied Workers
Education and Training	Keyin College

Stakeholder Category	Stakeholder Group
	St. Lawrence Academy
	College of the North Atlantic (Burin Campus)
Environment and Recreation	Canadian Parks and Wilderness Society
	Newfoundland and Labrador Wildlife Federation
	Newfoundland and Labrador Outfitters Association
	Newfoundland and Labrador Camping Association

There are no designated Aboriginal lands in the St. Lawrence region. Project activities will not affect Aboriginal or First Nations groups within the province.

In early 2015, the following stakeholders were invited to meet with CFI to discuss the Project and the EA process:

- CEA Agency;
- NL DOEC;
- NL DNR; and
- Town of St. Lawrence.

Meetings occurred with these stakeholders and summaries of these meetings are provided in Table 5-2.

A Public Information Session was held on April 16, 2015 at the St. Lawrence Recreation Centre from 6 to 9 pm, with a Project presentation at 6:15 pm. Notification for the Public Information Session was provided in the Southern Gazette newspaper on April 7, 2015, and mailed to key stakeholder groups identified in Table 5-1. Notification for the Public Information Session was also posted at the Town Hall and Post Office in St. Lawrence, as well as Farrell Bros Clover Farm, Aylwards Home Hardware, Aylwards Mini-Mart, East Side Gas Bar, St. Lawrence Local Water Supply Shed, and the St. Lawrence Pharmacy (Pharma Choice). A copy of the Notice as well as the information materials and exit surveys provided at the Public Information Session are provided in Appendix C.

A total of 50 individuals signed in and 42 participants submitted comment forms during the session. A summary of the comments received and issues raised during the Public Information Session is provided in Section 5.2.

5.2 Issues Scoping

Several meetings occurred with municipalities and regulatory agencies to provide an update on the Project, discuss the EA process and answer questions. A summary of the meeting details and key issues identified during these meetings is included in Table 5-2.

Table 5-2: Issues Identified through Agency and Municipal Meetings

Date	Stakeholder	Topic/Issue	Section where issue is addressed
February 26, 2015	CEA Agency	Federal EA requirements	Section 1.4.1: Approval of the Undertaking – Federal
		Water diversion of Grebes Nest Pond	Section 2.3: Construction Activities
April 1, 2015	NL Department of Environment and Conservation	Diversion pipeline and size of drainage area around proposed tailings site	Section 2.2.4: Tailings Management Facility
		Potential effects on municipal drinking water	Section 2.0: Project Description
		Potential effects of dust	Section 7.2: Atmospheric Environment Effects Analysis
April 7, 2015	Town of St. Lawrence Council	Location of security gates and plans for the current office complex (along with effects on walkers on Clarkes Pond road)	Section 2.0: Project Description
		Potential effects on fish as a result of dewatering Grebes Nest Pond	Section 7.3: Water Resources Effects analysis
		Potential effects on cabin owners in the area, specifically access	Section 7.7: Socio-Economic Effects Analysis
		Addition of capacity in TMF for the Newspar projects	Section 2.2.4: Tailings Management
April 15, 2015	Town of St. Lawrence Council	Potential effects of water discharge into the environment downstream of the TMF	Section 7.3: Water Resources Effects analysis
		Potential effects on recreational activities in the area, such as hunting, fishing and use of all-terrain vehicle (ATV) trails	Section 7.7: Socio-Economic Effects Analysis
April 27, 2015	NL Department of Natural Resources	TMF closure concept	Section 2.5: Rehabilitation and Closure

Public Information Session participants were invited to sign in on arrival and circulate the room where information posters were set up. CFI representatives and technical experts were present to answer questions, and record comments and concerns. When exiting the Public Information Session, participants were given a comment form to provide feedback on the Public Information Session and the Project. The comment form was also designed to gather specific information about recreational activities in the Project area, values associated with Grebes Nest Pond and ideas for offsetting potential fisheries habitat loss.

The comment form provided at the Public Information Session included eleven questions. The first five questions related to the Information Session itself and demographic information. The responses to these are summarized below, followed by a table of the comments received, organized by issue category, and including CFI's responses. The remaining 6 questions related to recreational activities, Grebe's Nest Pond valuation and fish habitat offsetting.

The first question inquired about how the participant learned about the Public Information Session. A graphical representation of the responses to the first question is shown in Figure 5-1. The majority heard about the Public Information Session by notices posted in the community. The remaining participants indicated they heard about the Public Information Session through a friend (20%), the newspaper (15%), letter invites (7%), and other means (20%). Other means identified included email, the Town Council and the Burin Chamber of Commerce.

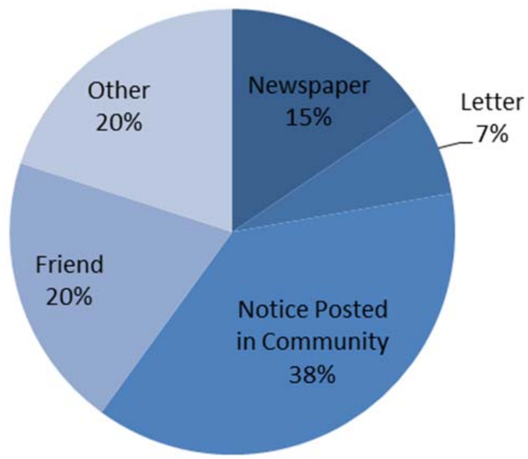


Figure 5-1: Responses to "How did you learn about this Public Information Session?"

The second question related to the community in which the participant resides. A graphical representation of the responses to the second question is shown in Figure 5-2. The majority of participants reside in St. Lawrence. The remaining participants indicated they reside in Marystown (20%), Burin (10%), Garnish (3%), Grand Bank (2%) and Victoria (2%).

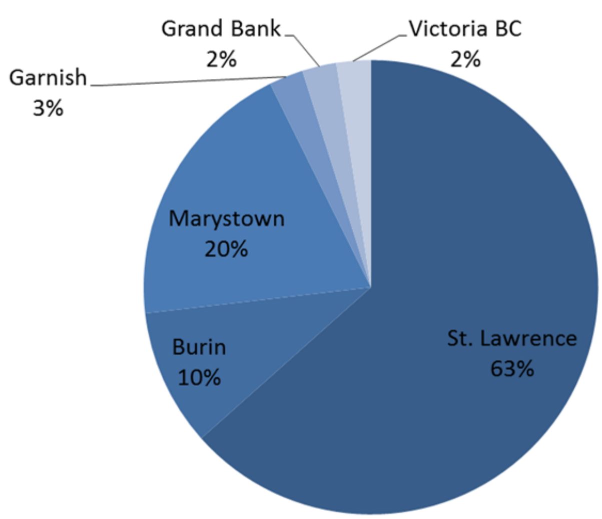


Figure 5-2: Responses to "Which Community Do You Reside In?"

The third question was about the usefulness of the information delivered in the presentation. Responses to the third question are presented graphically in Figure 5-3. The majority found the information presented at this Open House to be very useful with a lot of new information. Six respondents identified that the information provided was somewhat useful with some new information. No respondents indicated that they were neutral about the information presented or that the information provided was not very useful.

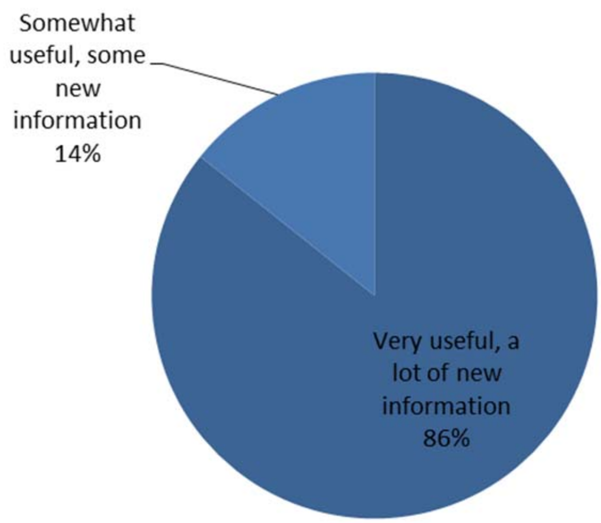


Figure 5-3: Responses to "Was the information in the presentation useful?"

The fourth question asked respondents about the relevance of responses to questions provided by CFI representatives during the Public Information Session. Responses to the fourth question are presented graphically in Figure 5-4. The majority of respondents indicated that information provided by CFI and/or Golder representatives was very useful with a lot of new information provided. Two respondents indicated that they were neutral, with no new information provided and two respondents indicated that the information was somewhat useful with some new information provided.

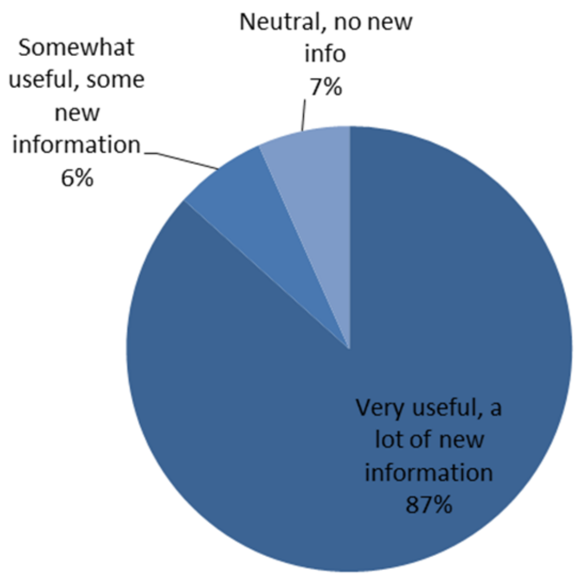


Figure 5-4: Responses to "If you asked a question, were the answers provided by CFI and/or Golder useful?"

The fifth question asked respondents "What was your main reason for attending this Public Information Session?" Responses to the fifth question are presented in Figure 5-5. Respondents indicated a variety of reasons, including learning more about the Project (22 participants), employment and business interests (9 participants), and future opportunities (6 participants). Some representatives from the Keyin College indicated that they were interested in offering the Hard Rock Miner Program in St. Lawrence.

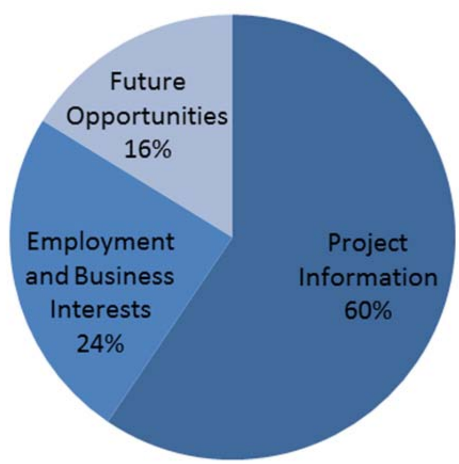


Figure 5-5: Responses to "What was your main reason for attending this Public Information Session?"

The sixth question asked respondents if they use any water bodies for fishing near the Project area. Seven participants stated that they fish in the area and water bodies that they identified for fishing activities included Grebes Nest Pond (5 participants), John Fitzpatrick Pond (3 participants), Bill Hill Pond (1 participant), Shoal

Cove Pond (1) areas along the road to Little Lawn (1 participant) and along Chamber Cove Road (extension of Pollux Crescent) (1 participant). Thirty-three participants said that they do not fish near the Project area.

The seventh question asked respondents if they use any water bodies for recreational activities, other than fishing, near the Project area. Ten respondents identified that they practice recreational activities such as hunting, hiking and picnicking in the following areas: Shoal Cove Beach (4 participants), Shoal Cove Pond (1 participant), Clarkes Pond (1 participant), Brook at Salt Cove (1 participant) and Chambers Cove area (1 participant). Thirty-one participants said that they do not practice recreational activities near the Project area.

The eighth question of the comment form asked respondents to rate their value of Grebes Nest Pond on a scale from 1 to 5, with 1 being "I place very little value on Grebes Nest Pond and rarely use the area around the pond" and 5 being "I place a high level of value on Grebes Nest Pond and use the area around the pond frequently". Figure 5-6 provides a graphical representation of the responses. Sixty percent (60%) of respondents indicated they place little or no value on Grebes Nest Pond.

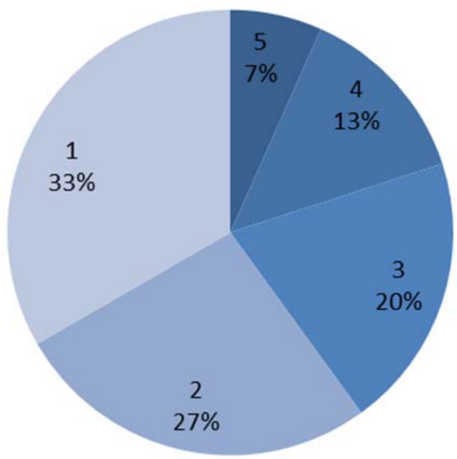


Figure 5-6: Ratings of Value of Grebes Nest Pond

(1 = I place very little value on GNP and rarely use the area around the pond; 5 = I place a high level of value on GNP and use the area around the pond frequently)

Respondents were also asked about what types of activities were practiced in the area around Grebes Nest Pond and to provide any additional comments related to Grebes Nest Pond. Respondents indicated that walking/hiking and fishing, as well as hunting, Skidoo and all-terrain vehicle (ATV) use were common activities in the Grebes Nest Pond area. Two respondents indicated that the area around Grebes Nest Pond is a recreational area and they don't want to lose that aspect of the area. Several participants indicated that they would move to other areas for fishing and other recreational activities once the Project was operational.

Participants were asked, through two means, about offsetting fisheries habitat loss. An interactive display board requested participants identify on a map any water bodies being used for commercial or recreational activities. Based on the information collected as part of the comment form and through discussions with participants during the Public Information Session, participants identified Grebes Nest Pond, John Fitzpatrick Pond, Bill Hill Pond, Upper Island Pond, Little Lawn River, Little Lawn Pond and Shoal Cove Pond are used for fishing and Shoal

Cove Beach, Shoal Cove Pond, Chambers Cove, Salt Cove, Blue Beach Cove, and Clarkes Pond are used for other recreational activities including hunting, ATV use and berry picking.

Verbal comments, questions and concerns from participants were recorded during the Public Information Session. A summary of the frequency of issues raised is shown in Figure 5-7. The most frequently raised issues by participants included economy and employment, and current/historical land use.

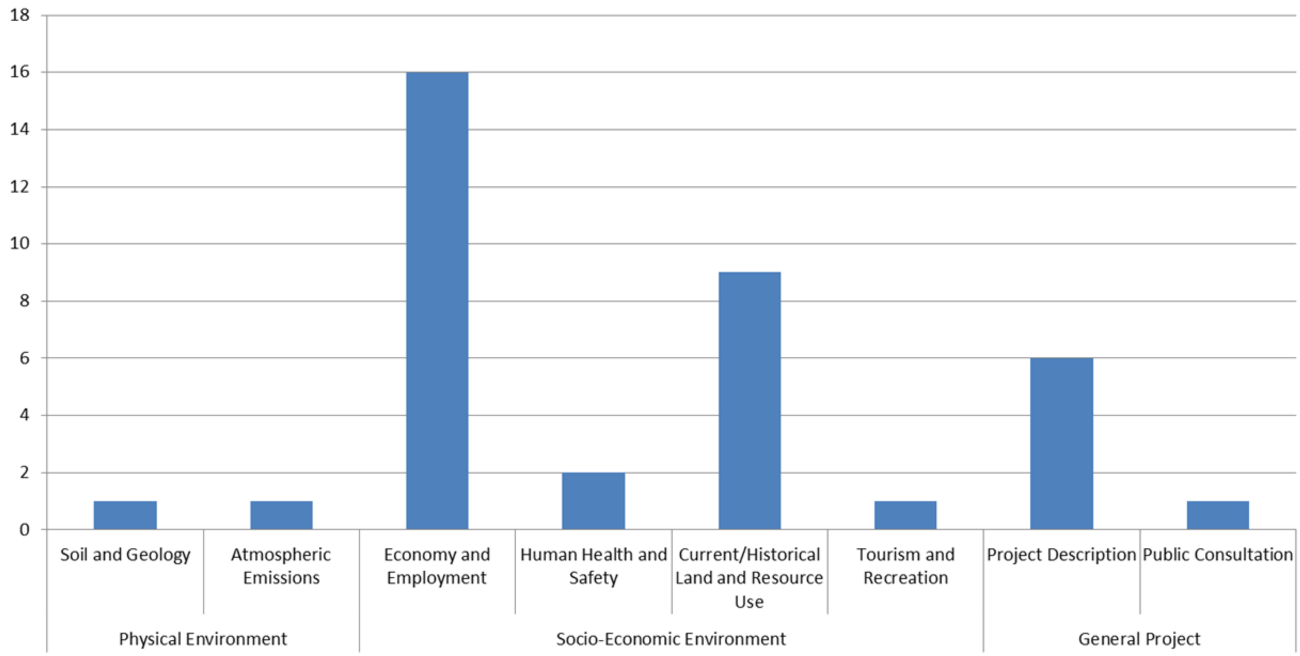


Figure 5-7: Frequency of Issues Identified through Written and Verbal Comments Received

A list of written and verbal comments received, identified by issue, with responses is provided in Table 5-3.

Table 5-3: Summary of Key Issues Raised by Public Information Session Participants

Category	Issue	Comment Summary	Response and Location in EA Registration
Physical Environment	Atmospheric Emissions	Will there be dust during transport of concentrate from site to Terminal? There was a lot of dust when Alcan was operating and it should be mitigated.	Mitigation measures will be implemented to reduce dust emissions. Additional information is provided in Section 7.2: Atmospheric Environment Effects Analysis.
	Soil	This year the sand completely disappeared at Shoal Cove Beach.	Comment noted. This change is not caused as a result of the Project. Information on Soil and Geology is provided in Sections 6.1.2: Soil and Geology and 7.1: Physical Environment Effects Analysis.
Socio-Economic Environment	Economy and Employment	I want to learn more about the Project and future opportunities.	Priority for employment and business opportunities will be given to qualified workers and businesses in the region.
		Business opportunities.	

Category	Issue	Comment Summary	Response and Location in EA Registration
		I'm interested in local development.	Additional information on employment, business opportunities and diversity is provided in Section 2.6: Occupations.
		I'm interested in the business potential of the Project.	
		I'm very interested in getting the mine in order, possible work for myself.	
		I'm very keen for the Project to start so I can get work close to home.	
		I have worked across Canada and am keen on the mine start up.	
		I'm interested in spin off employment.	
		What are the salaries going to be at AGS? How many people will work?	
		There should be workplace diversity. Women are well suited for some of the jobs (such as operation of mine haul trucks).	
		This is a great Project and we hope the economics are right this time.	CFI is currently assessing the Project cost through a pre-feasibility study. Additional information about the justification for the Project is provided in Section 3.1: Project Purpose and information on Project funding is provided in Section 8.0: Funding.
		Future development of the community.	The Project will generate opportunities for community and economic development. Information about socio-economic effects is available in Section 7.7: Socio-Economic Effects Analysis.
		The Project would bring lots of economic development opportunities to the region.	
Socio-Economic Environment	Human Health and Safety	Safety will be important. The previous mine operators did not do much for the safety of workers.	Safety is a top priority for CFI and a strong emphasis will be placed on safety of workers during all phases of the Project. A Project-specific Health and Safety plan will be developed for each Project phase. Additional information on health and safety is provided in Section 7.7: Socio-Economic Effects Analysis.
		Open pit mine is much safer than underground mining. It is good to hear that CFI is proposing open pit mining.	
	Current/Historical Land and Resource Use	I hunt birds along the Blue Beach Cove. Will I still have access to that area once the Marine Terminal is developed?	Certain areas that are currently used for recreational activities will be restricted or lost as a result of the Project. However, there are other

Category	Issue	Comment Summary	Response and Location in EA Registration
		My dad fishes in Grebes Nest Pond but said that he wants the mine to go ahead and he will go fish in other ponds.	areas with similar types of vegetation, wildlife populations and habitats that will remain accessible. Additional information on effects on land and resource use activities and proposed mitigation measures is provided in Section 7.7: Socio-Economic Effects Analysis.
		I use the roads around AGS for quads in the summer.	
		Is this Project going to affect locals who berry pick and fish in this area?	
		I also pick bakeapples and blueberries in the AGS area, there are lots of berries there.	
	Tourism and Recreation	I would not like to lose the recreational aspects of this area.	
General Project	Project Description	What is the life of the Mine?	Based on the current resource estimate, life of the Project is estimated at 10 years. Information on the Project schedule is provided in Section 2.7: Project Schedule.
		What is happening to the Tarefare Project?	The Newspar project is on hold. Additional information on the status of the Newspar project is provided in Section 1.0: Introduction.
		Are you going to use BBN Mill?	A new Mill will be built to accommodate the higher production rate. Additional information on the Mill is provided in Section 2.2.1: Mill and Ancillary Buildings
		What is the difference in ore types at AGS?	A description of the ore in the AGS Vein is provided in Section 6.1.2 Soil and Geology:
		Wind conditions in Blue Beach Cove will affect ship loading operations.	An evaluation of the potential effects of wind on ship loading activities has been completed. The results of this analysis and the proposed mitigation measures are presented in Section 7.2: Atmospheric Environment
		Many miners prefer open pit work because they don't feel trapped and it is safer.	Safety is a top priority for CFI and a strong emphasis will be placed on safety of workers during all phases of the Project. A Project-specific Health and Safety plan will be developed for each Project phase. Additional information on health and safety is provided in Section 7.7: Socio-Economic Effects Analysis.

Category	Issue	Comment Summary	Response and Location in EA Registration
	Public Consultation	Advertising of information session should be on the advertisement channel [on television].	This comment will be considered for future Public Information Sessions. Information on how the session was advertised is provided in Section 5.1: Consultation Approach and Activities.

6.0 EXISTING ENVIRONMENT

A description of the physical, biological and socio-economic environments in the Project area is provided in the following section.

6.1 Physical Environment

The description of the physical environment in the Project area includes an overview of climate, soil and geology, surface water, groundwater and air quality.

6.1.1 Climate

The Town of St. Lawrence is located on the south east portion of the Burin Peninsula where the climate is heavily influenced by the ocean. Summers are cool and winters are mild with limited to no snow cover. Fog is frequent all year round along the Burin Peninsula especially during the spring and summer.

The average daily temperature for the area is 4.8 ^{o}C. Precipitation occurs all year round as rain with some snow in the winter months. Average monthly precipitation ranges from 110.2 mm (July) to 165.9 mm (October), with an annual total of 1,617 mm. Average annual potential evapotranspiration is estimated to be 479.2 mm, occurring mainly in the months June to September. The following long-term averages, shown in Table 6-1, are based on the analysis of the 1966 to 2005 monthly climate data for the St. Lawrence, NL meteorological station, which is located less than 10 km east of the AGS mine site and less than 3 km northeast of the TMF site (Environment Canada 2015a).

Table 6-1: 1966 to 2005 Long-Term Averages for the St. Lawrence Meteorological Station

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
Mean Maximum Temperature (°C)[1]	-0.4	-0.7	1.5	5.1	9.6	13.4	17.1	18.4	15.7	11.0	6.5	2.3	8.3
Mean Minimum Temperature (°C)[1]	-7.3	-7.8	-5.2	-1.6	1.8	5.5	9.9	11.3	8.2	4.0	0.3	-4.1	1.3
Total Precipitation (mm)[2]	144.5	131.2	129.3	125.7	123.6	123.0	110.2	120.3	147.9	165.9	154.2	145.2	1,617
Rainfall (mm)[2]	73.1	71.5	90.0	107.5	120.0	121.9	109.1	119.2	146.4	163.0	141.1	103.5	1,364
Snowfall (cm)[2]	82.8	63.9	40.9	18.5	1.8	0.2	0.0	0.0	0.0	1.0	12.2	44.7	264.9
Potential Evapotranspiration (mm)[3]	0.0	0.0	1.1	15.4	49.1	75.2	102.1	101.0	71.7	43.4	18.4	1.9	479.2

NOTES:

1 Missing temperature data for the St. Lawrence meteorological station were estimated by linear regression on temperature data for the Winterland meteorological station

2 Missing precipitation data were estimated using the normal ratio method from precipitation data for the Westbrook St. Lawrence and Winterland meteorological stations

3 Potential evapotranspiration data for the St. Lawrence station were estimated using the Thornthwaite equation from temperature data

A SmartBay meteorological/oceanographic buoy is located at the mouth of Placentia Bay (46° 58.9’ N, 54° 41.1' W), less than 60 km from St. Lawrence Harbour. This buoy measures real time data of a variety of atmospheric and surface conditions including, wind speed and direction, air temperature, humidity, dew point, barometric pressure, water temperature, salinity, current speed, current direction, wave height, wave direction and wave period (SmartBay 2015).

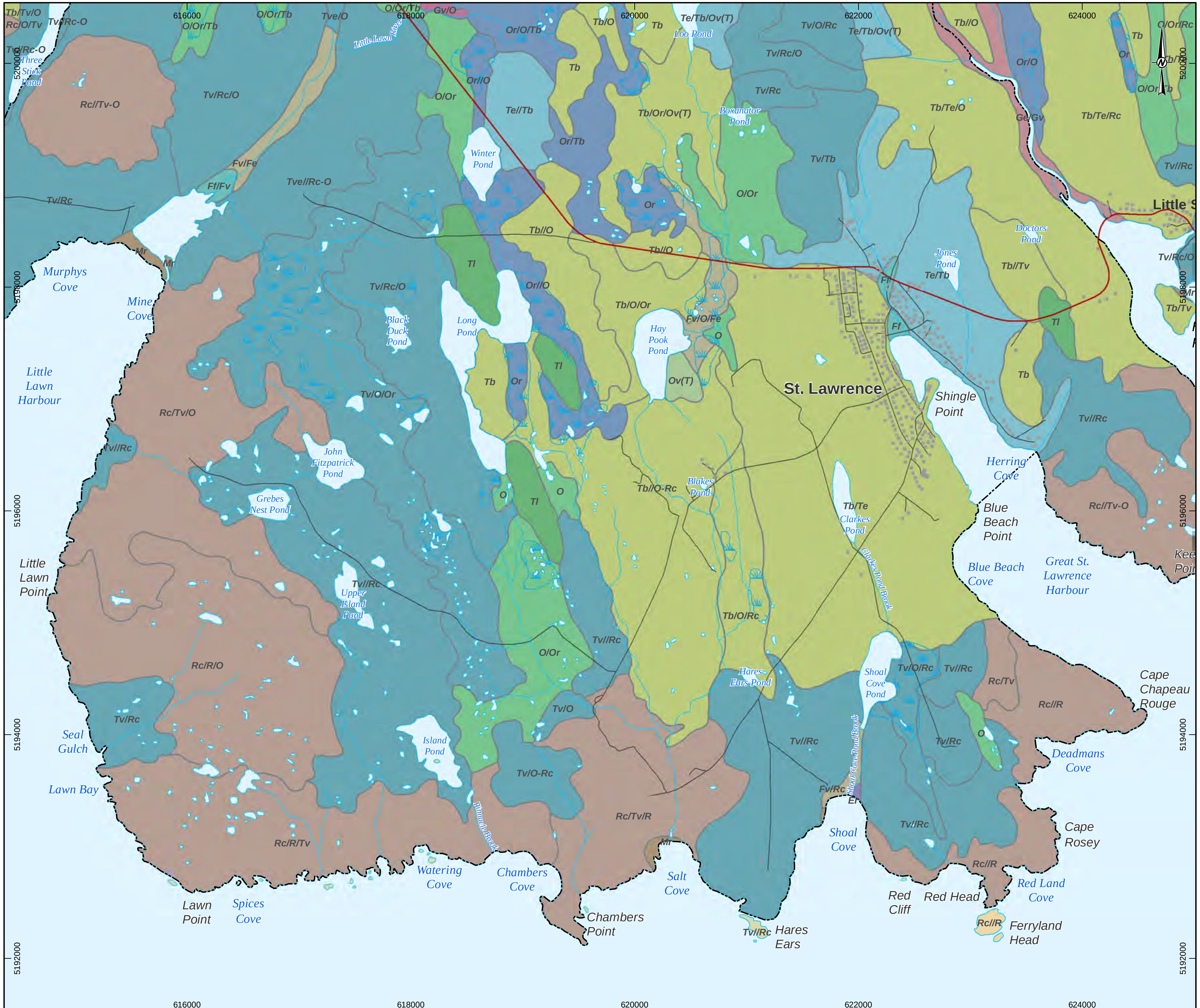
6.1.2 Soil and Geology

Based on provincial Department of Natural Resources (DNR) surficial geology mapping (DNR 2014), soils in the area generally consist of a relatively thin (1.5 m) to thick (15 m) glacial till consisting of silty sand and gravel with varying percentages of cobbles and boulders over much of the Project area (Figure 6-1). On higher ground to the northeast, areas of bog are underlain by glacial till predominate. At the highest topographic levels, such as the hills of Cape Chapeau Rouge and western parts of the Project area, bedrock is exposed or covered by a thin veneer of till or vegetation.

The St. Lawrence area is part of the Avalon Zone of the Appalachian mountain chain in eastern NL. This Zone is characterized by thick dominantly subaerial, volcanic rocks and marine to terrestrial clastic sedimentary rocks of the Late Precambrian Age. These rocks are locally overlain by shallow marine sedimentary and minor volcanic rocks of Cambrian age. Both sequences are locally overlain with angular unconformity by Devonian and Carboniferous age sedimentary and volcanic rocks. The Avalon Zone is intruded by several Late Precambrian and Late Devonian to Carboniferous granites (Roscos Postle Associates (RPA) 2013; Agnerian 2015).

The Project area is primarily underlain by the Late Devonian St. Lawrence Granite and associated porphyritic rocks of similar composition. The porphyritic rocks are locally referred to as rhyolites, and these form sills and dykes within the host metasedimentary rocks at the Mine Site. These igneous rocks intrude older Late Precambrian to Ordovician metasedimentary (argillite) and minor metavolcanic rocks of the Inlet Group (Figure 6-2). The metavolcanic rocks include porphyritic andesite, lithic and crystal tuff, and brecciated tuff (RPA 2013; Agnerian 2015).

The St Lawrence area hosts at least 40 fluorite veins that range up to 3 km in length and, in some places, exceed 30 m in thickness. These veins are genetically and spatially associated with the St Lawrence Granite and its associated porphyritic rocks. These veins typically follow major faults that cut through the granitic/rhyolitic and metasedimentary rocks of the Project Area. The major veins in St Lawrence are shown on Figure 6-2, including the AGS, Tarefare, Director, and Blue Beach veins (Agnerian 2015).



LEGEND

DETAILED SURFICIAL GEOLOGY

- Aeolian ridge
- Fluvial fan
- Fluvial veneer
- Glacial blanket
- Glacial eroded and dissected
- Glacial lineated
- Glacial veneer
- Glaciofluvial eroded and dissected
- Glaciofluvial veneer
- Marine ridge
- Organic
- Organic ridge
- Organic veneer
- Rock concealed by vegetation

HYDROGRAPHY

- Watercourse
- Waterbody
- Wetland

Er	Aeolian ridge
Ft	Fluvial terrace
Fv	Fluvial veneer
Gv	Glaciofluvial veneer
Mr	Marine ridge
O	Organic
Or	Organic ridge
Ov	Organic veneer
R	Rock
Rc	Rock concealed by vegetation
Tb	Glacial blanket
Te	Glacial eroded and dissected
Tl	Glacial lineated
Tv	Glacial veneer

0 1 2
Kilometres
1:35,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; GEOSCIENCE ATLAS, GOVERNMENT OF NEWFOUNDLAND AND LABRADOR; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE

SURFACE GEOLOGY

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT No. 14-07707 Rev. 0 FIGURE **6-1**

LEGEND

DETAILED BEDROCK GEOLOGY

- Plutonic felsic
- Siliciclastic marine shale
- Volcanic mafic marine
- Fluorspar Vein

HYDROGRAPHY

- Watercourse
- Waterbody
- Wetland

0 1 2
Kilometres
1:35,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; GEOSCIENCE ATLAS, GOVERNMENT OF NEWFOUNDLAND AND LABRADOR; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

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CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE

BEDROCK GEOLOGY

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT No.	Rev.	FIGURE
14-07707	0	6-2

Acid Generation Potential

A preliminary geochemistry program was conducted to gain an initial understanding of the acid generation and metal leaching potential of the mine wastes and ore. A total of sixteen samples, including; 10 waste rock, 2 ore 2 DMS float and 2 tailings samples were collected from the Project to conduct a preliminary geochemical characterization. Geochemical static test work was completed on all sixteen samples to evaluate the potential for acid generation and metal leaching (Golder 2015b).

Acid Base Accounting (ABA) testing was completed on all sixteen samples to determine the acid generating potential of the waste rock, ore, DMS floats and tailings. All samples of waste rock, ore, and DMS float had neutral to slightly alkaline paste pH values and low sulphide contents (<0.9 wt% as S). Based on the Mine Environment Neutral Drainage (MEND), 2009 Net Potential Ratio (NPR) / carbonate NPR (CO_3-NPR) criteria, all waste rock samples have NPR values greater than 2 and are classified as non-acid generating. The metasediments and rhyolite waste rock samples have low carbonate contents but also have low sulphide contents. These waste rock samples have CO_3-NPR values less than 1 however, given the low sulphide content and neutral conditions observed in NAG tests these samples are considered non-acid generating. Ore and DMS float samples have NPR and CO_3-NPR values greater than 2 and are classified as non-acid generating. Net Acid Generating (NAG) pH values for all samples were greater than 4.5, which classifies all the samples as being non-acid generating. Based on the ABA and NAG test results of the waste rock, ore, DMS float and combined tailings samples collected from the AGS project, are considered to be non-acid generating.

The tailings sample with sulphide concentrate has a CO_3-NPR value between 1 and 2 and has an uncertain potential to generate acidic conditions. However, this sample is considered non-acid generating based on the NAG tests. The tailings samples were collected from processing of low carbonate ore which only represents approximately 34% of the ore to be mined. The combined tailings with sulphide concentrate is considered the worst case in terms of geochemical properties of the expected tailings. Since the majority of tailings will come from the high carbonate ore (approximately 66%) which has approximately twice the amount of carbonate based on the ABA results, the tailings is considered non-acid generating. Furthermore, the current tailings facility closure design includes maintaining a water cover over the tailings at closure. This would further limit reactivity of the tailings and therefore, no additional testing is likely required at this time. Additional static testing will be completed to confirm the acid generation potential of the combined tailings, including high carbonate ore, once samples are available.

Metal Leaching Potential

The results of short-term leach test were compared to NL *Environmental Control Water and Sewage Regulations* (EWSR) (2003) and Canadian Council of Ministers of the Enivronment (CCME) water quality guidelines for the protection of aquatic life (CCME 2007) to identify any potential parameters of concern. The results indicate that metal leaching from the waste rock, ore and DMS float does not appear to be an issue under neutral pH conditions. In the shake flask extraction (SFE) results, fluoride concentrations were above CCME guidelines in all samples while select metals (e.g., arsenic, chromium, copper, and lead) were above either CCME or EWSR guidelines in at least one sample. The NAG leachate results were consistent with the SFE results.

The tailings decant water reported elevated concentrations of fluoride, arsenic, copper, iron and lead compared to CCME guidelines consistent with the short-term leach test results of the tailings. Therefore, SFE results are a good indicator of expected tailings porewater concentrations.

6.1.3 Surface Water

The St. Lawrence area has been shaped by glaciation into three broad but elongated southward sloping upland valley troughs separated by rounded ridges that form the main watersheds. The direction of these features follows the structure of the geology. At the coast, the land drops from an elevation of 300 m to 500 m in the north to about 50 m to 100 m in the south. Gradients in the Project area are generally low and many shallow ponds of various sizes have formed (Newfoundland Fluorspar Ltd. 1967). Flat areas between ponds are often occupied by heavily saturated upland bogs. Before 1967, a canal was constructed to divert water from the Director Mine to the lower reaches of Salt Cove Brook, which reduced flows into the upper reaches of this brook and Director Mine.

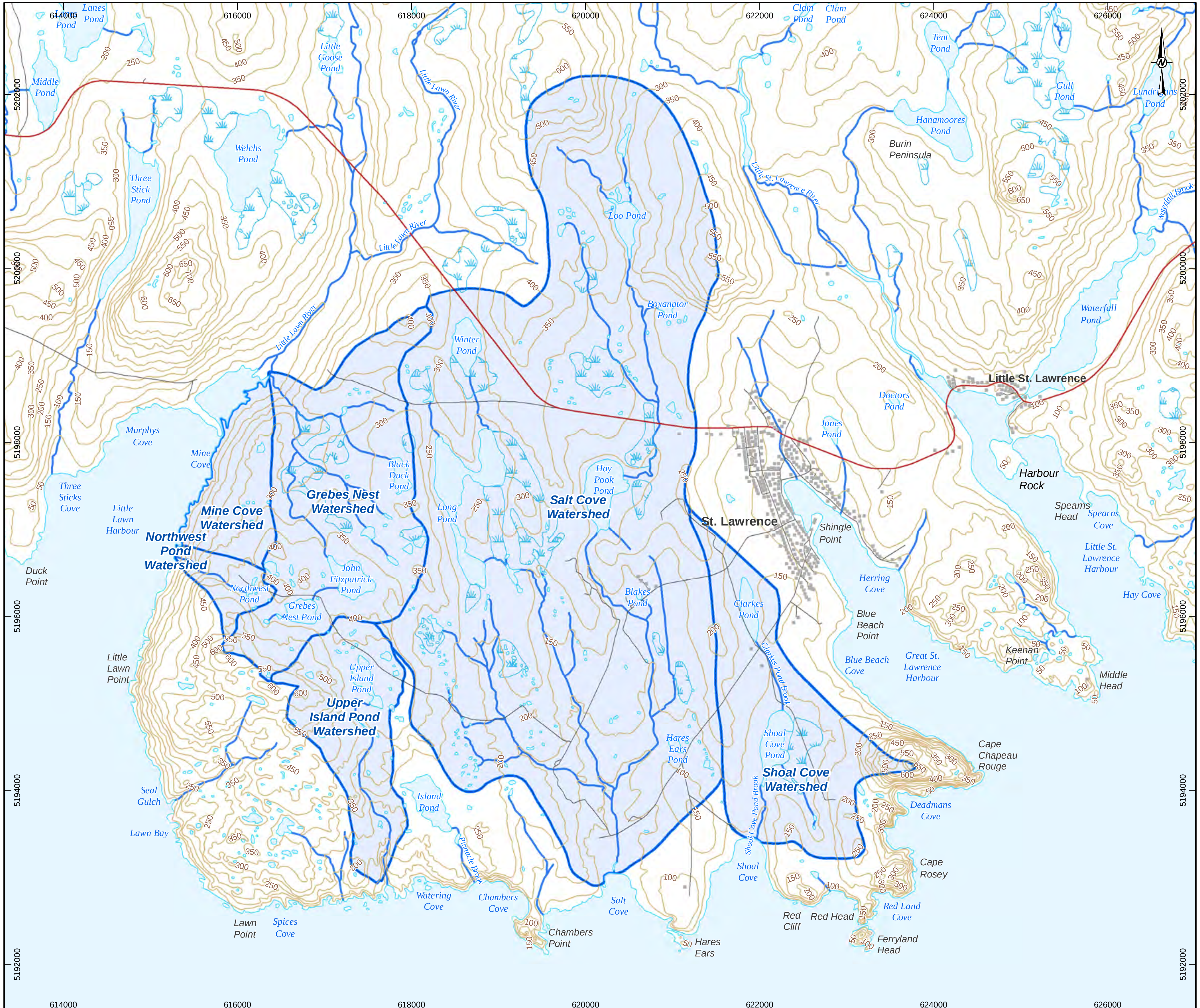
The entire Project area can be sub-divided into several separate catchments or watersheds (Figure 6-3). Additional details on the watersheds in the Project area are presented in Section 6.2.3 Freshwater Fish and Fish Habitat.

The existing mill site and the former tailings facility are located in the Shoal Cove Brook watershed, which is approximately 3.9 km² in size. The catchment encompasses two ponds (Shoal Cove Pond [15.7 hectares (ha)] and Clarkes Pond [10.0 ha]) as well as the brook itself (ADI Nolan Davis 1990). During previous mining activities, Shoal Cove Pond was used for tailings deposition. Based on previous data analysis, Clarkes Pond is in hydraulic continuity with, and partially fed by, groundwater and was historically used as the water supply for previous underground mining operations. A hydrological assessment was conducted in 2009 to determine flow duration curves for the Shoal Cove Brook watershed and the results were incorporated into the 2009 EPR (CFI 2009).

The valleys located near the centre of the Project area form the Salt Cove watershed, where the previously mined Tarefare and Director Veins are located. The size of the topographic catchment of Salt Cove Brook to the sea is approximately 24.7 km². The Salt Cove Brook watershed covers Salt Cove Brook from its mouth at Salt Cove, northward to the outlet of Haypook Pond. The outflow of Haypook Pond currently flows through a man-made diversion channel constructed in the 1950s to redirect water from the Director Mine area. The Salt Cove Brook watershed also encompasses two larger ponds outside the Project area; Haypook Pond and Long Pond. Similar to the Shoal Cove Brook watershed, a hydrological assessment was conducted in 2009 to determine flow duration curves for Salt Cove Brook and the results were incorporated into the 2009 EPR (CFI 2009).

In the vicinity of the AGS Vein, there are four watersheds, as shown on Figure 6-3. The largest is the Grebes Nest watershed (approximately 5.5 km^2), followed by the Upper Island watershed (approximately 2.5 km^2),the Northwest Pond watershed (approximately 0.6 km^2) (the Northwest Pond watershed) and the Mine Cove watershed (approximately 1.4 km^2) (Golder 2015a).

The Grebes Nest watershed flows to the northwest of the Project area and includes two major waterbodies; Grebes Nest Pond (0.08 km^2) and John Fitzpatrick Pond (0.15 km^2). The watershed flows in a general northwest direction and contains a main channel stream approximately 2.7 km in length that flows from a series of small ponds to the southwest of Grebes Nest Pond into Little Lawn Harbour (Golder 2015a).



LEGEND

WATERSHED

Watershed Area

TOPOGRAPHY

- Building
- Highway
- Road
- Contour Line (interval: 50 ft)
- Watercourse
- Waterbody
- Wetland

0 1 2

Kilometres
1:45,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; GEOSCIENCE ATLAS, GOVERNMENT OF NEWFOUNDLAND AND LABRADOR; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE

SURFACE WATER

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-13
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT No.	Rev.	FIGURE
14-07707	0	6-3

The Upper Island Pond watershed contains Upper Island Pond (0.82 km^2) located near its headwaters as well as another smaller unnamed pond (0.01 km^2) to the northeast. The Upper Island Pond watershed flows in a southern direction into a small cove located near Watering Cove. The length of the stream that begins at Upper Island Pond is approximately 900 m (Golder 2015a).

The Northwest Pond watershed contains a small waterbody, Northwest Pond (0.004 km^2). The watershed also drains to the west over steep slopes, into a small cove located to the south of Mine Cove (Golder 2015a).

The Mine Cove watershed contains several small intermittent/ephemeral creeks that drain to the west over very steep slopes and discharge into Little Lawn Harbour.Stream flows in the Project area follow a bimodal pattern with a primary peak occurring in April (in response to snowmelt) and a secondary peak in December (due to rainstorms). The lowest flows occur in the summer months of July and August (when evapotranspiration by ground vegetation cover is highest). Average monthly runoff depths range from 58.8 mm (August) to 191.3 mm (April), with an annual total of 1,401 mm based on the analysis of the 1966 to 2005 daily stream flow data for Environment Canada's Garnish River near Garnish hydrometric station, which is located approximately 35 km north-northeast of the Project area (Environment Canada 2015a).

Water quality analysis has been conducted in all the watersheds between 1984 and 2014. This includes baseline results from the Shoal Cove and Salt Cove watersheds in 1984 to 1985, 2009 and 2014, operations results in the Shoal Cove watershed from 1986 to 1990 and baseline results from the AGS watersheds in 2014. Water quality results were compared to the NL EWSR (2003) and CCME water quality guidelines for the protection of aquatic life (CCME 2007) to identify any potential parameters of concern.

Water quality in the Salt Cove watershed was collected at six locations in 2009 and one location in 2014. The water can be summarized as having neutral to slightly acidic pH values (6.3 – 7.1). Parameters that exceeded guidelines in at least one sample location included fluoride, total phosphorus, aluminum, cadmium, iron and lead.

The Shoal Cove watershed water quality samples were collected at eight locations between 1984 and 2014. In 1984 and 1985, water quality sampling was conducted throughout the watershed. The water quality at that time can be summarized as having neutral to slightly acidic pH values (6.2 – 8.5). Parameters that exceeded guidelines in at least one sample location included fluoride, total phosphorus, aluminum, copper, iron, lead and zinc. Mining occurred in the Project area between 1986 and 1990 with water quality samples collected between the Clarkes Pond inlet and the Shoal Cove Pond outlet. Parameters that exceeded guidelines in at least one sample location included fluoride, total suspended solids, iron, lead and zinc. With the exception of zinc, all other parameters exceeded guidelines in at least on sample location during sampling programs in 2009 and 2014 (Golder 2015b).

In 2014, water quality sampling was conducted in the AGS watersheds. Water quality in the AGS watersheds can be summarized as having acidic pH values (5.0 – 6.2) and elevated concentrations (compared to CCME guidelines) of fluoride, total phosphorus, aluminum, iron and lead. Additional detail on available water quality information in the project area is provided in Appendix D.

6.1.4 Hydrogeology

Granite has little or no intrinsic permeability, but contains significant fracture zones which give the granite a secondary permeability. The overlying glacial till can act as a shallow aquifer. The occurrence and movement of groundwater in St. Lawrence Granite is controlled by the frequency and degree of interconnectivity of the faults. Groundwater tends to occur in areas where mineralisation occurs, which are in discrete secondary aquifers.

Such aquifers also tend to be linear in conformity with the principal direction of faulting. Hydraulic conductivity describes the ease with which groundwater can move through pore spaces or fractures. The hydraulic conductivity of igneous rocks such as granite ranges from 10^{-11} m/s to 10^{-3} m/s for unfractured to fractured rocks (Freeze Cherry 1979). As part of the 2009 EPR, it was conservatively assumed that the hydraulic conductivity of St. Lawrence aquifers was within the range 10^{-8} m/s to 10^{-6} m/s and the veins 10^{-1} m/s to 10^{-5} m/s (CFI 2009). Based on pumping tests conducted in 2014 at the exploration boreholes of the AGS Vein, hydraulic conductivity ranged from 10^{-7} m/s to 10^{-6} m/s (Golder 2015a).

The faults present in the bedrock provide transmission paths and storage for groundwater, although storage of groundwater in the bedrock is low. The overlying glacial till constitutes a shallow aquifer that also provides storage for groundwater. This lateral extent of the shallow aquifer in the overlying glacial till is limited to the surface catchment or watershed in which it lies. The hydraulic conductivity of the till was estimated at 10^{-5} m/s to 10^{-4} m/s (CFI 2009).

When the 2009 EPR was completed, there was limited groundwater data available to define groundwater levels and flows with certainty. However, groundwater levels were expected to be close to ground surface and water levels of ponds were believed to represent groundwater levels (CFI 2009). Based on field work conducted in 2014 (Golder 2015a), groundwater levels in monitoring wells in the vicinity of the AGS Vein were observed to be near ground surface. It was also assumed that shallow bedrock flow directions are the same as surface water flows, as shown on Figure 6-3. It was determined that the shallow aquifer system is largely controlled by surface runoff and local recharge, which makes groundwater levels sensitive to dry periods. Water quality results in deep bedrock wells showed elevated concentrations of colour, aluminium, iron and total manganese, which is consistent with observations for surface water quality, as described in Section 6.1.3 Surface Water (Golder 2015a).

6.1.5 Air Quality

The closest government air quality monitoring station is located in Burin at the Department of Transportation and Works Salt Pond Depot, which is approximately 24 km northeast of St. Lawrence. This station monitors particulate matter less than or equal to 2.5 microns and 10 microns, total suspended particulate, ozone, nitric oxide, nitrogen dioxide, oxides of nitrogen, carbon monoxide and sulfur dioxide levels. The near real-time data is available on the provincial DOEC website (DOEC 2015).

The dominant wind direction is away from the community, with predominant winds blowing from the northwest to the southwest and strongest winds generally coming from the west, as shown on the wind rose diagram (Figure 6-4).

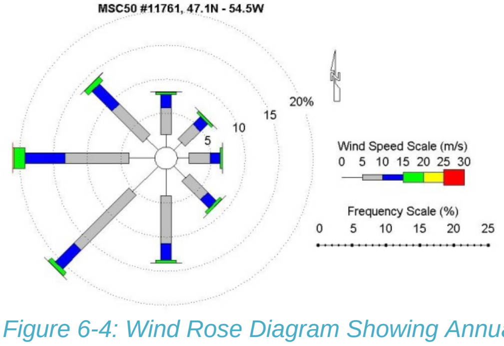


Figure 6-4: Wind Rose Diagram Showing Annual Average Wind Speeds and Frequencies for Weather, Station #11761

Source: CFI 2010a

Historically, there have been health concerns with the air quality in the underground mines in St. Lawrence, which include silicosis and high incidence of lung and respiratory cancers. It was determined that the dust levels from dry mining conditions in the 1930s and 1940s were the cause of silicosis and elevated radon and radon daughters were the cause of the high incidences of lung and respiratory cancer. There are naturally occurring radionuclides in the geology of the area which is the source of the radon. Groundwater that flowed through fractures of the host rock transported these elements, allowing them to escape as radon gas into underground openings. Proper ventilation and wet drilling was introduced by Alcan in the late 1950s to early 1960s. This effectively reduced to acceptable levels the inhalation exposure of miners to these agents (CFI 2009).

These issues remain a concern today; however, with today's technology, and health and safety standards it is much easier to proactively prevent and protect workers and the public.

6.2 Terrestrial and Freshwater Biological Environment

The description of the terrestrial and freshwater biological environment includes an overview of the vegetation, wetlands, freshwater fish and wildlife located in the Project area, including species at risk.

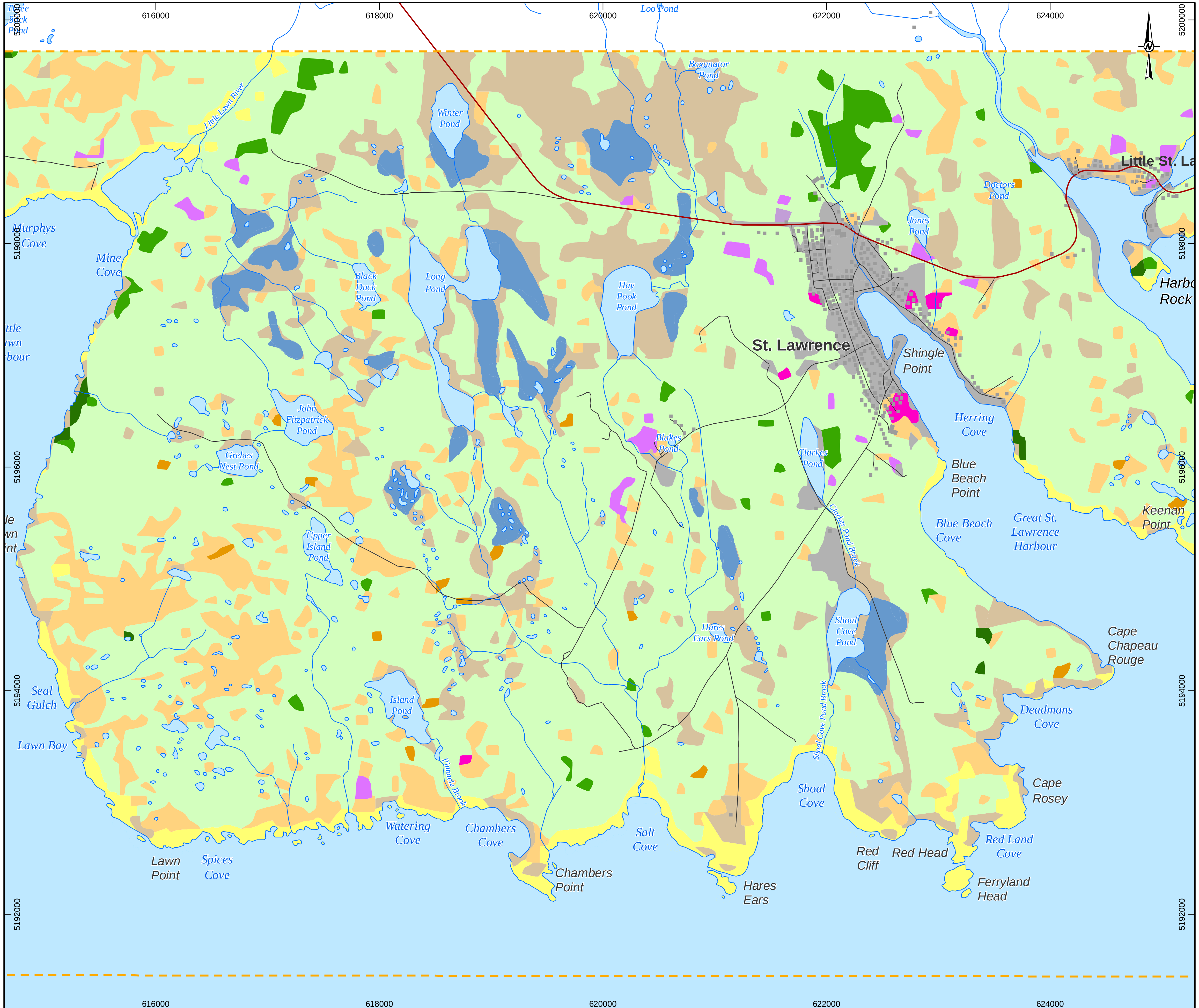
6.2.1 Vegetation

Vegetation communities, habitat types and vegetation species at risk are described in this section.

6.2.1.1 Vegetation Communities and Habitat Types

The Project area falls within the Eastern Hyper-Oceanic Barrens Ecoregion. Tree cover within this Ecoregion is limited; trees are stunted and consist mainly of balsam fir. Coastal barrens of heath moss (*Rhacomitrium lanuginosum*), as well as plateau and blanket bogs are characteristic of the region. Partridgeberries (*Vaccinium vitis-idaea L. var. minus Lodd*), bakeapples (*Rubus chamaemorus*), and blueberries (*Vaccinium angustifolium*) are commonly found in this ecoregion (DOEC 2008).

The presence of vegetation communities and habitat types found within the Project area were identified through Ecological Land Classification (ELC) presented in Figure 6-5. The ELC was conducted at a physiognomic level, including cover structure dominated by vegetation type and slope. An area of approximately 10,400 ha was selected for the ELC, equivalent to the area possibly affected by the Project (ELC Study Area). The ELC is based on CanVec+ data provided by the Canada Centre for Mapping and Earth Observation (Natural Resources Canada [NRCan] 2014), specifically the relief, hydrography (e.g., waterbodies, rivers and reef), disturbances (e.g., roads, clearings and buildings), and wooded areas, where identified. The CanVec+ data characterizes wooded areas using the Canadian Forest Service of Earth Observation for Sustainable Development (EOSD) and the Agriculture and Agri-Food Canada (AAFC) of National Land and Water Information Service (NLWIS).



LEGEND

ECOLOGICAL LAND CLASSIFICATION

- Limit of ELC Study Area
- Anthropogenic
- Barren
- Broadleaf Dense
- Coastal
- Coniferous Dense
- Coniferous Open
- Coniferous Sparse
- Mixwood Dense
- Mixwood Sparse
- Shrub Tall
- Shrub Low
- Wetlands
- Body of Fresh Water
- Body of Salt Water

0 1 2
Kilometres
1:35,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; GEOSCIENCE ATLAS, GOVERNMENT OF NEWFOUNDLAND AND LABRADOR; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE

ECOLOGICAL LAND CLASSIFICATION

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT No.	Rev.	FIGURE
14-07707	0	6-5

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As shown on Figure 6-5, fifteen (15) high level ecological land classes were identified in the ELC Study Area. The ecological land classes represent a particular community of vegetation cover and habitat type and the level of classification reflects the resolution used to delineate the class. Table 6-2 provides a description of each of the identified ecological land classes within the ELC Study Area.

Table 6-2: Ecological Land Classes

Class	Description
Barren	Terrestrial habitat representing primarily a coastal area composed of undulating bedrock with many rock outcrops dotted with bryophytes, lichens or moss.
Barren with Wetlands	Terrestrial habitat representing low-lying vegetation dotted with bryophytes, lichens, moss and wetlands such as blanket bogs.
Broadleaf Dense	Terrestrial habitat having more than 60% crown closure where broadleaf trees are 75% or more of total basal area.
Body of Fresh Water	Aquatic habitat consisting of any inland waterbody (lake, pond) or watercourse (river) that contains fresh water.
Body of Salt Water	Aquatic habitat consisting of any coastal waterbody (ocean) or watercourse (fiord) that contains salt water.
Coniferous Dense	Terrestrial habitat representing fairly productive, closed-crown forests having greater than 60% crown closure where coniferous trees are 75% or more of total basal area.
Coniferous Forest	Terrestrial habitat with predominantly coniferous forests or treed area that may include mixed forests and scrubland area.
Coniferous Open	Terrestrial habitat having very little forest cover (26 to 60% crown closure) where coniferous trees are 75% or more of total basal area.
Disturbance (Buildings or Industrial and Commercial Area	Groups of cleared lots and buildings operated or arranged for human activity that is primarily industrial, commercial, institutional and or considered as brown fields that can include buildings and old mining sites that have been abandoned.
Mixewood Dense	Terrestrial habitat composed of mixed coniferous and broadleaf/deciduous forest or treed areas.
Mixewood Sparse	Terrestrial habitat having of only 10 to 25% crown closure where neither coniferous nor broadleaf tree account for 75% or more of total basal area.
Reef	A rock formation that is alternatively covered and uncovered by the tide.
Shrub Low	Terrestrial habitat having at least 20% ground cover which is at least one-third shrub or shrubland vegetation community having an average shrub height less than or equal to 2 m.
Shrub Tall	Terrestrial habitat having at least 20% ground cover which is at least one-third shrub or shrubland vegetation community having an average shrub height greater than or equal to 2 m. Typically in the North, moist to wet erect tall shrub greater than 40 cm forming more than 25% of this vegetation cover. The remaining cover typically consists of graminoids, lichen, dwarf shrubs.
Wetlands	Water saturated habitat where there is little or no drainage and having a minimum size $100m^2$ such as a bog, fen, swamp or marsh.

Source: Natural Resources Canada (NRCan) 2014.

The ELC confirms the dominant presence of open coniferous tree cover (e.g., tuckamore in low-lying areas or scrub conifers along slopes), barrens, wetlands (including bog and marshes) and disturbed habitat (brownfields). In particular, the existing mill site is a brownfield site.

In 2013 and 2014, during geotechnical investigations to provide an assessment of the fluorspar mineralization within the AGS Vein, it was noted that the Project area is covered with many small ponds and limited amounts of coniferous forest (approximately 90% treeless). Vegetation was noted to be primarily black spruce, balsam fir and tamarack trees. Outcrops are locally abundant and flanked by glacial till or boulder fields (Agnerian 2015).

6.2.1.2 Vegetation Species at Risk

Protected species can be designated provincially under the NL *Endangered Species Act,* federally by the *Species at Risk Act* (SARA), or also by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) who operate independently of government. Species at risk are defined as any species listed federally as Special Concern, Threatened, Endangered, Extirpated or Extinct by COSEWIC (2015) or under the SARA Registry (Government of Canada 2015), or provincially as Endangered, Threatened or Vulnerable by DOEC (2014) under the *Endangered Species Act*.

In addition to the species that have been formally designated and protected under provincial or federal legislation (i.e., species at risk), it is important to consider other regionally rare species that could potentially be found in the Project area. These are considered to be of species of conservation concern and the following organizations can provide information on species occurrence and distribution:

- COSEWIC is an independent body of experts responsible for identifying and assessing species that are considered to be at risk and for providing information and advice to provincial and federal governments regarding their potential protection. In NL, designations under the *Endangered Species Act* follow recommendations from COSEWIC and/or the NL Species Status Advisory Committee. Although designations by COSEWIC or other such organizations do not in itself constitute legal protection (i.e., under SARA or the *Endangered Species Act*), they do provide a general indication of species that may be considered rare, and thus, of some degree of potential conservation concern (COSEWIC 2015).
- The Atlantic Canada Conservation Data Centre (ACCDC) is a non-profit organization that manages the species occurrence and distribution databases for the Wildlife Division of the DOEC, as well as other Atlantic provinces. The ACCDC ranks wildlife species known to occur in the province with consideration of the following factors: population size; number of occurrences; geographic distribution; trends in population; trends in distribution; threats to population; and threats to habitat. These ACCDC S-ranks (provincial rank) and N-ranks (national rank) provide useful and relevant indications of the relative rarity and current status in of a species (ACCDC 2015).
- The National General Status Working Group (NGSWG) is a committee within Environment Canada that monitors and reports on the general status of wild species on a five year cycle. A Wild Species report by the Canadian Endangered Species Conservation Council compiles information on a large number of Canadian wild species to assess the general status of species and species groups. This information can reveal early signs of trouble before species reach a critical condition (Environment Canada 2011).

A desktop survey was completed to identify vegetation species at risk or of conservation concern that have the potential to be affected by the Project (i.e., NL Range based on the SARA Registry [Government of Canada 2015]). At present there are twelve provincially listed plant, lichen, and moss species under the *Endangered Species Act*, eight federally listed species under SARA, and 10 species listed by COSEWIC that are known to occur in NL (DOEC 2014a; Government of Canada 2015; COSEWIC 2015) as presented in Table 6-3.

Table 6-3: Provincially and Federally Listed Vegetation Species in Newfoundland and Labrador

Common Name	Scientific Name	Provincial Listed Status (*Endangered Species Act*)[1]	Federal Listed Status (*Species at Risk Act*)[2]	Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Listed Status[3]
barrens willow	*Salix jejuna*	Endangered	Endangered (Schedule 1)	Endangered
blue felt lichen	*Degelia plumbea*	N/A	No Status (No Schedule)	Special Concern
boreal felt lichen	*Erioderma pedicellatum*	Vulnerable	Special Concern (Schedule 1)	Special Concern
crowded wormseed mustard	*Erysimum inconspicuum var. coarctatum*	Endangered	N/A	N/A
Fernald's braya	*Braya fernaldii*	Threatened	Threatened (Schedule 1)	Endangered
Fernald's milk-vetch	*Astragalus robbinsii var. fernaldii*	Vulnerable	Special Concern (Schedule 1)	Special Concern
Griscom's arnica	*Arnia griscomii ssp. Griscomii*	N/A	N/A	Threatened
Long's braya	*Braya longii*	Endangered	Endangered (Schedule 1)	Endangered
low northern rockcress	*Neotorularia humilis*	Endangered	N/A	N/A
Mackenzie's sweetvetch	*Hedysarum boreale subsp. Mackenzii*	Endangered	N/A	N/A
mountain fern	*Thelypteris quelpaertensis*	Vulnerable	N/A	N/A
northern bog aster	*Symphyotrichum boreale*	Endangered	N/A	N/A
Porsild's bryum	*Mielichhoferia macrocarpa*	Threatened	Threatened (Schedule 1)	Threatened
rattlesnakeroot	*Prenanthes racemosa*	Endangered	N/A	N/A
mountain holly fern	*Polystichum scopulinum*	N/A	Threatened (Schedule 1)	Threatened
vole ears lichen	*Erioderma mollissimum*	N/A	Endangered (Schedule 1)	Endangered

Notes: N/A = not applicable (not listed).
[1] DOEC 2014a.
[2] Government of Canada 2015.
[3] COSEWIC 2015.

For the purposes of this EA Registration, species at risk includes only those designated species that are known to occur, or to have occurred, in the vicinity of the Project area, and not all provincially and federally protected species. None of the sixteen species presented in Table 6-3 are known to occur within the Burin Peninsula, and are not expected to be located in the Project area.

ACCDC data received in 2015 for historical observations of species at risk or species or conservation concern was completed within a 5 km radius of the Project area, centred on Grebes Nest Pond. The ACCDC request identified only one historical occurrence of a plant species of conservation concern (Figure 6-5). Marsh fern (*Thelypteris palustris var. pubescens*) is ranked as S3 by ACCDC, indicating that this species is considered vulnerable to extirpation. Marsh fern is neither provincially or federally listed and is not considered globally rare outside of NL. In addition, based on the opinion of species experts within ACCDC, it is considered possible, but unlikely, for boreal felt lichen (*Erioderma pedicellatum*) to occur (Table 6-3). Additional information on these species, including detailed species descriptions can be found in the 2009 EPR (CFI 2009).

6.2.2 Wetlands

Wetlands are defined as areas of land that are saturated or covered by water for some time during the growing season, have poorly drained soils, and host predominantly hydrophytic (i.e., water-loving) vegetation. Wetlands provide or support a wide range of important ecological, social and economic functions and services in watersheds, such as water filtration, water storage (water recharge), flood reduction and control, carbon absorption, erosion control, and wildlife habitat and conservation.

Both the federal and provincial governments recognize the need to conserve or sustain wetland functions. The *Federal Policy on Wetland Conservation* (Government of Canada 1991) directs all federal government departments to conserve or sustain wetland functions during delivery of their programs. The NL DOEC has also developed a *Policy for Development in Wetlands* (DOEC 2001). The objective of the provincial policy is to manage developments in wetlands such that water quantity, water quality, hydrologic characteristics or functions, and terrestrial and aquatic habitats of the wetlands are not adversely affected. The policy allows and establishes the criteria for issuing a permit under Section 48 of the *Water Resources Act*, SNL 2002 cW-4.011.

In October 2013, the Town of St. Lawrence and the provincial government signed a Municipal Habitat Stewardship Agreement to provide for protection and enhancement within designated conservation areas that may affect wetland and upland habitats that are fundamental in maintaining and enhancing wildlife populations in the province. In accordance with the Agreement, the Town of St. Lawrence manages wetland habitat within the Management Units and Stewardship Zones in conjunction with technical advice provided by the DOEC, Wildlife Division.

The ELC confirmed at least 10% of the ELC Study Area is composed of wetland habitats including blanket bogs and marsh. Wetlands in the ELC Study Area have a minimum size of 100 m^2. From the ELC mapping presented in Figure 6-5, wetland habitat is concentrated in the northern portion of the ELC Study Area. Portions of the ELC Study Area found to contain wetland habitats generally include the following:

- west and south of Black Duck Pond (northeast and northwest of John Fitzpatrick Pond);
- south of Winter Pond;
- south and east of Long Pond;
- north and east of Haypook Pond;
- north of Hares Ears Pond; and
- east of Shoal Cove Pond.

6.2.3 Freshwater Fish and Fish Habitat

The following is a consolidation of the existing historical and current information on the fish and fish habitat characterization and surveys within the six watersheds potentially affected by the Project: Shoal Cove and Salt Cove watersheds in the east and Grebes Nest, Upper Island, Northwest Pond and Mine Cove watersheds in the vicinity of the Mine and Mill Site to the west (Figure 6-3).

Information on the two eastern watersheds (i.e., Shoal Cove Brook and Salt Cove Brook) is based on publically available information and literature including:

- habitat characterization of Clarkes Pond (Barnes 1985);
- surveys of Shoal Cove Pond completed in 1990 and 1995 (ADI Nolan Davis 1990, 1995);
- fish habitat survey of Salt Cove Brook (ADI Nolan Davis 1996);
- *Canadian Environmental Assessment Act* (CEAA) screening report completed in 1997 (DFO 1997b); and
- water quality and fish habitat programs conducted in 2009 (AMEC Earth & Environmental [AMEC] 2009).

Information on the western watersheds is based on field studies completed in 2014 in support of this Project by Sikumiut Environmental Management Ltd. (SEM) focused on the Grebes Nest Pond watershed (SEM 2015). Additionally, in 2014, surface water flow monitoring data were collected by Golder for waterbodies in the vicinity of the AGS Vein, including Upper Island Pond, John Fitzpatrick Pond and Northwest Pond (Golder 2015a). Additional fish and fish habitat surveys to support the assessment of the potential effects of the Project on the western watersheds are planned for 2015.

Specific benthic invertebrate information is not available for any of the seven watersheds; however, it was previously noted during the course of other surveys that invertebrates were extremely scarce at all stream and pond locations for the eastern watersheds (ADI Nolan Davis 1990).

6.2.3.1 Shoal Cove Brook Watershed

Watershed Description

The Shoal Cove watershed encompasses Shoal Cove Pond and Clarkes Pond, as well as the watercourse itself, and is approximately 3.9 km^2 in size (Figure 6-3). Shoal Cove Pond also has two small sub-tributaries which drain from the east (named T1) and southeast (named T2). The watershed is relatively short with an overall length of 3.3 km and the primary source of water is from groundwater and precipitation. The watershed originates in a fen located north of Clarkes Pond. The main stem of the watercourse is divided into three sections, from upstream (north) to downstream (south):

- Clarkes Pond Inlet drains from the north into Clarkes Pond;
- Clarkes Pond Brook flows south between Clarkes Pond and Shoal Cove Pond; and
- Shoal Cove Brook flows south from the southwest corner of Shoal Cove Pond and discharges to Shoal Cove (ADI Nolan Davis 1990, 1995).

Field surveys conducted in 1990 recorded that the water within Shoal Cove Pond and Shoal Cove Brook was murky. Previous water sampling within the inlet and outlet streams of Clarkes Pond and Shoal Cove Pond has indicated little turbidity throughout the system in August with no observations of excessive sedimentation indicated; however, sampling conducted in April indicated greater turbidity throughout the system (8.9-38.5 nephelometric turbidity unit [NTU]) with the highest levels (38.5 NTU) found in the upper reaches of Shoal Cove Brook suggesting that previously deposited sediment within Shoal Cove Pond may become re-suspended during high flow or adverse weather conditions. In addition, analysis of water samples collected in 2009 within the Shoal Cove watershed indicated exceedances of the Canadian Council of Ministers of the Environment (CCME) guidelines (CCME 2014) for cadmium, aluminum, copper and iron (AMEC 2009).

Fish Populations

According to studies conducted in 1990 and 1995 (ADI Nolan Davis), the Shoal Cove watershed contains brook trout (*Salvelinus fontinalis*) and American eel (*Anguilla rostrate*). Fish from Clarkes Pond were found to be in better condition than fish further downstream; fish from Shoal Cove Pond exhibited shorter length, lower weight, and many were heavily infested with black spot (ADI Nolan Davis 1995). Like the previous studies, fish studies conducted in 2009 found that brook trout appeared to be more abundant in Clarkes Pond Brook compared to Shoal Cove Brook (AMEC 2009). Detailed species descriptions can be found in the 2009 EPR (CFI 2009).

Fish Habitat

Fish habitat for the various sections of the watercourses and the ponds within the Shoal Cove watershed is presented in Table 6-4.

Table 6-4: Fish Habitat in the Shoal Cove Pond Watershed

Watercourse Reach/Pond	Relevant Dimensions	Flow/Discharge	Substrate	Habitat Type	Other Information
Clarkes Pond Inlet [(a)]	1.2 m wide, 0.19 m deep	0.113 m^3/s	Cobble covered by fine silt.	Good salmonid rearing habitat with limited spawning habitat in isolated gravel pockets. Good feeding and holding areas for larger fish in deeper pools, pockets or backwater eddies. Riffle or riffle/run habitat.	Inlet is a small stream which winds its way through a fen for approximately 300 m. Primary source of water was formerly from mine drainage prior to the mine closing.
Clarkes Pond [(a, b, c, d)]	0.1 km^2 surface area, 1.5 m average depth	N/A	Thick aquatic vegetation (pondweed [*Potamogeton sp*.] and yellow water lily [*Nuphar variegatum*]); thick muddy bottom in northern portion and rocky substrate in lower quarter.	N/A	Water is supplied to the pond through groundwater/underground springs and formerly from mine drainage from Clarkes Pond Inlet. In 1985 the northern three-quarters of the pond were chocked with weeds and in the late summer the pond fills with lily pads (*Nymphaeaceae sp*.). The shoreline banks are stable and well vegetation with grass, alder (*Alnus sp*.), spruce (*Picea sp*.) and fir (*Abies sp*.).
Clarkes Pond Brook [(f)]	1.6 m to 3.4 m wetted width; 6.4 m to 11.8 m channel width; 0.07m to 0.12 m depth range	0.08 m^3/s	Rubble, cobble and gravel with sand, silt and small boulder found as a minor proportion.	Good salmonid rearing habitat with limited spawning habitat in isolated gravel pockets. Good feeding and holding areas for larger fish in deeper pools, pockets or backwater eddies. Riffle or riffle/run habitat.	Brook is approximately 1,000 m long. Total area of fish habitat in the brook is in the range of 1,000 to 4,000 m^2 and areas with substrate suitable for spawning are located in areas with no cover. Stream banks are variable, with some sections affected by vegetation removal (the 60 m section below Clarkes Pond is primarily composed of exposed soil, gravel, alder and grass), whereas some sections flow through natural wooded and fen areas.
Shoal Cove Pond [(a)]	0.16 km^2 surface area; 1.8 m max depth	N/A	The bottom of the pond is covered with a thick layer of fine silt; patches of emergent vegetation (i.e., *Potamogeton sp.)* occur on the east side, northeast and southeast corner.	Tailings disposal has resulted in the deposition of tailings throughout the pond.	The pond is shallow throughout, especially towards the northern end. Tailings from settling basins located upgradient of the pond have migrated and infilled a large portion of the pond (approximately 50%). Unlike Clarkes Pond, the water levels in Shoal Cove Pond fluctuate seasonally.

Watercourse Reach/Pond	Relevant Dimensions	Flow/Discharge	Substrate	Habitat Type	Other Information
Shoal Cove Brook [e, f]	2.1 m to 4.5 m wetted width; 5.6 m to 9.2 m channel width; 0.09 m to 0.38 m depth range	0.177 m^3/s	Small boulder, rubble, cobble and gravel with sand, silt and large boulders found as a minor proportion; more frequent and deeper pools than upper reaches.	Primarily good salmonid rearing habitat with limited spawning habitat in isolated gravel pockets with small areas (less than 1m long) of migratory habitat consisting of faster flowing (rapid) water. Discharge into Shoal Cove at low flow conditions crosses sandy beach with unstable channel (barrier to fish passage).	Brook is approximately 600 m long. Banks are steep in places and well vegetated with grass, alder, blueberry, fir and spruce. The lower 70m of the stream, prior to reaching the beach of Shoal Cove, is located in a marshy area. The upper 100m of the brook has been diverted from its historical route, channelized and the banks have been stabilized with rock as a result of previous mine tailings management activities.

Notes:
N/A = not applicable (no information available).
[a] ADI Nolan Davis 1990.
[b] Barnes 1985.
[c] Burin Minerals Ltd. 2009.
[d] DFO 1997b.
[e] ADI Nolan Davis 1995.
[f] AMEC 2009.

6.2.3.2 *Salt Cove Brook Watershed*

Watershed Description

The Salt Cove Brook watershed is approximately 24.7 km^2 in size and encompasses Salt Cove Brook from its mouth at Salt Cove, north to the outlet of Haypook Pond, approximately 4.6 km in length (Figure 6-3). The outflow of Haypook Pond flows through a man-made diversion channel constructed in the 1950s to re-direct water from the Director Mine area. The re-directed section of Salt Cove Brook (approximately 1.3 km in length) resulting from the diversion channel is also included in this description, as the 1996 Compensation Plan established between CFI and DFO for the Project, includes re-establishing fish habitat in this area (DFO 1997).

The Salt Cove Brook watershed encompasses two larger ponds outside the Project area; Haypook Pond and Long Pond located to the north. Salt Cove Brook also has two tributaries (T-1 and T-2) which drain from the west of the Project area. The main stem of Salt Cove Brook is divided into seven sections, from downstream (south) to upstream (north):

- Section A (from the mouth of Salt Cove Brook at Salt Cove to the bridge on Iron Springs Road);
- Section B (from Iron Springs Road bridge to the mouth of the second tributary – T-2);
- Section C (from the second tributary to the junction of the diverted, former stream bed);
- Section D (from the junction of the diverted, former stream bed to the washed out intersection of an old overland trail and the existing stream channel diversion);
- Section E (from the washed out intersection to the point of the proposed Compensation Diversion);
- Section F (from the point of the proposed Compensation Diversion to Haypook Pond);
- Section G (the diverted, former stream bed from where the Compensation Diversion will enter to where it will rejoin the existing stream) (ADI Nolan Davis 1996).

Field surveys conducted in 2009 recorded that the concentration of cadmium, aluminum and iron in the Salt Cove Brook watershed exceeded CCME (2014) guidelines. Turbidity values for April ranged from 8.8 to 9.3 NTU while all readings in August were 0.0 NTU (AMEC 2009).

Fish Populations

According to previous studies (ADI Nolan Davis 1996; AMEC 2009), the Salt Cove watershed contains brook trout, American eel and Atlantic salmon (*Salmo sala*). Atlantic salmon were found within Section B (as juveniles) and Section F (as fry) whereas the only eel located was in Section E, and brook trout were found throughout the system (ADI Nolan Davis 1996). A comparison of fish from the Salt Cove Brook watershed and Shoal Cove watershed indicated that trout are smaller in the Salt Cove watershed (ADI Nolan Davis 1996). Detailed species descriptions can be found in the 2009 EPR (CFI 2009).

Fish Habitat

Fish habitat for the various sections of the watercourses and the ponds within the Salt Cove watershed is presented in Table 6-5. Effects on Salt Cove Brook are primarily due to the diversion of water away from the natural stream channel and into a linear man-made diversion channel which contains little instream structure conducive to productive fish habitat. In addition, a concrete dam constructed in one of the upper reaches is considered a barrier to fish passage (CFI 2009).

Table 6-5: Fish Habitat in Shoal Cove Watershed

Watercourse Reach/Pond	Relevant Dimensions	Flow/Discharge	Substrate	Habitat Type	Other Information
Section A [(a)]	440 m length; 13.5 m wetted width; 5,933 m^2 surface area	N/A	Primarily cobble and boulder substrate.	Good salmonid rearing habitat, limited spawning in isolated gravel pockets. Good feeding and holding areas for larger fish in deeper pools, pockets or backwater eddies. Primarily riffle habitat. The gravel beach serves as a barrier to the movement of fish in and out of the system; however, under certain conditions the mouth of the brook has been open.	A pond approximately 60 m by 150 m is located on the southern end of the section created by an extensive gravel beach. There is a single pool in the riverine portion and there is little overhanging vegetation or undercut banks.
Section B [(a)]	574 m length; 10.1 m wetted width; 5,739 m^2 surface area	N/A	Primarily cobble, boulder and bedrock substrate.	Good salmonid rearing habitat, limited spawning in isolated gravel pockets. Good feeding and holding areas for larger fish in deeper pools, pockets or backwater eddies. Primarily riffle habitat. Small sections of poor rearing habitat with no spawning capabilities, used for migratory purposed.	Greater amount of pool habitat than Section A.
Section C [(a)]	1.0 km length; 9.2 m wetted width; 9,631 m^2 surface area	N/A	Primarily cobble and boulder substrate. Lesser amounts of gravel and sand.	Good salmonid rearing habitat, limited spawning in isolated gravel pockets. Good feeding and holding areas for larger fish in deeper pools, pockets or backwater eddies. Primarily riffle habitat.	Considered to be the most conducive salmonid habitat with substrate diversity, presence of pools, back eddies, and well developed morphology.
Section D [(a)]	312 m length; 6.0 m wetted width; 1,870 m^2 surface area	N/A	Dominated by larger substrates; cobble and boulder.	Good salmonid rearing habitat, limited spawning in isolated gravel pockets. Good feeding and holding areas for larger fish in deeper pools, pockets or backwater eddies. Primarily riffle habitat.	Straight man-made channel section bound by steep banks approximately 3 to 4 m high. Moderate to steep stream bed channels.
Section E [(a)]	899 m length; 5.1 m wetted width; 4,557 m^2 surface area	N/A	Dominated by larger substrates; cobble and boulder.	Good salmonid rearing habitat, limited spawning in isolated gravel pockets. Good feeding and holding areas for larger fish in deeper pools, pockets or backwater eddies. Primarily riffle habitat.	Straight man-made channel section bound by steep banks approximately 3 to 4 m high. Moderate to steep stream bed channels.

Watercourse Reach/Pond	Relevant Dimensions	Flow/Discharge	Substrate	Habitat Type	Other Information
Section F [(a)]	1.3 km length; 4.9 m wetted width; 6,542 m^2 surface area	N/A	Dominated by larger substrates; cobble, boulder and gravel.	Good salmonid rearing habitat, good spawning areas, often with pools for larger age classes. Primarily riffle habitat.	Straight man-made channel section bound by steep banks approximately 3 to 4 m high. Lower slope than Sections D and E.
Section G [(a, b, c)]	1.3 km length; 5.3 m wetted width; 6,635 m^2 surface area	N/A	Substrate composition of gravel, cobble and boulder. Gravel substrate heavily embedded due to reduced flow and sedimentation within the channel.	Good salmonid rearing habitat, good spawning areas, often with pools for larger age classes. Riffle/run habitat.	Historic, natural section of river bed. Channel construction resulted in the diversion of the majority of flow away from this section, there still remains some flow and standing water. Riparian zone well vegetated with trees on both banks and has a better channel morphology than Sections D, E or F.

Notes:
N/A = not applicable (no information available).
[(a)] ADI Nolan Davis 1996.
[(b)] AMEC 2009.
[(c)] ADI Nolan Davis 1986.

6.2.3.3 AGS Vein Watersheds: Grebes Nest Pond, Upper Island Pond and Northwest Pond

AGS Vein Watersheds Description

The Grebes Nest watershed is approximately 5.5 km^2 in size and includes two waterbodies, Grebes Nest Pond (approximately 0.72 km^2 in size) and John Fitzpatrick Pond (approximately 0.56 km^2 in size) (Figure 6-3). The watershed flows in a general northwest direction and contains a main channel stream approximately 2.7 km in length that flows from a series of small ponds to the southwest of Grebes Nest Pond into Little Lawn Harbour (Golder 2015a). At the outlet of Grebes Nest Pond, the stream section is approximately 2.4 m to 2.6 m wide and discharge is estimated to range from 0.004 m^3/s to 0.079 m^3/s. From John Fitzpatrick Pond to the confluence with the ocean (Little Lawn Harbour), the stream section is approximately 3.8 m to 6.3 m wide and discharge is estimated to range from 0.004 m^3/s to 0.020 m^3/s. At the ocean confluence, the stream section is approximately 12.6 m wide and discharge is estimated to be 0.028 m^3/s, although this value is influenced by the incoming tide (SEM 2015).

The Upper Island Pond watershed is approximately 2.5 km^2 in size and contains Upper Island Pond (approximately 0.73 km^2 in size) located near its headwaters, as well as another smaller unnamed pond (approximately 0.18 km^2 in size) to the southeast. The Upper Island Pond watershed flows in a southerly direction into a small cove located near Watering Cove. The length of the stream that begins at Upper Island Pond is approximately 900 m (Golder 2015a).

Located to the northwest of the AGS Vein is a small watershed approximately 0.6 km^2 in size and containing a small unnamed waterbody (Northwest Pond) (approximately 0.08 km^2 in size). The watershed also drains to the southwest over very steep slopes into a small cove located to the south of Mine Cove (Golder 2015a).

Baseline surface water quality samples were collected in waterbodies located in the vicinity of the AGS Vein. Water quality results showed elevated concentrations of colour, aluminium, iron and total manganese. Low pH values are also characteristic of the surface water samples analyzed. Surface water in NL is often found to be acidic due to large amounts of organic materials produced by bogs, swamps and boreal forest. Low pH values can also be attributed to granitic rocks that tend to make groundwater slightly acidic and the lack of limestone in the area to buffer the acidity. Furthermore, the dark colour of surface water, as observed in samples collected is likely a result of wetland drainage (Golder 2015a).

AGS Vein Watersheds Fish Populations

According to the 2014 fish population surveys conducted in support of the Project, the AGS Vein watersheds in the west contain brook trout, American eel and Atlantic salmon. Brook trout and American eel were reported in all surveyed stream sections of the watersheds (the outlet between Grebes Nest Pond and John Fitzpatrick Pond, as well as the outlet downstream to the confluence with the ocean), while Atlantic salmon were only reported at the confluence. Additionally, only brook trout and American eel were recorded in Grebes Nest Pond and John Fitzpatrick Pond (SEM 2015).

AGS Vein Watersheds Fish Habitat

Fish habitat for the various AGS Vein watersheds (Grebes Nest Pond, Upper Island Pond, and Northwest Pond) is presented in Table 6-6.

Table 6-6: Fish Habitat in the AGS Vein Watersheds: Grebes Nest Pond, Upper Island Pond and Northwest Pond

Watercourse Reach/Pond		Relevant Dimensions	Flow/Discharge	Substrate	Habitat Type	Other Information
Grebes Nest Pond	Grebes Nest Pond[(a)]	2.0 m secchi depth, 87,712 m^2 area	Outflow from 0.004 m^3/s to 0.079 m^3/s	Predominantly boulder and cobble with lesser amounts of rubble and gravel.	N/A	Areas identified as boulder fields noted in the northern portion of the pond, as well as an area of emergent vegetation and an area of grasses / aquatic plants. Riparian vegetation noted along the southern pond boundary included grasses, trees, mixed trees, and shrubs.
	John Fitzpatrick Pond[(a)]	3.0 m secchi depth, 139,031 m^2 area	Outflow from 0.004 m^3/s to 0.020 m^3/s	Predominantly boulder, rubble and cobble with lesser amounts of gravel.	N/A	Areas identified as boulder fields noted in the eastern portion of the pond. Areas identified as emergent vegetation and grasses / aquatic plants noted at the inlet and outlet. Riparian vegetation noted along the pond boundary included grasses, trees, mixed trees, and shrubs.
Upper Island Pond	Upper Island Pond	N/A	N/A	N/A	N/A	N/A
	Southeast Pond	N/A	N/A	N/A	N/A	N/A
Northwest Pond[(b)]		N/A	N/A	N/A	N/A	Based on the overall size of the Northwest Pond watershed, steepness of the outflow stream (approximately 600 m) and small waterbody size, this watershed is not likely productive fish habitat.

Notes:
N/A = not applicable (no information available).
[(a)] SEM 2015.
[(b)] Golder 2015a.

6.2.3.4 Fish Species at Risk

A desktop survey was conducted to identify fish species at risk or of conservation concern with the potential to occur in the watersheds potentially affected by the Project (i.e., NL Range based on the SARA Registry [Government of Canada 2015]). At present there are two provincially listed freshwater fish species under the *Endangered Species Act*, two federally listed species under SARA, and three species listed by COSEWIC that are known to occur in NL (DOEC 2014b; Government of Canada 2015; COSEWIC 2015) as presented in Table 6-7.

Table 6-7: Provincially and Federally Listed Freshwater Fish Species in Newfoundland and Labrador

Common Name	Scientific Name	Provincial Listed Status (*Endangered Species Act*)[1]	Federal Listed Status (*Species at Risk Act*)[2]	Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Listed Status[3]
banded killifish	*Fundulus diaphanous*	Vulnerable	Special Concern (Schedule 1)	Special Concern
American eel	*Anguilla rostrata*	Vulnerable	No Status (No Schedule)	Threatened
Atlantic salmon	*Salmo salar*	N/A	No Status (No Schedule)	Threatened
fourhorn sculpin	*Myoxocephalus quadricornis*	N/A	Special Concern (Schedule 3)	Data Deficient

Notes:
N/A = not applicable (not listed).
[1] DOEC 2014b.
[2] Government of Canada 2015.
[3] COSEWIC 2015.

For the purposes of this EA Registration, species at risk includes only those designated species that are known to occur, or to have occurred, in the vicinity of the Project area, and not all provincially and federally protected species. Both of the provincially Vulnerable listed species, the banded killifish and American eel, have a known range that includes the Burin Peninsula. The South Newfoundland population of Atlantic salmon listed as Threatened by COSEWIC (2015) is also known to have a range that includes the Burin Peninsula. As noted in the previous sections, both American eel and Atlantic salmon have been documented in the Project area in the Shoal Cove and Salt Cove watersheds. The fourhorn sculpin (*Myoxocephalus quadricorni*), listed as Special Concern under Schedule 3 of SARA, has a range that has been known to include NL; however, some sources indicate that the range is limited to the Northwest Territories and Nunavut (Government of Canada 2015).

ACCDC data received in 2015 did not identify any historical occurrence of freshwater fish species at risk or species or conservation concern within the 5 km radius; however, based on the opinion of species experts within ACCDC, it is considered possible for banded killifish to occur (Table 6-7). Additional information on these species, including detailed species descriptions can be found in the 2009 EPR (CFI 2009).

6.2.4 Wildlife

6.2.4.1 Birds

Not counting rare and vagrant birds, there are over 175 species reported for insular Newfoundland. In general, these are categorized as residents (year-round), migrant breeders, migratory visitors and vagrants. A list of species common to these groups is provided by Meades (1990).

Based on surveys completed in 2002 (Jacques Whitford Environmental Limited [JWEL] 2003), the St. Lawrence area is expected to support 75 to 100 species of birds. The study identified 98 species of which 24 were seabirds or coastal shorebirds, nine were resident town feeders and three were vagrants (JWEL 2003). Shorebirds surveys in the Shoal Cove Beach area are conducted for spring and fall migrants every year by Gail and Norman Wilson, who share the shorebird survey records on an annual basis with regulatory agencies, including the Canadian Wildlife Service (N. Wilson 2015, pers. comm.). From 2003 to 2009, Gail and Norman Wilson recorded 132 bird species in the St. Lawrence area; 50 migratory breeder species of which 8 are marine/coastal, 34 migratory species of which 16 are marine/coastal, and 33 resident species of which two are marine/coastal (Table 6-8) (CFI 2009).

Table 6-8: Bird Species Reportedly Observed in St. Lawrence (2003 to 2009) and Months of Occurrence

Common Name	Scientific Name	Category	Month											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
common loon	*Gavia immer*	R		X	X	X	X	X	X	X	X	X		X
American coot	*Fulica americana*	V					X							
manx shearwater	*Puffinus puffinus*	MB						X	X	X	X	X		
northern fulmar	*Fulmaris glacialis*	MB					X	X			X			
northern gannet	*Morus bassanus*	MB	X	X	X	X	X	X	X	X	X	X	X	
great cormorant	*Phalacrocorax carbo*	R		X		X		X				X		X
double-crested cormorant	*Phalacrocorax auritus*	MB	X	X	X	X	X	X	X	X	X	X	X	X
parasitic jaeger	*Stercorarius parasiticus*	V						X						
Leach's storm petrel	*Oceanodroma leucorhoa*	V									X			
great blue heron	*Ardea herodias*	M					X			X				
little blue heron	*Egretta caerulea*	V					X	X						
yellow-crowned night heron	*Nyctanassa violacea*	V								X				
American bittern	*Botaurus lentiginosus*	MB						X	X					
Canada goose	*Branta canadensis*	MB				X	X	X	X	X	X	X	X	
mallard	*Anas platyrhynchos*	MB/R				X	X	X						
green-winged teal	*Anas carolinensis*	MB					X	X	X	X				
white-winged scoter	*Melanitta deglandi*	M								X				
American black duck	*Anas rubripes*	MB/R				X	X	X			X		X	
northern pintail	*Anas acuta*	MB					X	X						
greater scaup	*Aythya marila*	MB/R					X	X						
black scoter	*Melanitta americana*	M												
oldsquaw (long-tailed duck)	*Clangula hyemalis*	M				X	X						X	
red-breasted merganser	*Mergus serrator*	R					X							
northern goshawk	*Accipiter gentilis*	R		X				X						
sharp-shinned hawk	*Accipiter striatus*	R	X	X	X	X	X	X	X	X	X	X	X	X
rough-legged hawk	*Buteo lagopus*	R			X			X		X				

Common Name	Scientific Name	Category	Month											
northern harrier	*Circus cyaneus*	MB				X	X	X	X	X				
osprey	*Pandion haliaetus*	MB					X	X	X	X	X			
peregrine falcon	*Falco peregrinus*	M					X					X		
bald eagle	*Haliaeetus leucocephalus*	R	X	X	X	X	X	X	X	X	X	X	X	X
American kestrel	*Falco sparverius*	MB			X			X						
merlin	*Falco columbarius*	MB					X	X	X					
great horned owl	*Bubo virginianus*	R	X	X	X	X	X	X	X	X	X	X	X	X
short-eared owl	*Asio flammeus*	R					X	X	X					
willow ptarmigan	*Lagopus lagopus*	R	X	X	X	X	X	X	X	X	X	X	X	X
ruffed grouse	*Bonasa umbellus*	R		X	X	X	X	X						
black-bellied plover	*Pluvialis squatarola*	M					X			X	X	X		
American golden plover	*Pluvialis dominica*	M								X				
semipalmated plover	*Charadrius semipalmatus*	MB							X	X	X	X		
ruddy turnstone	*Arenaria interpres*	M								X	X	X		
semipalmated sandpiper	*Calidris pusilla*	MB								X	X	X		
least sandpiper	*Calidris minutilla*	MB								X				
greater yellowlegs	*Tringa melanoleuca*	MB				X	X	X	X	X	X	X	X	
spotted sandpiper	*Actitis macularius*	MB					X	X	X	X	X	X	X	
sanderling	*Calidris alba*	M					X		X	X	X	X		
common snipe	*Gallinago gallinago*	MB				X	X	X	X	X	X			
whimbrel	*Numenius phaeopus*	M								X				
white-rumped sandpiper	*Calidris fuscicollis*	M								X				
piping plover	*Charadrius melodus*	V									X			
northern lapwing	*Vanellus vanellus*	V											X	X
great black-backed gull	*Larus marinus*	R	X	X	X	X	X	X	X	X	X	X	X	X
herring gull	*Larus argentatus*	R	X	X	X	X	X	X	X	X	X	X	X	X
ring-billed gull	*Larus delawarensis*	MB	X	X	X	X	X	X	X	X	X	X	X	X
black-legged kittiwake	*Rissa tridactyla*	MB/R								X				
Iceland gull	*Larus glaucoides*	M	X	X	X	X	X							X
glaucous gull	*Larus hyperboreus*	M	X											
black-headed gull	*Chroicocephalus ridibundus*	V		X								X		
Franklin's gull	*Leucophaeus pipixcan*	V						X						
caspian tern	*Hydroprogne caspia*	MB					X	X	X	X	X			
common tern	*Sterna hirundo*	MB					X	X	X	X				
Arctic tern	*Sterna paradisaea*	MB							X					
dovekie (little auk)	*Alle alle*	M	X	X								X	X	X
common murre	*Uria aalge*	MB/R						X						
black guillemot	*Cepphus grylle*	R	X	X	X	X	X	X	X	X	X	X	X	X
rock dove	*Columba livia*	R					X			X				

Common Name	Scientific Name	Category	Month											
mourning dove	*Zenaida macroura*	M	X	X	X	X	X	X	X	X	X	X	X	X
belted kingfisher	*Megaceryle alcyon*	MB	X	X			X	X	X	X	X	X	X	
northern flicker	*Colaptes auratus*	R				X	X	X	X	X	X	X	X	
eastern kingbird	*Tyrannus tyrannus*	M					X	X						
yellow-bellied flycatcher	*Empidonax flaviventris*	M						X	X	X	X			
alder flycatcher	*Empidonax alnorum*	M						X						
tree swallow	*Tachycineta bicolor*	MB						X	X	X	X	X	X	
barn swallow	*Hirundo rustica*	M				X	X	X		X		X	X	
chimney swift	*Chaetura pelagica*	M				X						X	X	
grey jay	*Perisoreus canadensis*	R	X	X	X	X	X	X	X	X	X	X	X	X
blue jay	*Cyanocitta cristata*	R	X	X	X	X	X	X	X	X	X	X	X	X
common raven	*Corvus corax*	R	X	X	X	X	X	X	X	X	X	X	X	X
American crow	*Corvus brachyrhynchos*	R	X	X	X	X	X	X	X	X	X	X	X	X
black-capped chickadee	*Poecile atricapillus*	R	X	X	X	X	X	X	X	X	X	X	X	X
boreal chickadee	*Poecile hudsonicus*	R					X	X						X
red-breasted nuthatch	*Sitta canadensis*	MB				X	X	X					X	
golden-crowned kinglet	*Regulus satrapa*	R										X		
ruby-crowned kinglet	*Regulus calendula*	MB					X	X	X	X				
grey catbird	*Dumetella carolinensis*	M					X	X						
American robin	*Turdus migratorius*	R	X	X	X	X	X	X	X	X	X	X	X	X
hermit thrush	*Catharus guttatus*	MB					X	X	X	X	X			
Swainson's thrush	*Catharus ustulatus*	MB						X						
horned lark	*Eremophila alpestris*	MB				X	X	X	X	X				
northern shrike	*Lanius excubitor*	MB	X											
water pipit	*Anthus spinoletta*	MB					X	X	X	X	X	X		
cedar waxwing	*Bombycilla cedrorum*	M							X					
bohemian waxwing	*Bombycilla garrulus*	V		X										
starling	*Sturnidae*	R	X	X	X	X	X	X	X	X	X	X	X	X
yellow warbler	*Setophaga petechia*	MB					X	X	X	X	X	X	X	
magnolia warbler	*Setophaga magnolia*	M						X						
yellow-rumped warbler	*Setophaga coronata*	MB			X	X	X	X	X	X	X	X	X	
black-throated green warbler	*Setophaga virens*	M						X				X		
palm warbler	*Setophaga palmarum*	M					X				X			
blackpoll warbler	*Setophaga striata*	MB				X	X	X	X	X	X	X		
black-and-white warbler	*Mniotilta varia*	MB					X	X	X	X				
northern waterthrush	*Parkesia noveboracensis*	MB					X	X	X	X				

Common Name	Scientific Name	Category	Month											
mourning warbler	*Geothlypis philadelphia*	MB					X	X	X					
common yellowthroat	*Geothlypis trichas*	MB					X	X	X	X	X			
Philadelphia vireo	*Vireo philadelphicus*	V						X			X			
red-winged blackbird	*Agelaius phoeniceus*	M	X	X	X	X							X	X
brown-headed cowbird	*Molothrus ater*	V							X					
Wilson's warbler	*Cardellina pusilla*	MB					X	X	X	X	X			
scarlet tanager	*Piranga olivacea*	V					X							
American redstart	*Setophaga ruticilla*	M						X						
American tree sparrow	*Spizella arborea*	M	X	X	X	X	X	X	X					
chipping sparrow	*Spizella passerina*	V				X								
Savannah sparrow	*Passerculus sandwichensis*	MB	X	X	X	X	X	X	X	X	X	X		
fox sparrow	*Passerella iliaca*	MB	X	X	X	X	X	X	X	X	X	X	X	X
song sparrow	*Melospiza melodia*	MB	X	X	X	X	X	X	X	X	X	X	X	X
swamp sparrow	*Melospiza georgiana*	MB					X	X	X	X	X	X	X	
white-throated sparrow	*Zonotrichia albicollis*	MB	X	X	X	X	X	X	X	X	X	X	X	
dark-eyed junco	*Junco hyemalis*	R	X	X	X	X	X	X	X	X	X	X	X	X
snow bunting	*Plectrophenax nivalis*	M										X	X	
white-winged crossbill	*Loxia leucoptera*	R	X	X	X									
rose-breasted grosbeak	*Pheucticus ludovicianus*	M				X	X							
indigo bunting	*Passerina cyanea*	M				X		X						
purple finch	*Haemorhous purpureus*	R	X	X	X	X	X	X	X	X	X	X		
rusty blackbird	*Euphagus carolinus*	MB	X	X		X	X	X	X			X		
common grackle	*Quiscalus quiscula*	R		X	X	X	X	X	X	X	X	X	X	
pine grosbeak	*Pinicola enucleator*	R	X	X	X	X	X	X	X	X	X	X	X	X
blue grosbeak	*Passerina caerulea*	V										X		
common redpoll	*Acanthis flammea*	M		X	X	X	X	X	X	X				
hoary redpoll	*Carduelis hornemanni*	M				X								
pine siskin	*Carduelis pinus*	R	X	X	X	X	X	X	X	X	X	X		
American goldfinch	*Spinus tristis*	R	X	X	X	X	X	X	X	X	X	X	X	X
house sparrow	*Passer domesticus*	R	X	X	X	X	X	X	X	X	X	X	X	X
dickcissel	*Spiza americana*	M	X	X	X									X

Source: CFI 2009; N. Wilson 2015, pers. comm.

Notes:

X = Months When Species May Be Expected. Blank = Does not Occur.

M – Migratory

MB – Migratory Breeder

R – Resident

V - Vagrant

Terrestrial bird species diversity in the Project area is low but includes a diversity of boreal and heathland (subarctic) species. Hence there is an interesting mix of wood warblers, such as yellow-rumped warbler (*Setophaga coronate*), blackpoll warbler (*Setophaga striata*), and northern waterthrush (*Parkesia noveboracensis*) with species such as horned larks (*Eremophila alpestris*) and willow ptarmigan (*Lagopus lagopus*), more typical of the open coastal barrens. The rusty blackbird (*Euphagus carolinus*) is a local breeder along the edges of bogs and wetlands, and red crossbills (*Loxia curvirostra percna)* are recorded irregularly in the general area. Birds of prey in the vicinity of the Project area include resident bald eagles (*Haliaeetus leucocephalus*) and osprey (*Pandion haliaetus*) (migratory breeder), as well as the resident northern goshawk (*Accipiter gentilis*) and great horned owl (*Bubo virginianus*). The short-eared owl (*Asio flammeus*) may be a local breeder, and peregrine falcons (*Falco peregrinus*) are regular fall migrants (CFI 2009).

One of the highest densities of bald eagles in eastern North America breeds in the Placentia Bay area, Newfoundland (Dominguez 1998). The DOEC Wildlife Division has conducted bald eagle surveys in the Placentia Bay area most years since 1983, and since the early 1990s, permanent survey plots for nesting bald eagles were established on Long Island, Merasheen Island, Ragged Island and a section of coastline along the adjacent western the Placentia Bay area. This area contains 20 to 30 active nests annually (J. Brazil 2009 pers. comm. cited in CFI 2009). The osprey is less numerous than the bald eagle in the Placentia Bay area but occurs regularly from late April to September (CFI 2009). There are no known occurrences of active bald eagle nests in the St. Lawrence area (N. Wilson 2015, pers. comm.)

For additional detail regarding marine birds, refer to Section 6.3.2 of this report. Additional information, including detailed species descriptions can be found in the 2009 EPR (CFI 2009).

6.2.4.2 Wildlife Species at Risk

A desktop survey was conducted to identify wildlife species at risk or of conservation concern with the potential to be affected by the Project (i.e., NL Range based on the SARA Registry [Government of Canada 2015]) (Table 6-9). At present, there are eight provincially listed bird species under the *Endangered Species Act*, seven federally listed species under SARA, and ten species listed by COSEWIC that are known to occur in NL. In addition, there are four provincially listed mammal species under the *Endangered Species Act*, and six federally listed species under SARA and by COSEWIC that are known to occur in NL (DOEC 2014b; Government of Canada 2015; COSEWIC 2015).

Table 6-9: Provincially and Federally Listed Wildlife Species in Newfoundland and Labrador

Common Name	Scientific Name	Provincial Listed Status (*Endangered Species Act*)[1]	Federal Listed Status (*Species at Risk Act*)[2]	Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Listed Status[3]
Birds				
red crossbill *percna subspecies*	*Loxia curvirostra percna*	Endangered	Endangered (Schedule 1)	Endangered
chimney swift	*Chaetura pelagica*	Threatened	Threatened (Schedule 1)	Threatened
peregrine falcon	*Falco peregrinus anatum*	Vulnerable	No Status (No Schedule)	Non-active
	Falco peregrinus tundrius	Vulnerable	Special Concern (Schedule 3)	Non-active
rusty blackbird	*Euphagus carolinus*	Vulnerable	Special Concern (Schedule 1)	Special Concern

Common Name	Scientific Name	Provincial Listed Status (*Endangered Species Act*)[1]	Federal Listed Status (*Species at Risk Act*)[2]	Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Listed Status[3]
short-eared owl	*Asio flammeus*	Vulnerable	Special Concern (Schedule 1)	Special Concern
common nighthawk	*Chordeiles minor*	Threatened	Threatened (Schedule 1)	Threatened
grey-cheeked thrush	*Catharus minimus*	Vulnerable	N/A	N/A
olive-sided flycatcher	*Contopus cooperi*	Threatened	Threatened (Schedule 1)	Threatened
bank swallow	*Riparia riparia*	N/A	No Status (No Schedule)	Threatened
barn swallow	*Hirundo rustica*	N/A	No Status (No Schedule)	Threatened
bobolink	*Dolichonyx oryzivorus*	N/A	No Status (No Schedule)	Threatened
red-necked phalarope	*Phalaropus lobatus*	N/A	N/A	Special Concern
Mammals				
American marten	*Martes americana atrata*	Threatened	Threatened (Schedule 1)	Threatened
polar bear	*Ursus maritimus*	Vulnerable	Special Concern (Schedule 1)	Special Concern
wolverine	*Gulo gulo*	Endangered	Endangered (Schedule 1)	Non-active
caribou	*Rangifer tarandus*	Threatened	Threatened (Schedule 1)	Threatened
little brown myotis	*Myotis lucifugus*	N/A	Endangered (Schedule 1)	Endangered
northern myotis	*Myotis septentrionalis*	N/A	Endangered (Schedule 1)	Endangered

Notes:
N/A = not applicable (not listed).
[1] DOEC 2014b.
[2] Government of Canada 2015.
[3] COSEWIC 2015.

For the purposes of this EA Registration, species at risk includes only those designated species that are known to occur, or to have occurred, in the vicinity of the Project area and not all provincially and federally protected species. Of the 12 provincially and/or federally listed bird species presented in Table 6-9, seven have a known range that includes the Project area or have potential to occur: red crossbill, chimney swift (*Chaetura pelagica*), peregrine falcon, rusty blackbird, short-eared owl, olive-sided flycatcher (*Contopus cooperi*), and barn swallow (*Hirundo rustica*). As noted in the previous sections, chimney swift, peregrine falcon, rusty blackbird, short-eared owl and barn swallow were observed in the St. Lawrence area between 2003 to 2009 by Gail and Norman Wilson. There has been no record of chimney swift or peregrine falcon since 2009, but the remainder of the species have been recorded since 2009 (N. Wilson 2015, pers. comm.) None of the mammal species have a known range or are expected to occur in the Project area (CFI 2009).

ACCDC data received in 2015 identified 15 occurrences of species at risk or species of conservation concern within the 5 km radius, that represent five bird species (Table 6-10). In addition, based on the opinion of species experts within ACCDC, it is considered possible for short-eared owl to occur. None of the five bird species identified by ACCDC are listed provincially and/or federally and are not considered globally rare outside of the province of NL.

Table 6-10: Atlantic Canada Conservation Data Centre Listed Bird Species in Vicinity of the Project (5 km radius)

Common Name	Scientific Name	Atlantic Canada Conservation Data Centre (ACCDC) Listed Status	Status Short Definition
American pipit	*Anthus rubescens*	S3B,S5M	Breeding population uncommon in province Migratory population widespread, abundant and demonstrably secure in province
chipping sparrow	*Spizella passerina*	S2B	Breeding population rare in province
northern goshawk	*Accipiter gentilis*	S3B	Breeding population uncommon in province
northern harrier	*Circus cyaneus*	S3B	Breeding population uncommon in province
sharp-shinned hawk	*Accipiter striatus*	S3B	Breeding population uncommon in province

Source: ACCDC 2015.

The majority of the historical occurrences reported by ACCDC occurred outside of the Project area; north of Haypook Pond. Just south of the Marine Terminal, an occurrence of listed fauna (i.e., the chipping sparrow [*Spizella passerine*] and northern harrier [*Circus cyaneus*]) was recorded within the Coniferous Open ELC approximately 600 m south-west of the Shoal Cove Pond Tailing area (ACCDC 2015). As noted in the previous sections, all of the ACCDC reported species, with the exception of American pipit (*Anthus rubescens*), were observed in the St. Lawrence area between 2003 to 2009 by Gail and Norman Wilson (CFI 2009). In addition, past studies have identified the monarch butterfly (*Danaus plexippus*), a federally protected terrestrial species listed as Special Concern under Schedule 1 of SARA and by COSEWIC (Government of Canada 2015; COSEWIC 2015), as potentially occurring within the vicinity of the Project (Burin Minerals Ltd. 2009).

During the course of the 2013 and 2014 geotechnical investigations of the AGS Vein, it was noted that wildlife in the Project area includes moose (*Alces alces*), coyote (*Canis latrans*), fox (*Vulpini spp.),* bear (*Ursidae spp*.), rabbit (*Lepus curpaeums*), and lynx (*Lynx canadensis*) (Agnerian 2015), none of which are species at risk.

Additional information, including detailed species descriptions can be found in the 2009 EPR (CFI 2009).

6.3 Marine Biological Environment

Information on marine fish and fish habitat, marine birds, marine mammals and species at risk is provided in this section.

6.3.1 Fish and Fish Habitat

Blue Beach Cove is located in the Great St. Lawrence Harbour (the Harbour). Comprehensive underwater habitat surveys were conducted in the vicinity of Blue Beach Cove in June 2009 to support the 2009 EPR (CFI 2009) prepared for the Reactivation of the St. Lawrence Fluorspar Mine. Habitat surveys were completed both by boat using a drop camera and using a SCUBA diver equipped with a camera. Surveys took place over two areas originally proposed as north and south options for the marine terminal component of the Newspar project. The description of fish and fish habitat presented in the following subsections is based on the results of these surveys, as well as publically available information and literature regarding marine invertebrates, finfish, and commercial fisheries in Blue Beach Cove.

Under section 35 of the federal *Fisheries Act*, "no person shall carry on any work, undertaking or activity [w/u/a] that results in serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish that support such a fishery". Species that are part of Commercial, Recreational and Aboriginal (CRA) fisheries include: "those fish that fall within the scope of applicable federal or provincial fisheries regulations as well as those that can be fished by Aboriginal organizations or their members for food, social or ceremonial purposes or for purposes set out in a land claims agreement" (Government of Canada 2014). As such, the discussion in the following subsections is centred on those CRA fish species that are known to occur, or to have occurred, in the vicinity of Blue Cove Beach. Additional information, including detailed species descriptions can be found in the 2009 EPR (CFI 2009).

6.3.1.1 Fish Habitat

During the 2009 habitat surveys, water depths in the vicinity of Blue Beach Cove ranged from 3 to 20 m. Generally substrate in the northern area was observed to be homogenous, with limited surface complexity or irregularity, consisting of coarse sand underlain by bedrock. The area farthest north was bound by an exposed bedrock ridge, extending east from the shoreline. In the southern area, substrates were observed to be predominantly boulders with limited areas of sand. Gravel was observed along the eastern edge of the southern area. Substrate in the nearshore habitat consisted of rock and cobble (CFI 2009).

Marine vegetation in the northern area included coralline algae (*Corallinaceae spp.*), filamentous red algae (*Rhodophyta spp.*) and sea colander (*Agarum cribosum*). In this area, marine vegetation was concentrated in the nearshore environment, while sandy areas were largely devoid of vegetation. In the southern area, marine vegetation was noted to be much more abundant and included kelp (*Alaria spp.,* horsetail kelp [*Laminaria digitata*], sea colander [*Agarum clathratum*]), knotted wrack (*Ascophyllum nodosum*), rock weed (*Fucus spp*.), filamentous red algae, and filamentous green algae (*Pediastrum boryanum*). Marine vegetation was more prevalent in the shallow inshore waters, although kelp was observed along the eastern boundary of the southern area (CFI 2009).

Consultations with local fishermen indicated that Blue Beach Cove has a rocky, hard bottom; however, some mud substrate occurs in the deep parts of the Harbour (E. Jarvis 2009, pers. comm. cited in CFI 2009). Fishermen also indicated that Blue Beach Cove is characterized by high exposure and that high wave action is common in fall and winter, lasting into May. The occurrence of predominately hard, large particle substrates and high wave action suggests that the presence of eelgrass (*Zostera marina*), a component of important nursery habitat for juvenile cod (Gotceitas et al. 1997), is highly unlikely.

6.3.1.2 Marine Invertebrates

Marine invertebrates were observed throughout the surveyed areas (CFI 2009). Potential habitat for polychaetes and/or clams, were also observed in sandy substrate, as well as habitat for lobster in the boulder areas (CFI 2009). Although they were not observed during the 2009 habitat surveys, a number of other marine invertebrates have the potential to occur in Blue Beach Cove based on review of publically available information and literature (DFO 2009a cited in CFI 2009). Marine invertebrates with the potential to occur in Blue Beach Cove are presented in Table 6-11.

Table 6-11: Marine Invertebrates with Potential to Occur in Blue Beach Cove

Scientific Name	Common Name	Occurrence and Fishery Information	Source of Occurrence Information
sand dollar	*Echinarachnius parma*	N/A	2009 underwater habitat surveys
green sea urchin	*Strongylocentrotus droebachiensis*	N/A	2009 underwater habitat surveys
sea star	*Asteroidea spp.*	N/A	2009 underwater habitat surveys
purple sunstar	*Solaster endeca*	N/A	2009 underwater habitat surveys
sea anemone	*Anemonia sulcata*	N/A	2009 underwater habitat surveys
rock crab	*Cancer irroratus*	N/A	2009 underwater habitat surveys
spider (toad) crab	*Hyas araneus and Hyas coarctatus*	N/A	2009 underwater habitat surveys
American lobster	*Homarus americanus*	Limited fishery in Blue Beach Cove and along the west shore of the Harbour Lobster Fishing Area (LFA) 10 (DFO 2014a) Traps set close to shore (e.g., depths less than 20 m) fished from open boats Seasonal: 8 to 10 weeks in the spring	DFO 2009a and E. Jarvis, pers. comm. 2009 (cited in CFI 2009)
snow crab	*Chionoecetes opilio*	Commercial vessel traffic relatively high along the eastern side of the Harbour (home of Supplementary Crab Fleet) Northwest Atlantic Fisheries Organization (NAFO) Division 10A (DFO 2005) Fished at depths from 99 to 180 m Seasonal: May to September	DFO 2009a cited in CFI 2009
northern shortfin squid	*Illex illecebrosus*	Recreational fishery only Fished using hook and line at depths of 4 to 18 m Seasonal: August to September	DFO 2009a cited in CFI 2009
longfin inshore squid	*Loligo pealeii*	Recreational fishery only Fished using hook and line at depths of 4 to 18 m Seasonal: August to September	DFO 2009a cited in CFI 2009

6.3.1.3 Marine Finfish

Marine finfish were observed throughout the surveyed area (CFI 2009). Although they were not observed during the 2009 habitat surveys, a number of other marine finfish have the potential to occur in Blue Beach Cove based review of publically available information and literature (DFO 2009a cited in CFI 2009; Small Craft Harbours [SCH] 2006). Marine finfish with the potential to occur in Blue Beach Cove are presented in Table 6-12.

Table 6-12: Marine Finfish with Potential to occur in Blue Cove Beach

Scientific Name	Common Name	Occurrence and Fishery Information	Source of Occurrence Information
winter flounder	*Pleuronectes americanus*	N/A	2009 underwater habitat surveys (CFI 2009)
sculpins	*Myoxocephalus spp.*)	N/A	2009 underwater habitat surveys (CFI 2009)
ocean pout	*Macrozoarces americanus*	N/A	2009 underwater habitat surveys (CFI 2009)
cunner	*Tautogolabrus adspersus*	N/A	2009 underwater habitat surveys (CFI 2009)
tomcod	*Microgadus tomcod*	N/A	Other project surveys (SCH 2006)

Scientific Name	Common Name	Occurrence and Fishery Information	Source of Occurrence Information
Atlantic herring	*Clupea harengus*	Historic commercial fishery more prominent in the 1980s before stock was overfished (Sjare et al. 2003) Bait fishery along the east side of the Harbour across from Blue Beach Cove Fished using gillnets at depths from 9 to 36 m Seasonal: January to April	DFO 2009a and E. Jarvis 2009, pers. comm. (cited in CFI 2009)
Atlantic mackerel	*Scomber scombrus*	Bait fishery along the eastern portion of the Harbour from Herring Cove to Calipouse Fished using nets at depths of approximately 18 m Seasonal: August through September	DFO 2009a cited in CFI 2009
capelin	*Mallotus villosus*	Historic commercial fishery in the Harbour using seine, dip nets, and buckets at depths from 9 to 27 m Numbers currently too low to support a commercial fishery	DFO 2009a cited in CFI 2009
Atlantic cod	*Gadus morhua*	Commercial fishery south of the Harbour Recreational fisheries have occurred over the past few years in Placentia Bay, located further east Fished using gillnets, cod traps, hook and line, and trawl at depths from 27 to 90 m Seasonal: June to October	DFO 2009a cited in CFI 2009
thorny skate	*Amblyraja radiata*	Commercial fishery throughout North Atlantic Fisheries Organization (NAFO) Subdivision 3Ps and adjacent Divisions 3LNO With the decline of other groundfish resources, Canadian interest in skate increased and a total allowable catch (TAC) was introduced in 1995 for NAFO Subdivision 3Ps (DFO 2013a)	DFO 2009a cited in CFI 2009
lumpfish	*Cyclopterus lumpus*	Commercial fishery targeting spawing females for the row market largely outside of the Harbour although distribution extends around Cape Chateau Rouge Fished as an inshore fishery from small vessels using nets at depths from 11 to 45 m Seasonal: April to July (Blackwood 1983)	DFO 2009a cited in CFI 2009
witch flounder or greysole	*Glyptocephalus cynoglossus*	Commercial fishery outside of the Harbour, typically from south of Lawn Point east to Ferryland Head Fished using nets and hook and line at depths from 90 to 108 m Seasonal: January to March	DFO 2009a cited in CFI 2009
American plaice	*Hippoglossoides platessoides*	Moratorium on direct fishing in NAFO Subdivision 3Ps since 1993 Catches since that time have been by-catch in other fisheries (DFO 2014b) In the Harbour, “flounder” are fished commercially and although not specified, “flounder” may include American plaice among other species Seasonal: May to October	DFO 2009a cited in CFI 2009

Atlantic cod is the dominant commercial fishery in the northwest Atlantic and has been a traditionally important species in the Newfoundland economy. Fishing, directed and bycatch, has historically been and remains as one of the primary threats to the Laurentian north population of Atlantic cod. The Laurentian north population of Atlantic cod has been designated as Endangered by the COSEWIC and is under consideration under the federal SARA (DFO 2014c).

In 2009, the NL population of American plaice (*Hippoglossoides platessoides*) was designated Threatened by COSEWIC due to the significant decline in abundance. The greatest threat to the recovery of American plaice is continued fishing mortality. Fishing mortality occurs exclusively as by-catch in other commercial fisheries. A recovery potential assessment (RPA) was introduced by DFO for American plaice which includes a recovery strategy for the NL population (DFO 2011).

6.3.2 Marine Birds and Marine Mammals

The description of marine birds and marine mammals presented in this section is based on publically available information and literature, as well as the results of:

- bird surveys completed between 1998 and 2007 in the St. Lawrence area (JWEL 2003; LGL Limited 2007); and
- review of a DFO marine mammal sightings database, as well as year-round marine mammal surveys undertaken from August 2006 to April 2007 in the Placentia Bay area (Newfoundland and Labrador Refining Corporation [NLRC] 2007).

Marine birds for the purposes of this EA Registration are those species that spend time associated with the coastal and/or pelagic environment. Most species have either a coastal or pelagic distribution (i.e., spend most of their lives at sea) but some species, such as large gulls, spend time in both habitats.

Seabird breeding colonies are numerous on headlands and islands along the entire perimeter of the Placentia Bay area., three of which rank as Important Bird Areas (IBA) off the southern Burin Peninsula, including Green Island, Middle Lawn Island and Corbin Island off the southern Burin Peninsula.

The Green Island IBA is a federal migratory bird sanctuary comprised of sedge/grass meadow and coastal cliff/rocky shore (marine) habitat types. The island is approximately 5.61 km^2, located midway between the St. Pierre and Miquelon Islands and the Burin Peninsula. This sanctuary is home to a significant number of nesting Leach's storm petrels (i.e., 72,000 pairs), approximately 1.5% of the estimated western Atlantic breeding population; however, a number of other seabirds have also been recorded nesting on the island including herring gulls (*Larus smithsonianus*), common terns (*Sterna hirundo*) and Arctic terns (*Sterna paradisaea*) (Bird Studies Canada 2015).

The Middle Lawn Island IBA is located approximately 4 km south of Lord's Cove and is comprised of sedge/grass meadow and coastal cliff/rocky shore (marine) habitat types. The island is approximately 4.17 km^2, and supports the largest and only known active breeding colony of manx shearwater (*Puffinus puffinus*) in North America. In the 1980s, approximately 100 pairs, plus an additional 300 non-breeding birds were estimated to occur on Middle Lawn Island. In addition, over 26,000 pairs of Leach's storm petrels nest on the island, as well as 20 pairs of herring gulls, 6 pairs of greater black-backed gulls (*Larus marinus*), and 8 pairs of black guillemots (*Cepphus grille*) (Bird Studies Canada 2015).

The Corbin Island IBA is located approximately 1 km from the mainland and although little descriptive information is available, the shoreline is likely rocky and the interior is likely comprised of grasses and low shrubs. The island is approximately 5.25 km^2, and supports a globally significant colony of Leach's storm petrels. In 1974, approximately 2% of the estimated western Atlantic Leach's storm petrel population was thought to occur on the island (i.e., 100,000 pairs). In addition, a large colony of herring gulls (i.e., 5,000 pairs) estimated as 3.5% of the North American population, occurs on the island. Other nesting species include 50 pairs of black-legged kittiwakes (*Rissa tridactyla*), 25 pairs of greater black-backed gulls, and black guillemots (Bird Studies Canada 2015).

The coastal area of St. Lawrence experiences high to moderate wave energy, and bounds the western mouth of the Placentia Bay area, an area rich in marine bird life. In summer, colonies of gannets, cormorants, alcids, gulls and terns nest along cliffs and on numerous islands, archipelagos and adjacent headlands of the Placentia Bay area. Table 6-13 includes species of marine birds reported to regularly use the Placentia Bay area from the tidal zone to the offshore zone (CFI 2009).

Table 6-13: Marine Birds known to Occur in Placentia Bay and Months of Occurrence

Common Name	Scientific Name	Abundance[1]	Month											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Canada goose	*Branta canadensis*	Uncommon			X	X	X	X	X	X	X	X	X	X
gadwall	*Anas strepera*	Rare	X	X	X						X	X	X	X
American wigeon	*Anas americana*	Scarce				X	X				X	X	X	
American black duck	*Anas rubripes*	Common	X	X	X	X	X	X	X	X	X	X	X	X
mallard	*Anas platyrhynchos*	Scarce	X	X	X	X	X				X	X	X	X
blue-winged teal	*Anas discors*	Scarce				X	X			X	X	X		
northern pintail	*Anas acuta*	Uncommon				X	X	X	X	X	X	X	X	
green-winged teal	*Anas crecca*	Uncommon				X	X	X	X	X	X	X	X	X
ring-necked duck	*Aythya collaris*	Uncommon				X	X	X	X	X	X	X		
greater scaup	*Aythya marila*	Uncommon	X	X	X	X	X					X	X	X
lesser scaup	*Aythya affinis*	Scarce				X	X				X	X	X	X
king eider	*Somateria spectabilis*	Scarce	X	X	X	X	X					X	X	X
common eider	*Somateria mollissima*	Common	X	X	X	X	X				X	X	X	X
harlequin duck	*Histrionicus histrionicus*	Scarce	X	X	X	X					X	X	X	X
surf scoter	*Melanitta perspicillata*	Uncommon	X	X	X	X	X	X	X	X	X	X	X	X
white-winged scoter	*Melanitta fusca*	Uncommon	X	X	X	X	X	X	X	X	X	X	X	X
black scoter	*Melanitta nigra*	Uncommon	X	X	X	X					X	X	X	X
long-tailed duck	*Clangula hyemalis*	Common	X	X	X	X						X	X	X
bufflehead	*Bucephala albeola*	Scarce	X	X	X	X						X	X	X
common goldeneye	*Bucephala clangula*	Uncommon	X	X	X	X	X	X	X	X	X	X	X	X
Barrow's goldeneye	*Bucephala islandica*	Rare											X	X
hooded merganser	*Lophodytes cucullatus*	Rare										X	X	X

Common Name	Scientific Name	Abundance[1]	Month											
			Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
common merganserr	*Mergus merganser*	Uncommon	X	X	X	X	X	X	X	X	X	X	X	X
red-breasted merganser	*Mergus serrator*	Common	X	X	X	X	X	X	X	X	X	X	X	X
red-throated loon	*Gavia stellata*	Uncommon									X	X	X	X
common loon	*Gavia immer*	Common	X	X	X	X	X	X	X	X	X	X	X	X
horned grebe	*Podiceps auritus*	Scarce	X	X	X							X	X	X
red-necked grebe	*Podiceps grisegena*	Uncommon	X	X	X	X						X	X	X
northern fulmar	*Fulmarus glacialis*	Common	X	X	X	X	X	X	X	X	X	X	X	X

Source: CFI 2009.
Notes:
X = Months When Species May Be Expected. Blank = Does not Occur.
1: Rare – occurs rarely, usually not present monthly, may be less than annual. Scarce – occurs in very low numbers, may be absent in some months. Uncommon – occurs in low numbers in appropriate habitat and season. Common – occurs in moderate numbers in appropriate habitat and season.

During the bird surveys undertaken between 1998 and 2007 in the St. Lawrence area, a total of 24 species of shorebirds and seabirds were observed including but not limited to northern fulmar (*Fulmaris glacialis*), northern gannet (*Morus bassanus*), manx shearwater, common eider (*Somateria mollissima*), white-winged scoter (*Melanitta deglandi*), black scoter (*Melanitta americana*), long-tailed duck (*Clangula hyemalis*), double-crested cormorant (*Phalacrocorax auritus*), great cormorants (*Phalacrocorax carbo*), red-breasted mergansers (*Mergus serrator*), common goldeneye (*Bucephala clangula*), and common loons (*Gavia immer*) (CFI 2009; JWEL 2003; LGL Limited 2007).

The largest numbers of shorebirds migrate through Newfoundland during the fall migration period from mid-July to mid-November when they feed in tidal areas. The area of Shoal Cove beach and Shoal Cove Pond supports a variety of shorebird species during migration (Table 6-13), as well as the piping plover. The *melodus* subspecies of the piping plover is listed as Endangered under the provincial Endangered Species Act, under the federal SARA and by COSEWIC (DOEC 2014b; Government of Canada 2015; COSEWIC 2015).

The Project area supports a sparse marine bird population and species diversity is relatively low. In general, use appears to be seasonal either as spring or fall migrants. Shorebirds rely on invertebrates in the upper sediments of substrates at sites such as Shoal Cove and Shoal Cove Pond. Sea ducks, especially common eiders occur in winter, and seabirds such as manx shearwaters and Leach's storm petrels breed nearby on offshore islands that are designated as IBAs, and would well serve as focal species. The great cormorant is a year-round resident and therefore represents both the wintering and breeding components of the life history. Many seabirds rely on fish (cormorants), bottom invertebrates (eiders), and pelagic plankton (petrels) for food, the components of the marine habitat that can be affected by marine anthropogenic activities. Therefore, these species of birds have life stages that occur throughout the habitat (i.e., upper/surface and lower water column, and on bottom substrates) (CFI 2009).

Various mammals, including cetaceans and seals, are expected to occur within Placentia Bay, including Blue Beach Cove. Based on the review of the DFO marine mammal sightings database completed by NLRC in support of another project, humpback whales (*Megaptera novaeangliae*), minke whales (*Balaenoptera acutorostrata*), Atlantic white-sided dolphins (*Lagenorhynchus acutus*), harp seals (*Pagophilus groenlandicus*), harbour porpoises (*Phocoena phocoena*), and long-finned pilot whales (*Globicephala melas*) have been documented in the southeast Burin Peninsula area. Blue whales (*Balaenoptera musculus*) have also been documented in the southeast Burin Peninsula area, although rarely. Other species considered common in Placentia Bay include fin whales (*Balaenoptera physalus*), white-beaked dolphins (*Lagenorhynchus albirostris*), grey seals (*Halichoerus grypus*) and harbour seals (*Phoca vitulina*); however, they were not listed in the DFO marine mammal sightings database for the southern Burin Peninsula (NLRC 2007).

Additional information, including detailed species descriptions can be found in the 2009 EPR (CFI 2009).

6.3.3 Marine Species at Risk

A desktop survey was conducted to identify marine species at risk or of conservation concern with the potential to occur in the watersheds affected by the Project (i.e., NL Range based on the SARA Registry [Government of Canada 2015]) (Table 6-14). At present there are three federally listed marine fish species under SARA and seven species listed by COSEWIC that are known to occur in NL. There are five provincially listed marine bird species under the *Endangered Species Act* and six federally listed species under SARA and by COSEWIC that are known to occur in NL. Additionally, there are seven federally listed marine mammal species under SARA and 12 species listed by COSEWIC that are known to occur in NL (DOEC 2014b; Government of Canada 2015; COSEWIC 2015).

Table 6-14: Provincially and Federally Listed Marine Species in Newfoundland and Labrador

Common Name	Scientific Name	Provincial Listed Status (*Endangered Species Act*)[1]	Federal Listed Status (*Species at Risk Act*)[2]	Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Listed Status[3]
Marine Fish				
northern wolffish	*Anarhichas denticulatus*	N/A	Threatened (Schedule 1)	Threatened
spotted wolffish	*Anarhichas minor*	N/A	Threatened (Schedule 1)	Threatened
Atlantic wolffish	*Anarhichas lupus*	N/A	Special Concern (Schedule 1)	Special Concern
smooth skate	*Malacoraja senta*	N/A	No Status (No Schedule)	Endangered
thorny skate	*Amblyraja radiata*	N/A	No Status (No Schedule)	Special Concern
Atlantic cod	*Gadus morhua*	N/A	No Status (No Schedule)	Endangered
American plaice	*Hippoglossoides platessoides*	N/A	No Status (No Schedule)	Threatened
Marine Birds				
piping plover *melodus* subspecies	*Charadrius melodus melodus*	Endangered	Endangered (Schedule 1)	Endangered

Common Name	Scientific Name	Provincial Listed Status (*Endangered Species Act*)[1]	Federal Listed Status (*Species at Risk Act*)[2]	Committee on the Status of Endangered Wildlife in Canada (COSEWIC) Listed Status[3]
eskimo curlew	*Numenius borealis*	Endangered	Endangered (Schedule 1)	Endangered
red Knot *rufa* subspecies	*Calidris canutus rufa*	Endangered	Endangered (Schedule 1)	Endangered
harlequin duck	*Histrionicus histrionicus*	Vulnerable	Special Concern (Schedule 1)	Special Concern
Barrow's goldeneye	*Bucephala islandica*	Vulnerable	Special Concern (Schedule 1)	Special Concern
ivory gull	*Pagophila eburnea*	N/A	Endangered (Schedule 1)	Endangered
Marine Mammals				
Atlantic walrus	*Obobenus rosmarus rosmarus*	N/A	No Status (No Schedule)	Special Concern
north Atlantic right whale	*Eubalaena glacialis*	N/A	Endangered (Schedule 1)	Endangered
northern bottlenose whale	*Hyperoodon ampullatus*	N/A	Endangered (Schedule 1)	Endangered
Sowerby's beaked whale	*Mesoplodon bidens*	N/A	Special Concern (Schedule 1)	Endangered
leatherback sea turtle	*Dermochelys coriacea*	N/A	Endangered (Schedule 1)	Endangered
killer whale	*Orcinus orca*	N/A	N/A	Special Concern
porbeagle shark	*Lamna nasus*	N/A	N/A	Endangered
shortfin mako shark	*Isurus oxyrinchus*	N/A	N/A	Threatened
blue shark	*Prionace glauca*	N/A	N/A	Endangered
fin whale	*Balaenoptera physalus*	N/A	Special Concern (Schedule 1)	Special Concern
blue whale	*Balaenoptera musculus*	N/A	Endangered (Schedule 1)	Endangered
harbour porpoise	*Phocoena phocoena*	N/A	Threatened (Schedule 1)	Special Concern

Notes:
N/A = not applicable (not listed).
[1] DOEC 2014b.
[2] Government of Canada 2015.
[3] COSEWIC 2015.

Under SARA, a Recovery Strategy and corresponding Action Plan must be prepared for Endangered, Threatened, and Extirpated species. A Management Plan must be prepared for species designated as Special Concern. Finalized Recovery Strategies have been prepared for five species currently designated as either

Endangered or Threatened under Schedule 1 of SARA: (1) leatherback sea turtle (Atlantic Leatherback Turtle Recovery Team [ALTRT] 2006); (2) north Atlantic right whale (Brown et al. 2009); (3) spotted wolffish (Kulka et al. 2007), (4) northern wolffish (Kulka et al. 2007), and (5) blue whale (Beauchamp et al. 2009). A proposed Recovery Strategy has been prepared for and the Scotian Shelf population of northern bottlenose whale (DFO 2009b).

For the purposes of this EA Registration, species at risk includes only those designated species that are known to occur, or to have occurred, in the vicinity of the Project area and not all provincially and federally protected species. Of the seven provincially and/or federally listed marine fish species presented in Table 6-14, all species with the exception of the smooth skate (*Malacoraja senta*) have a known range that includes the Project area. As noted in the previous sections, there are active fisheries for thorny skate (*Amblyraja radiata*), Atlantic cod and American plaice in the vicinity of the Harbour.

Of the six provincially and/or federally listed marine bird species presented in Table 6-14, all species with the exception of the ivory gull (*Pagophila eburnea*) have a known range that includes the Project area. As noted in the previous sections, the piping plover was observed in the St. Lawrence area between 2003 to 2009 by Gail and Norman Wilson (CFI 2009). Purple sandpiper (*Calidris maritima*) is the only shorebird that winters in the Placentia Bay area, and is a species of current management interest (P. Thomas 2009, pers. comm. cited in CFI 2009). They are relatively common and ubiquitous in the general area of the Burin Peninsula and Placentia Bay. Flocks have been observed along the wave wash and intertidal areas where seaweeds were abundant (LGL Limited 2007).

Of the 12 provincially and/or federally listed marine mammal species presented in Table 6-14, all species with the exception of the Atlantic walrus (*Obobenus rosmarus rosmarus*) and the Sowerby's beaked whale (*Mesoplodon bidens*) have a known range that includes the Project area. As noted in the previous sections, the fin whale is considered common in the Project area, and the blue whale and harbour porpoise have been documented in the southeast Burin Peninsula area through the DFO marine mammal sightings database (NLRC 2007).

The northwest Atlantic population of harbor porpoise is listed as Special Concern (COSEWIC 2015) and Threatened under Schedule 2 of SARA (Government of Canada 2015). The most significant threat to the recovery of the northwest Atlantic population of harbor porpoise may be getting caught in bottom-set gill nets for groundfish (DFO 2008a).

The blue whale population in the northwest Atlantic was designated as Endangered by COSEWIC in May 2002 and under Schedule 1 of SARA in January 2005. The greatest threats to the recovery of the blue whale include anthropogenic noise which causes a degraded underwater acoustic environment and alters behaviour, and food availability for the blue whale. Other threats to the recovery of the population include persistent marine contaminants, collisions with ships and disturbance caused by whale-watching activities, accidental entanglements in fishing gear, and toxic product spills (Beauchamp et al. 2009).

The Atlantic population of fin whale is listed as Special Concern by COSEWIC (COSEWIC 2015) and under Schedule 1 of SARA (Government of Canada 2015). There are several threats to the recovery of the fin whale population including noise pollution, caused by shipping, seismic exploration, military sonar and industrial development. Other important threats are changes in food availability, toxic spills, disease, and whaling which still occurs off the coasts of Greenland and Iceland (DFO 2013b).

ACCDC data received in 2015 did not identify any historical occurrence of marine species at risk or species of conservation concern within the 5 km radius; however, based on the opinion of species experts within ACCDC, it is noted that the Project area is within the range of the Barrow's goldeneye (*Bucephala islandica*) (Table 6-14).

Additional information on these species, including detailed species descriptions can be found in the 2009 EPR (CFI 2009).

6.4 Socio-Economic Environment

The Project is located on the Burin Peninsula, within the municipal boundaries of the Town of St. Lawrence (St. Lawrence), where there has been a long history in mining dating back to the 1930s. The following section provides an overview of the demography of the area, economy, employment, community services and infrastructure, and historic resources.

6.4.1 Data Limitations

The most recent census of the Canadian population was conducted in 2011, with data released in 2012. Since the Government of Canada eliminated the mandatory long census form in 2011, there exist data gaps. The 2011 Census is limited to population and private dwelling data. Other information, such as labour force and occupation statistics, are presented in the National Household Survey (NHS) (Statistics Canada 2013).

6.4.2 Demography

Since the mid-1980s, the population of St. Lawrence has been declining (Figure 6-6). The 2011 Census population for St. Lawrence was 1,244 individuals, which represented a 7.8% decline from the 2006 population of 1,349 individuals (Statistics Canada 2012). Similarly, the population of the Burin Peninsula declined 3.2% between 2006 and 2011 (Newfoundland and Labrador Department of Finance [NLDF] 2014). During the same period, the overall population of the province increased 1.8%, growing from 505,469 individuals to 514,536 individuals, as shown in Table 6-15 below (Statistics Canada 2012).

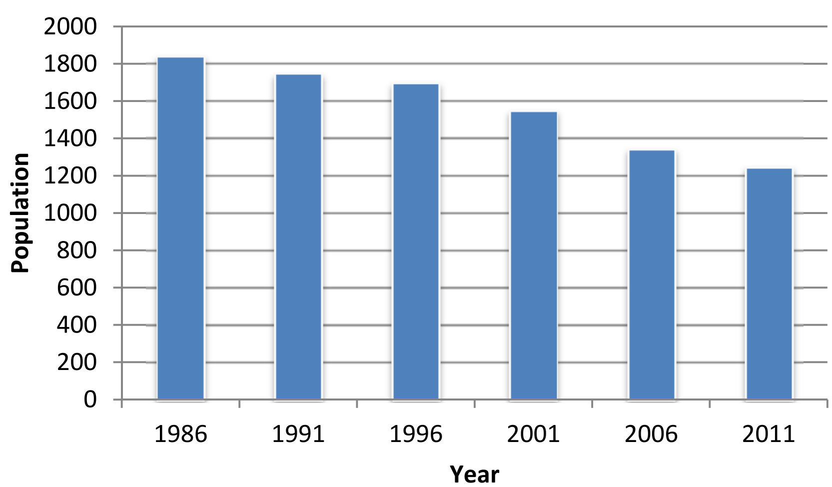


Figure 6-6: St. Lawrence Population (Source: NLSA 2015)

Table 6-15: Population Change (2006 to 2011)

Location	2006	2011	Change (5 years)	Change (%)
St. Lawrence[a]	1,349	1,244	-105	-7.8
Burin Peninsula	21,819	21,112	707	-3.2
Newfoundland and Labrador[a]	505,469	514,536	9,067	1.8

[a] Statistics Canada 2012.
[b] NLDF 2014.

The population of St. Lawrence has been aging; in 2001 the median age was 38 years, increasing to 43 years in 2006 and to 47 years in 2011 (Newfoundland and Labrador Statistics Agency [NLSA] 2015). However, in 2011, 84.9% of the population was aged 15 years and over, compared to 85.1% for the Province (Statistics Canada 2012).

6.4.3 Economy, Employment and Business

Historically, mining activities encouraged development of the local economy of St. Lawrence. Following closure of the mine in 1990, the community experienced a decline in population associated with out-migration of experienced and skilled workers. In 2011, the total labour force in St. Lawrence was 985 individuals. The employment rate was 42.6% and unemployment was 11.6% (Statistics Canada 2013). There has been a 5.1% decline in unemployment between 2006 and 2011, as the 2006 unemployment rate was 16.5% (NLSA 2015). Some of this decline in unemployment can be attributed to increased communiting of workers to northern mines and Alberta.

The key occupations of the local labour force in St. Lawrence include trades, natural resources related occupations, manufacturing, sales and services, education, and community and government services. According to the NHS conducted for the 2011 Census, the distribution of employment by sector in St. Lawrence identified manufacturing as the leading sector with 27% of the employment, followed by health care and social assistance (15%), construction (13%) and retail trade (9%). In 2011, only 3% of the workforce in St. Lawrence was employed in the mining sector (Statistics Canada 2013).

The fish plant owned by Ocean Choice International is the largest employer in St. Lawrence (Town of St. Lawrence 2015). Other employers include the US Memorial Health Care Centre, St. Lawrence Academy and a number of small businesses. In 2011, the gross personal income per capita in St. Lawrence was $26,900. For the Burin Peninsula, gross personal income per capita was $28,000. Both the values for St. Lawrence and the Burin Peninsula are below the gross personal income per capita for the province (i.e., $31,000) (NLSA 2015).

There are currently 18 businesses in St. Lawrence and 79 businesses that are members of the Burin Peninsula Chamber of Commerce (BPCC) (Town of St. Lawrence 2015; BPCC 2015). The Marystown-Burin Area Chamber of Commerce was established in 1991 and in 2009 the boundaries of the chamber of commerce were expanded to include the entire Burin Peninsula to serve the entire business community in the region. To reflect this change, the organization was renamed as the BPCC (BPCC 2015). From a regional perspective, the businesses located in the Burin Peninsula represent 3.5% of all businesses in the province (NLSA 2014).

6.4.4 Community Services and Infrastructure

St. Lawrence owns and manages several infrastructure and services in the area, including the roads. The socio-economic effects of the Project will most likely be concentrated in the area of St. Lawrence; however, Project-related effects may also be experienced in areas from which goods and services for the Project are sourced (i.e., larger communities, Newfoundland and Canada in general). Located approximately 25 km from St. Lawrence, the communities of Marystown and Burin are the larger service centres for the region (e.g., licenced child care, police district offices).

Transportation

St. Lawrence is accessible via Highway Route 220/210, which is a two-lane highway connecting St. Lawrence with the Trans-Canada Highway (TCH) in Goobies. The Provincial Department of Transportation and Works maintain this highway. There are several paved roads within St. Lawrence and those are the responsibility of the municipality. There are no taxi services in St. Lawrence, but there are several privately owned transportation companies who can provide service between the Burin Peninsula and St. John’s.

There are a number of gravel access roads already in place throughout the Project area, used during historic mining operations. Currently, the access roads in the Project area are occasionally used for recreational purposes by local residents for walking, ATV use and berry picking.

A ferry service between the nearby community of Fortune and the French islands of St. Pierre and Miquelon is available. Additional information regarding marine transportation is provided in Section 6.5.5 Shipping and Navigation.

Housing

According to the 2011 Census, there were 485 dwellings in St. Lawrence in 2011, including 375 single family households, five multiple family households and 100 non-family households. Approximately 200 of those dwellings were built after 1971 (NLSA 2015).

The private rental market in St. Lawrence is limited and there is some demand for social housing for low income families. The regional supervisor for Newfoundland and Labrador Housing advised that there are 19 social housing units in St. Lawrence and in 2015, there were only two vacancies. There are also six cottage style units for seniors, which were fully occupied in 2015 (J. Cluett, Newfoundland and Labrador Housing Corporation pers. comm. 2015).

St. Lawrence has prepared a conceptual plan in anticipation of increased demand for housing associated with the Project. The town has submitted an application to the provincial Crown Lands Division of the Department of Municipal and Intergovernmental Affairs to access land for the development of a subdivision intended to accommodate 64 serviced lots for single family dwellings. An area has also been identified for use as a recreational vehicle (RV) park that can accommodate 20 units.

Education and Child Care

There is one school located in St. Lawrence; St. Lawrence Academy offers programming from kindergarten to grade 12. The school was built to accommodate 580 students, but enrolment has been declining. During the 2014-2015 school year, the total number of students enrolled was only 180 compared to 228 students in 2008 (NLSA 2015; CFI 2009). The school has capacity to accommodate additional students should there be families with children arriving in St. Lawrence as a result of the Project.

There are two colleges in the region: the College of the North Atlantic (CNA) has a campus located in Burin Bay Arm where post-secondary trades programs and the transition year program for university are offered, and a private college, Keyin College, has campuses located in St. Lawrence, Burin and Marystown. CFI has entered into an agreement with Keyin College to set up a mining school in St. Lawrence to train Mine and Mill workers, pending Project approval.

Adult basic education and literacy programs are offered in St. Lawrence, and other trades and training programs are offered in Burin and Marystown. Additionally, high-speed internet services are available on the Burin Peninsula, facilitating the delivery of distance learning programs.

In 2015, there were no child care centres licensed under the provincial regulations in St. Lawrence. There are only two licensed child care centres on the Burin Peninsula and they are located in Marystown. The provincial government does not track the number of unlicensed centres as they are not regulated (Newfoundland and Labrador Education and Early Childhood Development [NLEECD] 2015).

Health

The US Memorial Health Center in St. Lawrence offers acute and long term health care services with 24-hour emergency services, a family practice, long-term care, protective care and other specialty clinics. The facility is equipped with 30 long-term care beds, ten dementia care beds and two observation beds (Burin Peninsula Health Care Foundation [BPHCF] 2015).

As for community-based services in the region, there is a ten-bed emergency centre house in Marystown, known as Grace Sparkes House, which offers support for a period of six weeks for women and children leaving a violent domestic situation. The organization also operates a six unit affordable housing complex for women and children in need.

Policing and Fire Services

St. Lawrence is serviced by the Royal Canadian Mounted Police (RCMP) through the Burin Peninsula District which was established in 1997. The RCMP district office is located in Marystown, and there is a satellite office in St. Lawrence with two RPMP resident members (RCMP 2015).

Firefighting services are provided locally in St. Lawrence by a volunteer municipal fire department (Town of St. Lawrence 2015).

Energy

Electrical power in St. Lawrence is obtained from the Newfoundland Power electrical grid. St. Lawrence is the site of a windmill farm with nine turbines with a total capacity of 27 megawatts. The wind farm can produce enough electricity to meet the demands of approximately 7,000 homes. Electricity generated by the nine windmills is being diverted to the provincial power grid.

Waste Management

Historically, St. Lawrence had a municipal waste disposal site which closed following the advancement of the Provincial Solid Waste Management Strategy initiated by the provincial government to modernize waste management across the province by 2020. The Burin Peninsula Regional Service Board (BPRSB), established in 2013, provides municipal waste management services on the Burin Peninsula, including services to St Lawrence (BPRSB 2015).

Tourism

In the past years, the provincial government has been targeting resources to develop the tourism industry in Newfoundland and Labrador. In 2013, there were more than 495,000 visitors coming to the province with associated expenditures by non-residents exceeding $485 million for the year (NLDF 2014). Destination St. John's has been marketing the Burin Peninsula in its tourism campaign and the Heritage Run Tourism Association, a volunteer organization of operators, also seeks to promote the region (CFI 2009).

St. Lawrence is an integral part of the Heritage Run. The tourism infrastructure in St. Lawrence includes the Miner's Museum, a hotel, hiking and all-terrain trails and bird watching. Other major tourist attractions include the sites where Americans were rescued from two sinking ships, US Prollux and US Truxton, which can be observed from Chambers Cove and Lawn Point. Some of the areas that are used for hiking activities include Blue Beach, Cape Chapeau Rouge and Salt Cove Beach and an all-terrain trail owned and operated by the St. Lawrence Area Trail Association, which plans to expand the trail into the Burin Peninsula Trail system. The sandy beach at Shoal Cove has been identified as being used for recreational and tourism activities.

There is additionally a strong base around which tourism enterprises can further develop and expand, as visitors are interested in learning about fluorspar through visits of the mine and learning about the mineral.

Recreation

Recreational facilities in St. Lawrence are maintained by the town. Facilities include two soccer fields, an outdoor swimming pool, curling rink, basketball court, gymnasium in the school, and a recreation centre. There is also an active soccer association; fifteen years ago St. Lawrence established itself as the soccer capital of Canada.

Outdoors activities are a large part of the recreational activities accessible in the community, through the use of hiking trails to enable excursions to the ocean. Bird watching, berry-picking and camping are other activities that are practiced by community members and visitors. The town has access to sandy beach front at Shoal Cove Beach.

6.4.5 Commercial and Recreational Fisheries

Blue Beach Cove is located in the Great St. Lawrence Harbour (the Harbour), which falls within the Northwest Atlantic Fisheries Organization (NAFO) Subdivision 3Ps. NAFO is an intergovernmental fisheries science and management body that currently has 12 members from North America, Europe, Asia and the Caribbean. Among them are four coastal states bordering the Convention Area: USA, Canada, France (in respect of St. Pierre et Miquelon), and Denmark (in respect of Faroe Islands and Greenland). NAFO is a repository of information related to the fishery and maintains the fishery catch statistics for FAO Area 21 (the Northwest Atlantic) which includes both summary catch info and detailed catch and effort information. Geo-spatial information however is confidential and mostly used for compliance purposes.

The following description of commercial fisheries in the vicinity of the Project is based on NAFO fishery catch statistics from 1960 to 2013 for Subdivision 3Ps (NAFO 2014). Currently, DFO is in the process of retiring their georeferenced catch and effort datasets previously available using the web-based GeoBrowser (i.e., DFO commercial landings database). The former GeoBrowser maps are being transferred to the updated Interactive Maps website which presently provides fish and fish habitat map information covering British Columbia, the Yukon Territory, and the Canadian Pacific offshore (i.e., Mapster 3). Information collected via the DFO commercial landings database and personal communications with local fishers to support the 2009 EPR (DFO 2009a cited in CFI 2009) prepared for the Reactivation of the St. Lawrence Fluorspar Mine is also presented in this section, as applicable. Table 6-16 presents a list of commercially fished species in NAFO Subdivision 3Ps from 1960 to 2013.

Table 6-16: Commercially Fished Species in NAFO Subdivision 3Ps from 1960 to 2013

Common Name	Scientific Name	Species at Risk (Yes or No)
northern shortfin squid	*Illex illecebrosus*	No
American angler (anglerfish)	*Lophius americanus*	No
American eel	*Anguilla rostrata*	Yes
American lobster	*Homarus americanus*	No
American plaice	*Hippoglossoides platessoides*	Yes
argentines (ns)	*Argentina sphyraena*	No
Atlantic cod	*Gadus morhua*	Yes
Atlantic halibut	*Hippoglossus hippoglossus*	No
Atlantic herring	*Clupea harengus harengus*	No
Atlantic mackerel	*Scomber scombrus*	No
Atlantic redfishes (ns)	*Sebastes marinus and Sebastes mentella*	No
Atlantic rock crab	*Cancer irroratus*	No
Atlantic salmon	*Salmo salar*	Yes
Atlantic wolfish	*Anarhichas lupus*	Yes
bay scallop	*Aquipecten irradians*	No
blue mussel	*Mytilus edulis*	No
Capelin	*Mallotus villosus*	No
chars (Arctic char) (ns)	*Salvelinus alpinus*	No
cusk (tusk)	*Brosme brosme*	No
dogfishes (Atlantic dogfish) (ns)	*Squalus acanthias*	No
Greenland cod	*Gadus ogac*	No
Greenland halibut	*Reinhardtius hippoglossoides*	No
groundfishes (ns)	*N/A*	No
Haddock	*Melanogrammus aeglefinus*	No
Icelandic scallop	*Chlamys islandica*	No
large sharks (ns)	*N/A*	No
lumpfish (lumpsucker)	*Cyclopterus lumpus*	No
marine crabs (ns)	*N/A*	No
marine invertebrates (ns)	*N/A*	No
marine molluscs (ns)	*N/A*	No
northern (Atlantic) bluefin tuna	*Thunnus thynnus*	No
northern prawn (shrimp)	*Pandalus borealis*	No
pelagic fishes (ns)	*N/A*	No
pink (pandalid) shrimps	*Pandalus borealis*	No
pollock (saithe)	*Pollachius virens and Pollachius pollachius*	No
porbeagle (shark)	*Lamna nasus*	Yes
queen (snow) crab	*Chionoecetes opilio*	No
rainbow (American) smelt	*Osmerus mordax*	No
roughhead grenadier	*Macrourus berglax*	No
roundnose grenadier	*Coryphaenoides rupestris*	No
sculpins (ns)	*Myoxocephalus Scorpius and Myoxocephalus octodecimspinosus*	Yes

Common Name	Scientific Name	Species at Risk (Yes or No)
sea (giant) scallop	*Placopecten magellanicus*	No
sea urchin	*N/A*	No
shortfin mako shark	*Isurus oxyrinchus*	Yes
silver hake	*Merluccius bilinearis*	No
skates (ns)	*N/A*	Yes
soft (soft-shell) clam	*Mya arenaria*	No
spiny (picked) dogfish	*Squalus acanthias*	No
sturgeons (ns)	*N/A*	No
swordfish (Atlantic swordfish)	*Xiphias gladius*	No
trouts (ns)	*N/A*	No
whelks (ns)	*Buccinum undatum*	No
white hake	*Urophycis tenuis*	No
winter flounder	*Pseudopleuronectes americanus*	No
witch flounder (greysole)	*Glyptocephalus cynoglossus*	No
wolffishes (catfish) (ns)	*Anarhichas denticulatus and Anarhichas minor and Anarhichas lupus*	Yes
yellowtail flounder	*Limanda ferruginea*	No

Note: ns = Nova Scotia population. N/A = no species identified.
Source: NAFO 2014.

Of the 57 species or groups of species identified as commercially fished species in NAFO Subdivision 3Ps, ten are considered to be species at risk (Table 6-16). Information on fish species at risk is included in Sections 6.2.3 and 6.3.3.

The NAFO fishery catch statistics from 2000 to 2013 for Subdivision 3Ps reveal that a number of species historically had fisheries in the Subdivision (from 1960 to 1999), but no longer support active fisheries. Additionally, the catch data indicates that the Subdivision does not support a robust fishery for a number of other species based on the total harvest by weight reported in each year. As such, a number of species are excluded from further discussion. Table 6-17 presents a list of the 25 commercially fished species, or groups of species, in NAFO Subdivision 3Ps from 2000 to 2013.

Table 6-17: Commercially Fished Species in NAFO Subdivision 3Ps from 2000 to 2013

Common Name	Scientific Name	Species at Risk (Yes or No)
American angler (anglerfish)	*Lophius americanus*	No
American lobster	*Homarus americanus*	No
American plaice	*Hippoglossoides platessoides*	Yes
Atlantic cod	*Gadus morhua*	Yes
Atlantic halibut	*Hippoglossus hippoglossus*	No
Atlantic herring	*Clupea harengus harengus*	No
Atlantic mackerel	*Scomber scombrus*	No
Atlantic redfishes (ns)	*Sebastes marinus and Sebastes mentella*	No
Capelin	*Mallotus villosus*	No
Greenland halibut	*Reinhardtius hippoglossoides*	No
groundfishes (ns)	*N/A*	No
Haddock	*Melanogrammus aeglefinus*	No
Icelandic scallop	*Chlamys islandica*	No
marine invertebrates (ns)	*N/A*	No
northern prawn (shrimp)	*Pandalus borealis*	No
pollock (saithe)	*Pollachius virens and Pollachius pollachius*	No
queen (snow) crab	*Chionoecetes opilio*	No
sea (giant) scallop	*Placopecten magellanicus*	No
skates (ns)	*N/A*	Yes
whelks (ns)	*Buccinum undatum*	No
white hake	*Urophycis tenuis*	No
winter flounder	*Pseudopleuronectes americanus*	No
witch flounder (greysole)	*Glyptocephalus cynoglossus*	No
wolffishes (catfish) (ns)	*Anarhichas denticulatus and Anarhichas minor and Anarhichas lupus*	Yes
yellowtail flounder	*Limanda ferruginea*	No

Note: ns = Nova Scotia population. N/A = no species identified.
Source: NAFO 2014.

As indicated by the catch statistic data, the principal fisheries in Subdivision 3Ps (based on quantity of harvest) are Atlantic cod, Atlantic herring (*Clupea harengus*), Atlantic redfishes (*Sebastes marinus* and *Sebastes mentella*), queen (snow) crab (*Chionoecetes opilio*), sea (giant) scallop (*Placopecten magellanicus*), and welks (*Buccinum undatum*). Figure 6-7 presents the NAFO fishery catch statistics from 2000 to 2013 in Subdivision 3Ps for the principal fisheries.

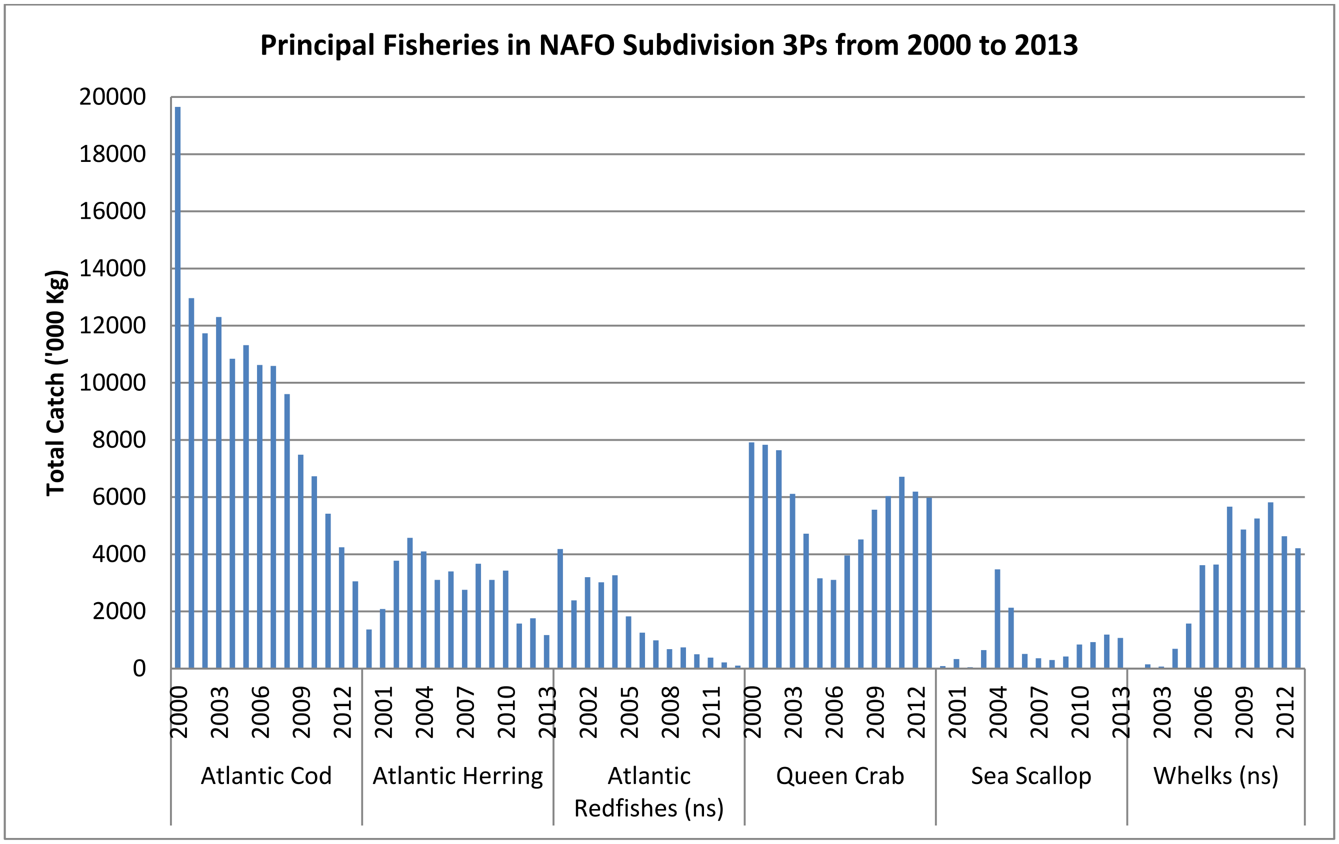


Figure 6-7: Principal Fisheries in NAFO Subdivision 3Ps from 2000 to 2013 (Source: NAFO 2014)

A discussion with a local St. Lawrence fisherman (E. Jarvis pers. comm. 2009 cited in CFI 2009) indicated that commercial fishing within the Harbour is now quite limited. Some lobster fishing occurs seasonally in Blue Beach Cove, and gill nets are sometimes set on the east side of the Harbour for a herring bait-fishery. Capelin traps were set in Blue Beach Cove historically, but not during recent years. A limited recreational squid fishery also occurs in the Harbour when the opportunity arises. Mr. Jarvis (pers. comm. 2009 cited in CFI 2009) indicated that most of the commercial fishery in the area is prosecuted outside of the Harbour. He said that both Atlantic cod and American plaice are fished primarily to the south and west of the Harbour. Additional details regarding the current, local fishery in the vicinity of the Project, gathered in support of the 2009 EPR (CFI 2009), are presented in Table 6-18.

Table 6-18: Current Fisheries within the Great St. Lawrence Harbour

Common Name	Scientific Name	Fishery Type	Season	Depth Fished (m)	Gear Type	Location
Atlantic mackerel	*Scomber scombrus*	Bait	August-September	18	Mackerel nets	Great St. Lawrence Harbour
Atlantic herring	*Clupea harengus harengus*	Bait	January-April	9 – 36	Seine nets, gillnets	Great St. Lawrence Harbour
capelin	*Mallotus villosus*	Observed	June	9 – 27	Seine, dip nets, buckets	Great St. Lawrence Harbour, including Blue Beach Cove
Atlantic cod	*Gadus morhua*	Commercial	June – October	27 – 90	Gillnets, cod trap, hook and line, trawl	South of Great St. Lawrence Harbour
lumpfish	*Cyclopterus lumpus*	Commercial	May – June	11 – 45	Lump nets	Outside of Great St. Lawrence Harbour
witch flounder or greysole	*Glyptocephalus cynoglossus*	Commercial	May – October	90 – 108	Nets, hook and line	South of Lawn Point East to Ferryland Head
northern shortfin squid	*Illex illecebrosus*	Recreational	August – September	4 – 18	Hook and line	Great St. Lawrence Harbour
snow crab	*Chionoecetes opilio*	Commercial	May – September	99 – 180	Crab pots	2-3 miles (3-5 km) outside of Great St. Lawrence Harbour
American lobster	*Homarus americanus*	Commercial	April – June	4 – 36	Lobster pots	West shore of Great St. Lawrence Harbour, including Blue Beach Cove

Source: CFI 2009.

Information on recreational fisheries was collected during the Public Information Session held in St. Lawrence in April 2015 (Section 5.0). Participants identified Grebes Nest Pond, John Fitzpatrick Pond, Bill Hill Pond, Upper Island Pond, Little Lawn and Shoal Cove Pond as water bodies that are used for recreational fishing activities.

6.4.6 Historic Resources

The Project area is largely located on a brownfield site given the previous mining activities that took place since the early 1930s. There is limited forest cover and the area mainly consists of bog, marsh, heathland with numerous shallow ponds. Blue Beach is the only registered archaeological site in the area, and consists of a ship wreck dating back to 1946. There have also been recordings of onshore shipwreck remains at Blue Beach (Gerald Penney Associates Limited [GPA] 2015).

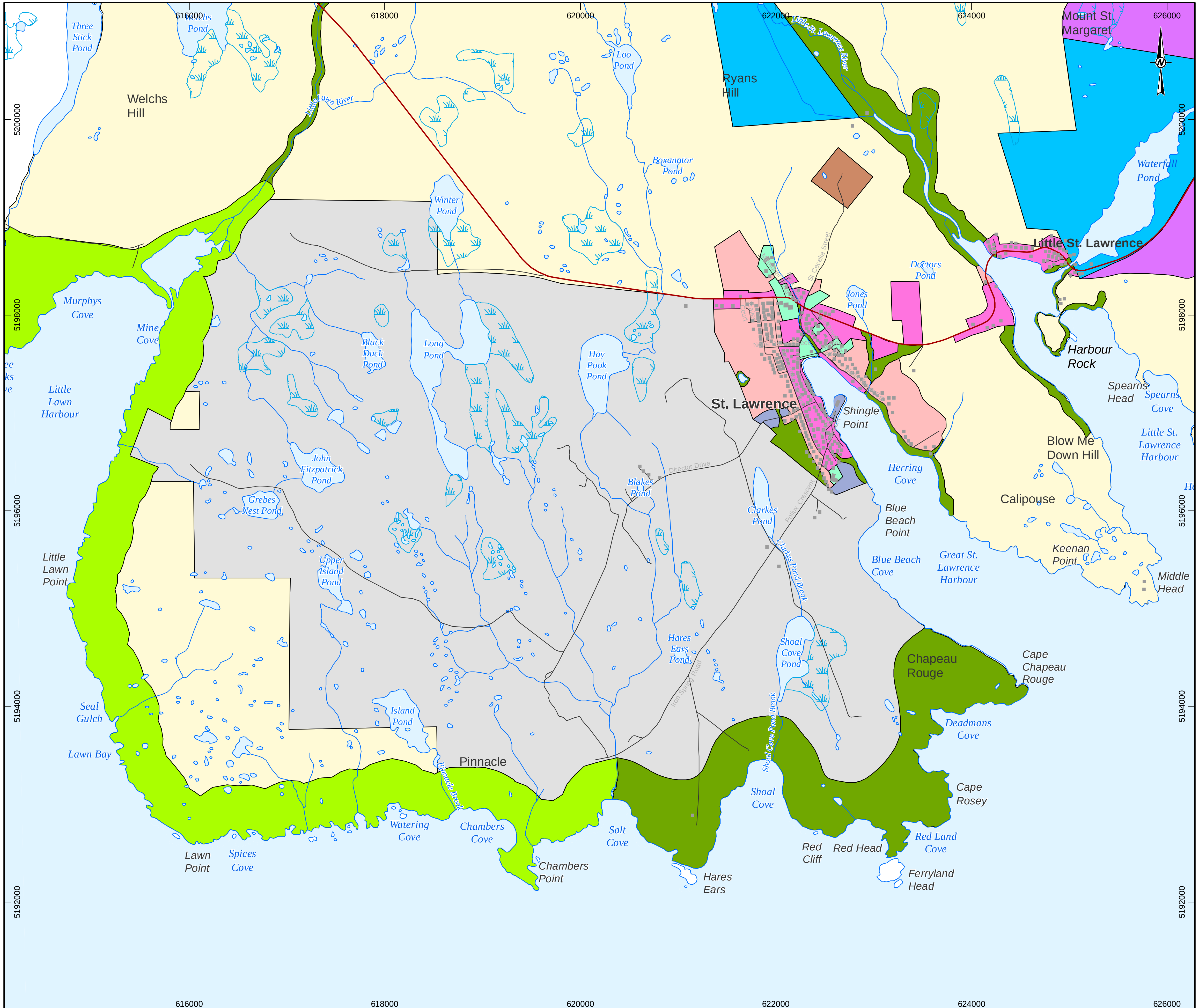
The field study conducted in 2014 as part of the historic resources assessment for the Project included an investigation of the AGS Mine and the proposed access roads. The Shoal Cove Pond former tailings facility and other Project areas were investigated in the previous study conducted in 2009. The results of the assessment indicate that the Project area is not likely to have been a habitation site in the past and only Shoal Cove Pond was likely to have been used, or be a transit point, before the opening of the first fluorspar mine in 1933. With the exception of the registered archaeological site, no historic resources were identified in the Project area, as acknowledged by the Provincial Archaeology Office (PAO) in response to the submission of the Historic Resources Report (PAO 2014; GPA 2015).

6.5 Land and Water Use

A description of land designation and ownership, current and historical land use activities, shipping and navigation and water use is provided in the following section.

6.5.1 Zoning Designation

The proposed AGS Mine and Marine Terminal components of the Project are located in an area designated for mining as per the 2011 Development Regulations for St. Lawrence (Figure 6-8). In 2002, the Blue Beach and Blue Beach Point areas were rezoned by the municipality to support the development of the Marine Terminal at Blue Beach. These amendments were subject to a public consultation process, as required under the provincial *Urban and Rural Planning Act*. In 2003, St. Lawrence posted notices stating that the purpose of the amendments to the Municipal Plan are to "allow the development of the Blue Beach Area as a future major deep water port by allowing transportation uses in the minerals working designation" (Southern Gazette 2003).



LEGEND

MUNICIPAL ZONING

- Residential
- Mixed Development
- Public
- Solid Waste Disposal
- Rural
- Industrial
- Mining
- Environmental Protection
- Environmental Protection-Management Unit
- Watershed Conservation
- Protected Public Water Supply

TOPOGRAPHY

- Building
- Highway
- Existing Road
- Watercourse
- Waterbody
- Wetland

0 1 2
Kilometres
1:40,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE

ST. LAWRENCE MUNICIPAL ZONING - 2011 DEVELOPMENT REGULATIONS

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT No. 14-07707 Rev. 0 FIGURE **6-8**

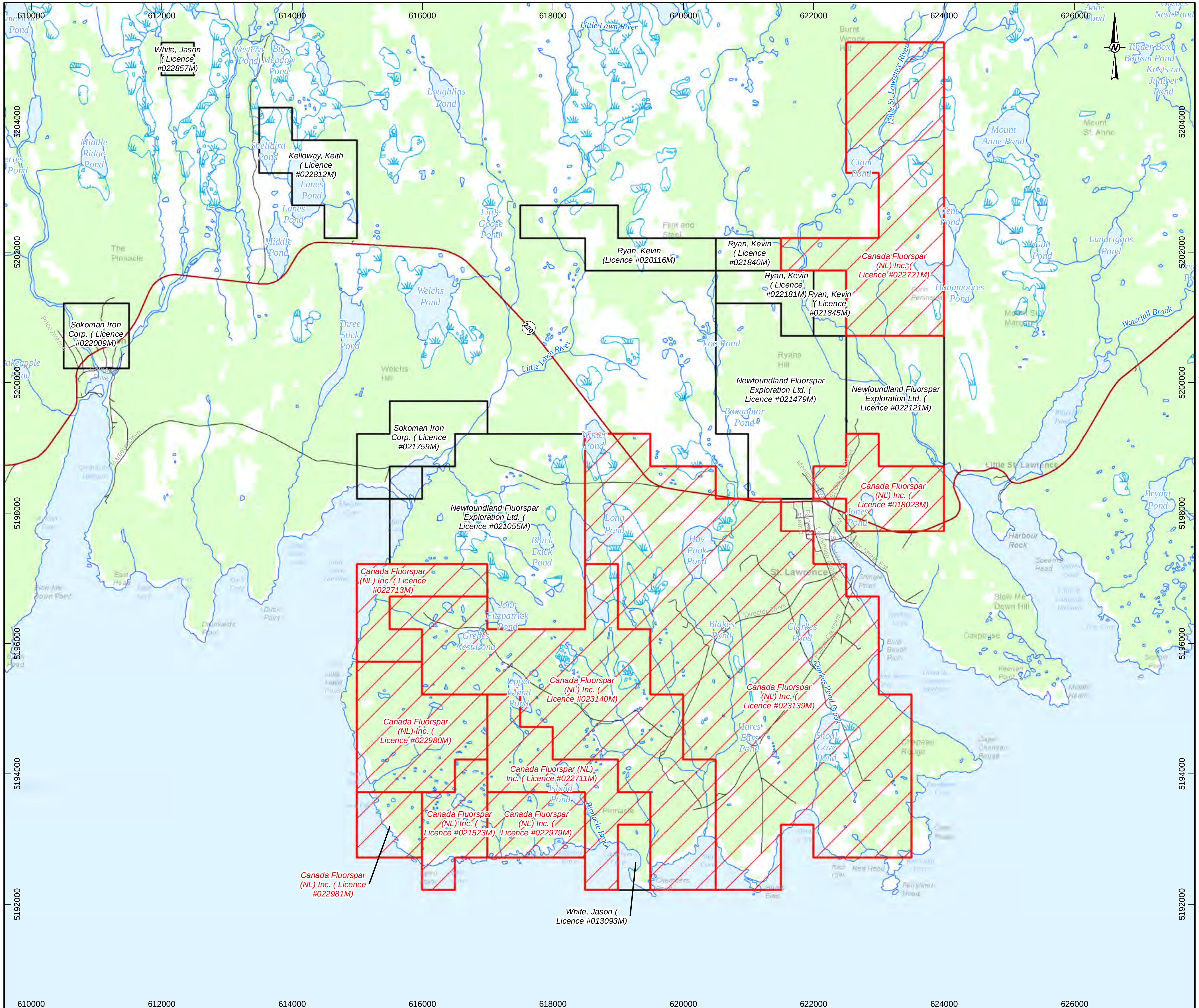
6.5.2 Land Ownership

The St. Lawrence Project area is owned by CFI. They have acquired nine mineral licences, with 200 mineral claims, covering an area of approximately 49 km^2 (Figure 6-9). These licences include:

- Director area (Mineral Licence No. 023139M);
- AGS area (Mineral Licence No. 023140M);
- AGS area west (Mineral Licence No. 022713M);
- Black Duck area (Mineral Licence No. 018023M);
- Chambers Cove area (Mineral Licence No. 022711M);
- Mount Margaret area (Mineral Licence No. 022721M);
- Spice Cove area (Mineral Licence No. 021523M);
- Watering Cove area (Mineral Licence No. 022979M);
- Lawn Point area (Mineral Licence No. 022980M); and
- Lawn Head area (Mineral Licence No. 022981M) (Agnerian 2015).

CFI and the Newspar partners also hold seven areas of mining and surface leases covering an area of approximately 6 km^2. These areas are adjacent to the Director area mineral licence (011590M) and are located in the following areas:

- Director Vein area (Mining Lease 212 and Surface Lease 126) (CFI);
- Blue Beach area (Mining Lease 214 and Surface Lease 131) (Newspar partners);
- Mill Site area (Lease CL E110124) (Newspar partners);
- Tarefare Vein area (Mining Lease 213 and Surface Lease 130) (Newspar partners);
- AGS Vein area (Mining Lease 150 and Surface Lease 127) (CFI);
- Blue Beach Wharf Lot area (Surface Lease 128) (CFI);
- Blue Beach Wharf Access area (Surface Lease 129) (CFI); and
- Tailings Management area (Surface Lease 133) (Newspar partners) (Agnerian 2015).



LEGEND

Canada Fluorspar (NL) Inc. Claims

Map Staked Claims

TOPOGRAPHY

Highway

Existing Road

Watercourse

Waterbody

Wetland

0 1.5 3

Kilometres

1:60,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; GEOSCIENCE ATLAS, GOVERNMENT OF NEWFOUNDLAND AND LABRADOR; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE

MINERAL LICENCES (CLAIMS)

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT No.	Rev.	FIGURE
14-07707	0	6-9

6.5.3 Current Land Use

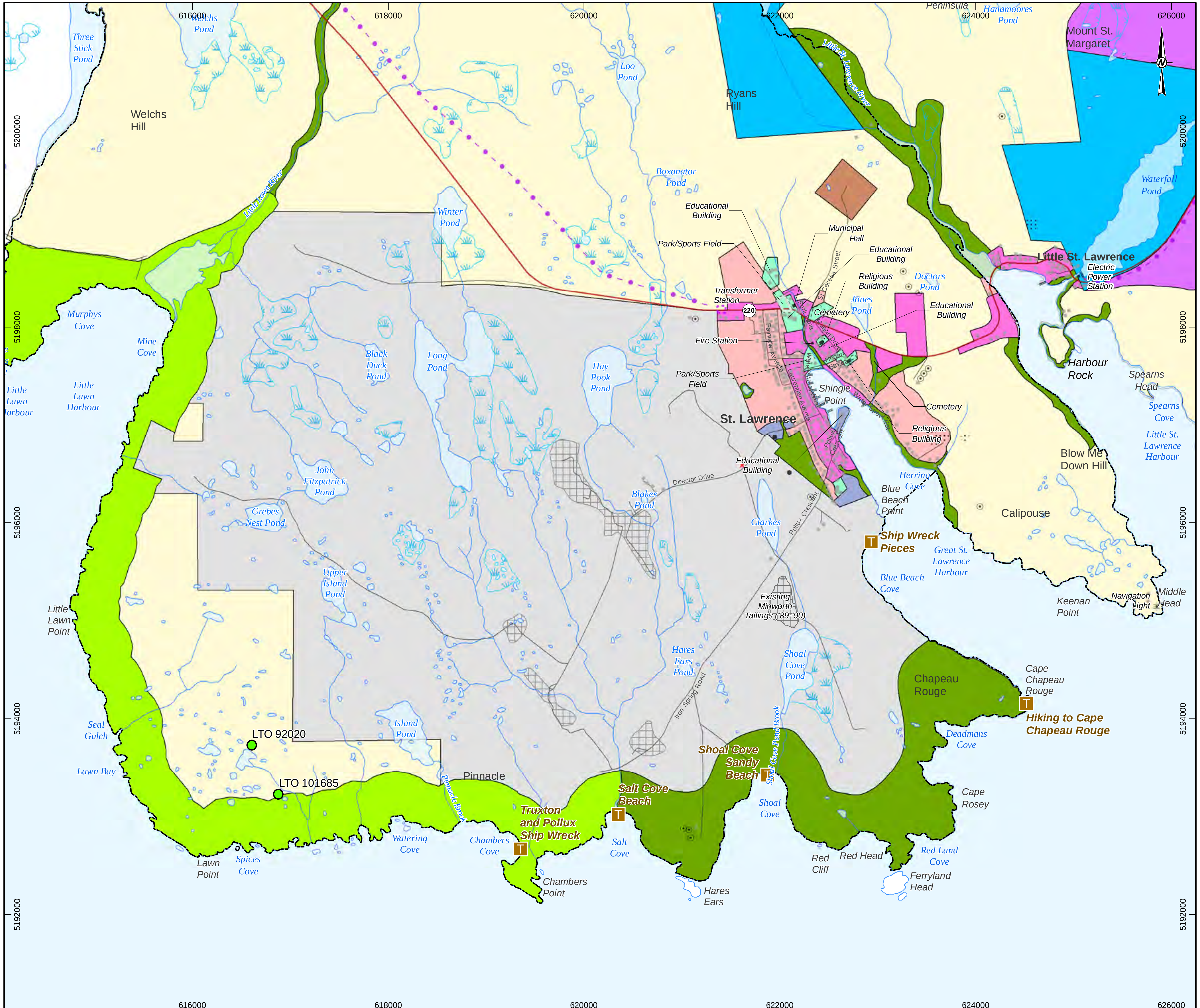
The Project area is occupied by existing CFI offices and equipment that are near the existing mill. There are no permanent dwellings located in the Project area. There are two registered cabins located west of Island Pond (Licence to Occupy [LTO] 92020 K. Kettle and LTO 101685 R. Slaney). These cabins are accessed by way of the existing gravel access roads within the Project area and are connected with an ATV trail (Figure 6-10). In addition, the Project area access roads are occasionally used for recreational purposes by local residents for walking, ATV use and berry picking.

There are some homes (permanent residential dwellings) located on privately owned properties located close to the Project area. Two homes are located off the Blue Beach South road between Clarkes Pond and Blue Beach and there are four homes off Director Drive in the vicinity of Haypook Brook and located about 2 km from the existing mill site to the southeast, 3 km from Tarefare No. 2 shaft to the southwest, and 1 km from the Blue Beach North mine site to the east. The four homes on Director Drive are not connected to the municipal water distribution system, but the two homes off Blue Beach South road are on the municipal water system and do not draw water from the Project area.

The land within the designated mining zone is not currently being used for industrial purposes. Numerous drilling, trenching and water sampling programs have occurred throughout the area; however, mining has not taken place since 1990.

The shore of Blue Beach is currently unutilized. There is no infrastructure in place along this portion of coastline. Shoal Cove, just west of Blue Beach, is known for its sandy beach and is often used by recreational users. There is a Provincial park located in Frenchman's Cove and privately owned park facilities in Lewin's Cove (which is approximately 28 km from the Project area). The Fortune Head Ecological Reserve is located in Fortune, approximately 70 km away.

There are no National Parks or National Historic Sites located near the Project area. There are also no designated Aboriginal lands near the Project. The wreck sites of the USS Truxtun and USS Pollux (located in Chambers Cove and off Lawn Head, respectively) have been designated as municipal historic sites by the Heritage Foundation of Newfoundland (a non-profit organization). The Iron Springs Mine site (located about 3 km from the existing mill/office site) is also classified as a municipal heritage site.



LEGEND

- T Tourist Attraction
- License to Occupy

MUNICIPAL ZONING

- Residential
- Mixed Development
- Public
- Solid Waste Disposal
- Rural
- Industrial
- Mining
- Environmental Protection
- Environmental Protection-Management Unit
- Watershed Conservation
- Protected Public Water Supply

TOPOGRAPHY

- Navigational aid (navigation light)
- Building (unknown)
- Building (religious building)
- Building (fire station)
- Building (electric power station)
- Building (municipal hall)
- Tower (communication)
- Tank
- Blocked passage
- Municipal Boundary
- Power transmission line (overhead)
- Highway
- Existing Road
- Manmade hydrographic entity (dam)
- Manmade hydrographic entity (wharf)
- Watercourse
- Waterbody
- Wetland
- Pit
- Mine
- Cemetery
- Park/Sports field
- Transformer station

0 1 2
Kilometres
1:40,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT
CANADA FLUORSPAR INC.

PROJECT
AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE
LAND USE

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT No. 14-07707 Rev. 0 FIGURE **6-10**

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

Path: H:\Projets\Canada Fluorspar\St_Lawrence_NL_Mines\PROJECTS\1407707_EA_AGS_Mine_St_Lawrence\MXD\Rev\A1407707_Figure_6-10_Land_Use_20150514.mxd

6.5.4 Historical Land Use

The proposed Project area has been used for mining and processing fluorspar for several decades beginning in the 1930's and as such, the area is classified as a brownfield site.

As described in Section 6.4.6, there is one registered archaeological site at Blue Beach. The site was registered by the provincial Provincial Archaeology Office in 2007 following the discovery of a ship wreck that occurred in 1946. However, based on the results of the historic resource assessment conducted for the Project, no other historic resources were identified in the Project area (GPA 2015).

6.5.5 Shipping and Navigation

For safety along Canada's coasts, the Vessel Traffic Services Zones Regulations under the *Canada Shipping Act* establish Vessel Traffic Services (VTS) zones. Shipping in these zones is monitored by the Canadian Coast Guard's Marine Communications and Traffic Services (MCTS). Ships of 500 tonnes gross tonnage or more must report to an MCTS officer 24 hours before entering the VTS zone. The incoming vessel must report information about the ship and its intended route, including any defects and deficiencies relevant to potential marine pollution, as well as position, speed, destination, etc. This allows any safety or environmental concerns to be addressed before ships receive clearance to enter Canadian waters. Vessels within the zone must also make regular reports at specified calling-in points (Transport Canada 2015).

VTS zones however, do not operate like air traffic control. It is the ship master's responsibility to safely guide the ship; however the master must comply with a direction given by a MCTS officer (Transport Canada 2015). A Pre-Arrival Information Report (PAIR) is required to be filed 96 hours prior to arrival in Canadian waters, as per the Marine Transportation Security Regulations in accordance with the instructions set out in the Canadian Coast Guard's Radio Aids to Marine Navigation, unless the total duration of the voyage before entering Canadian waters is less than 96 hours in which case the notification must be provided at least 24 hours prior to entering Canadian waters. The MCTS logs movements of larger vessels but non-reporting traffic includes a significant proportion of tugs, fishing and recreational vessels (DFO 2015).

The Placentia Bay VTS zone comprises all Canadian waters between a line bearing 180° True from Bass Point, 46°55'05"N 055°15'55"W; and a line bearing 180° True from Cape St. Mary's light, 46°49'22"N 054°11'49"W. As of March 2015, the St. John's MCTS centre consolidated to the Placentia MCTS centre, which covers the Project area (DFO 2015).

Marine vessels pass through Atlantic waters off the coast of the Burin Peninsula as they travel west to the Gulf of St. Lawrence or down the eastern seaboard, or as they travel east across the Atlantic. These vessels include crude tankers, product tankers, chemical tankers, ore ships, grain ships, general cargo, paper ships, reefer ships, container ships, passenger ships and fishing vessels. Many of these vessels pass by the south coast of the province without entering Newfoundland waters. Others enter Placentia Bay en route to the North Atlantic Refinery (also known as the Come by Chance Refinery) located in Come by Chance or the Newfoundland Transshipment facility located in Whiffen Head.

The main shipping lane in Placentia Bay is a deep water, two-way route that passes through the Eastern Channel between Long Island and the Avalon Peninsula. This route is on the eastern side of the Bay, across from the Great St. Lawrence Harbour. All vessels over 20 m entering the bay report to the Placentia MCTS centre. Traffic in Placentia Bay generally includes tankers, ferries, container and bulk carriers, general cargo and fishing vessels. Major ports in Placentia Bay include Come By Chance, Whiffen Head, Argentia and Marystown. According to available data, between 1992 and 2005, the number of tankers traversing the main shipping lane has increased from 346 vessels in 1992 to more than 1,200 vessels in 2005. The number of tankers in Placentia Bay reached a peak in 2003, with approximately 1,400 vessels using the shipping lane (DFO 2008b).

The Environmental Oil Spill Risk Assessment for the South Coast of Newfoundland (Transport Canada 2007) also contains information regarding large ships that travel off the south coast of Newfoundland. Data is available for ships traveling in and out of Placentia Bay, St. John's Harbour and those traveling to Trinity Bay en route to the Holyrood generating station; however, specific information regarding the number of vessels in-transit that do not enter a designated port in Newfoundland is not available. Therefore, shipping volume in Placentia Bay cannot be accurately defined.

A new marginal wharf was constructed in St. Lawrence Harbour between 2006 and 2007. The St. Lawrence Harbour is managed by the Harbour Authority of St. Lawrence. Each Harbour Authority is considered an independent business that is responsible for managing, operating and maintaining one or more public fishing harbours, through a lease agreement with DFO's SCH program. Small Craft Harbours' (SCH) primary responsibility is to ensure core fishing harbours are kept open and in good repair. The term "core harbour" includes harbours that are critical to the fishing and aquaculture industries. Of the 1035 SCH, approximately 750 are considered to be core harbours (DFO 2014).

According to DFO, St. Lawrence is a core fishing harbour, such that vessels within the Harbour are primarily used for commercial and recreational fishing activities (DFO 2014). In 2004, St. Lawrence was reportedly a Class "A" harbour that served 26 enterprises operating from 28 vessels with total length of 245 m (CFI 2009). As reported in previous sections, crab vessel traffic is relatively high in the Harbour, particularly along the eastern side, as it is home to the Supplementary Crab Fleet during the fishing season.

Vessel traffic during Project construction will consist of barges and tugs for the construction of the marine terminal. All vessels will meet Transport Canada regulations and standards, under the *Canada Shipping Act*, as well as international regulations established by the International Maritime Organization (IMO). Barges will be inspected and approved for use by a recognized classification society and the Project will retain the services of a Marine Warranty surveyor to verify that transportation procedures that are put into place for safe vessel operation and transportation of goods and materials are followed. Sea fastening of cargo will be designed to meet all requirements and follow recommended practice. Navigation aids will be provided as per Department of Fisheries and Oceans and Transport Canada, Canadian Coast Guard requirements.

Occasionally, large marine vessels associated with the Project will be transiting between the primary shipping lane in Placentia Bay and the St. Lawrence Harbour. The production capacity for the Project is relatively small (at 180,000 to 200,000 t/yr) and CFI proposes to construct a Marine Terminal at Blue Beach Cove to accommodate vessels up to 65,000 DWT in size. Approximately 15 to 20 shipments of fluorspar are anticipated per year from the Marine Terminal. In addition washed aggregate, a by-product from the fluorspar milling process may also be shipped from time to time. It should also be noted that neither fluorspar nor aggregate shipping falls under the *Transportation of Dangerous Goods Act*.

6.5.6 Water Use

There are a number of ponds and streams throughout the Project area. A number of these ponds were used historically as part of the mining processes. Shoal Cove Pond was used as a tailings deposition area and Clarkes Pond was used as a discharge point for mine water and intake for the mill’s process water during the Minworth operation.

The majority of the bedrock in the area is granite. Granite has varying amounts of naturally occurring uranium which decays to radon. Radon and its decay particles have been associated with health issues and concerns in the area historically. Due to the properties of the rock the water is flowing through, the groundwater in the area has naturally elevated levels of radon which can lead to various health concerns. As such groundwater wells are not recommended or used for potable water in the St. Lawrence area. The potable water supply is from surface water sources mainly the St. Lawrence River and its tributaries and is located approximately seven kilometers northeast of the AGS Mine (Golder 2015a).

7.0 ENVIRONMENTAL EFFECTS ANALYSIS

An environmental effects analysis was conducted for the various VECs identified for this Project, including:

- Physical Environment;
- Atmospheric Environment;
- Water Resources;
- Terrestrial Environment;
- Wildlife;
- Marine Environment; and
- Socio-Economic Enivronment.

The methodology for the analysis is described in Chapter 4.0. A description of likely environmental effects is provided for each VEC at each Project phase: construction, operation, and rehabilitation and closure. Mitigation measures and monitoring procedures that are designed to result in the avoidance or reduction of likely adverse environmental effects are outlined. The effects analysis also considered the implications of accidental events and malfunctions, and cumulative effects.

7.1 Physical Environment

The Physical Environment VEC is focused on surface soil quality and soil disturbance. The Project-related interactions and likely effects on the Physical Environment VEC, along with the mitigation to reduce or avoid these effects, are described below. Interactions between the Project and sub-surface geology are considered in the groundwater effects analysis (Section 7.3) while the potential for soil contamination due to accidental spills of petroleum products and hazardous material are covered in Section 7.8 Accidents and Malfunctions.

Based on the preliminary identification of likely Project-environment interactions (Table 4-1), it is likely that the Project will affect the Physical Environment VEC during all phases of the Project (i.e., construction, operation, rehabilitation and closure). The majority of the effects are associated with Project construction (i.e., stripping), when the majority of soil disturbance will occur.

CFI has engaged with stakeholder groups and is committed to being responsive to issues. During engagement activities, CFI identified one issue raised by stakeholder groups in relation to the physical environment. The participant commented on the sand at Shoal Cove Beach that apparently disappeared over the winter. This change in the environment is not related to the Project and information on potential effects on soil within the Project area are described in the following section.

7.1.1 Construction

The construction phase of the Project will have a direct effect on soils, primarily from exposing soils during clearing and grubbing, temporary and permanent soil displacement/disturbance, potential metal contamination of soil surface due to dust fallout, and contaminated surface runoff water on the ground surrounding the working areas. The main activity sources contributing to soil disturbance and loss during the construction phase are:

- stripping;
- excavation and blasting;
- construction activities and equipment mobilization;
- waste management; and
- staging and storage of construction-related equipment and materials.

The construction phase of the Project will have the greatest effect on the Physical Environment VEC. During stripping activities, excavation and blasting, and construction of roads and other mining infrastructures, trees, shrubs and stumps will be removed to accommodate construction of the open pits, disposal areas, access roads, and staging and stockpile areas. Further, borrow pits will be developed within the Mine Site as well, to obtain materials required for construction. The borrow pits constitute a permanent loss of soil as the pits will not be fully landfilled during rehabilitation and closure of the site.

Removal of the vegetation to accommodate construction will result in exposing topsoil and overburden soils to wind and water erosion. Topsoil and overburden will be carefully stripped to avoid admixing, and will be stockpiled separately, stabilized against erosion accordingly (e.g., covered with mulch), and used during the progressive rehabilitation of the Project site. Stripping activities will be limited to that required for construction and mining activities, to the extent practical.

A Site Grading and Drainage Plan will be developed during the detailed design phase. The plan will include the erosion control measures to be implemented across the Project area during all Project phases, such as directing surface flow; constructing drainage channels; and using rip-rap, filter fabrics, hay/straw mulch or wood chip mulches in areas prone to erosion.

Exposed surfaces that are at risk of erosion will be protected by using appropriate slopes and by diverting surface runoff away from disturbed areas. After precipitation events, slopes will be inspected and corrective measures will be implemented to prevent soil erosion. Slopes for finished-grade surfaces will be built in accordance with best engineering practices and will be surface-finished to provide long-term stability. Final grading will be undertaken immediately after completion of an activity rather than at the end of construction. Revegetation will also be considered for areas adjacent to existing roads where erodible soil has been exposed.

The main Project activities that may affect the soil quality during the construction phase are:

- waste rock stockpiling;
- temporary storage of construction-related material and equipment; and
- all activities which contribute to generating dust emission.

Storage of waste rock can result in contamination of soils within these storage areas and surrounding environment due to direct contact with the waste rock and water runoff from the stockpiles. Other construction material may be stored on the ground and can constitute a source of contamination as well (e.g., minor leaks or spills). As described in Section 6.1.2, geochemistry testing is ongoing to assess the acid rock drainage potential of the waste rock material. Preliminary results indicate that the waste rock samples evaluated to date are considered to be non-acid generating. Should any potential acid rock drainage issues be identified in the future, mitigation measures will be implemented to avoid contamination, if required.

As detailed in Section 7.2 Atmospheric Environment, fugitive dust emissions will increase locally during construction activities. Because the chemical composition of the mined ore and rocks could differ from the surrounding soils, dust deposition on the soil surface could potentially result in alteration of its chemical properties and may constitute a source of metal contamination. Based on the geochemistry testing conducted to date, the main elements found in the bedrock that may exceed typical crust abundance are iron, arsenic, bismuth, fluorine, lead, lithium, and antimony. The most affected soils are expected to be those that are downstream from the predominant wind direction, which blow from northeast to southwest.

Although the Project will result in the permanent loss of soils in the area of the open pits and waste rock dumps, the rehabilitation and closure activities allow for restoration of the rest of the Project footprint with topsoil and overburden stripped and salvaged during construction. Standard mitigation measures during construction, including proper disposal and/or recycling of all surplus construction materials and wastes, will minimize or avoid any further loss or disturbance of soil.

The potential contamination of soil surface with metal and other contaminants due to dust fallout and potentially contaminated runoff water is expected to be limited to the surroundings of the Project footprint, specifically in the vicinity of Project infrastructure and temporary construction storage areas. The extent of any potential contamination is considered to be low due to mitigation measures in place for reducing dust emissions throughout the Project life. Further, water quality sampling will be conducted to monitor surface runoff released into the natural environment so that its quality meets regulatory standards.

The following mitigation measures will be implemented during the construction phase:

- implement the detailed Site Grading and Drainage Plan, including erosion and sediment control to stabilize eroded areas;
- strip topsoil appropriately to avoid admixing with subsoil;
- minimize the need for borrow material by using granular material from the waste rock which will be extracted from the pits and crushed on-site, to the extent possible; and
- to prevent contamination of soils due to dust fallout, refer to mitigation measures related to reduction of dust emissions outlined in Section 7.2 Atmospheric Environment.

7.1.2 Operation

As for the construction phase, mining activities during the operation phase will affect soils mainly from temporary and permanent soil disturbance, potential metal contamination of soil surface due to dust fallout and contaminated runoff water on the ground surrounding the working areas and waste rock dumps. The main activity sources contributing to soil disturbance and loss during the operation phase are:

- ore extraction (including open pit mine production, blasting and excavation, waste rock disposal and overburden stockpiling);
- taillings management; and
- site and equipment maintenance.

Soil disturbance will be similar to that expected during the construction phase, but to a much lesser extent, as most of the site preparation will be completed during construction. Disturbed areas during the operation phase will be limited to smaller areas where ore extraction, waste rock disposal, tailings management, and site and equipment maintenance activities will occur. During these activities, exposed soil will be stabilized to limit the potential for erosion where possible and revegetation of disturbed areas will be done when the work in an area is completed (i.e., progressive rehabilitation). Grubbing of the upper soil horizons will be restricted to the minimum area required. As part of the progressive rehabilitation plan, the upper soil horizon material that has been stripped will be spread to cover inactive exposed areas and seeded.

The main Project activities that are likely to affect soil quality due to dust fallout and contaminated runoff during the operation phase are similar to those identified for the construction phase, with the addition of the tailings management. The potential contamination at the TMF is expected to be limited to the TMF footprint as it will be designed and constructed to prevent water flow outside of the TMF.

The mitigation measures identified for the construction phase will also be implemented during the operation phase, as appropriate, to address potential effects on soil quality and disturbance.

7.1.3 Rehabilitation and Closure

In general, the rehabilitation and closure phase of the Project will consist of similar activities as the construction phase and will therefore have similar effects. However, with respect to soil disturbance and loss, effects are expected to be limited, with the goal being to stabilize the area and return topsoil over disturbed areas to promote revegetation. During the rehabilitation and closure phase, all the above ground infrastructure will be dismantled and their footprints rehabilitated with the stored overburden and topsoil, except for the open pits and the waste rock piles. The crest, rim and berm of the open pits and the top surface of the waste rock piles will also be graded and covered with topsoil or glacial till. The progressive revegetation of disturbed and eroded areas is expected to have a positive effect on soil by reducing erosion.

Like the construction and operation phases, dust generation from the operation of heavy equipment and vehicle to transport materials and employees to the site is a Project-related effect for the rehabilitation and closure phase. The mitigation measures identified above and in Section 7.3 will be implemented to minimize the dust generation during the rehabilitation and closure phase of the Project.

7.1.4 Environmental Effects Summary

A summary of the likely environmental effects and proposed mitigation for the Physical Environment VEC is provided in Table 7-1.

Table 7-1: Environmental Effects Summary and Proposed Mitigation Measures for Physical Environment VEC

Project Phase	Activity	Likely Environmental Effects	Proposed Mitigation Measure
Construction	Stripping, excavation and blasting, construction activities and equipment mobilization	Temporary and permanent soil disturbance.	Minimize the Project footprint to that required for efficient and safe construction.
			Implement best practices to prevent soil erosion and sediment control.
			Strip topsoil appropriately to avoid admixing with subsoil.
			Minimize the need for borrow pits, by using granular material from the waste rock to the extent possible.
	Excavation and blasting, construction activities and equipment mobilization, transportation, waste management staging and storage of construction related equipment and material	Potential metal contamination of soil surface due to dust fallout.	Implement best practices to prevent soil erosion and sediment control.
			See mitigation measures specific to dust emissions reduction in Section 7.2 Atmospheric Environment .
	Staging and storage of construction-related equipment and materials	Possible contamination of soil due to contaminated runoff water.	Wherever possible, make use of previously disturbed areas for staging and stockpiling.
Operations and Maintenance	Ore Extraction	Temporary and permanent soil disturbance.	Minimize the Project footprint to that required for efficient and safe operation.
			Implement best practices to prevent soil erosion and sediment control.
			Minimize the need for borrow pits, by using granular material from the waste rock to the extent possible.
	Ore extraction, ore processing, transportation, tailings management	Potential metal contamination of soil surface due to air dust fallout	See mitigation measures specific to dust emissions reduction in Section 7.2 Atmospheric Environment.
	Ore extraction, tailings management	Possible contamination of soil due to water runoff.	Engineered TMF structure and ongoing monitoring to prevent water to flow outside of the designated tailings area.

Project Phase	Activity	Likely Environmental Effects	Proposed Mitigation Measure
Rehabilitation and Closure	Rehabilitation and Closure	Potential contamination of soil surface due to air dust fallout	See mitigation measures specific to dust emissions reduction in Section 7.2 Atmospheric Environment.

7.2 Atmospheric Environment

The Atmospheric Environment VEC includes consideration of air quality and noise. Several sources of atmospheric emissions will result from the proposed Project including noise and air emissions, including greenhouse gases (GHG), from fuel burning vehicles and equipment, and emissions generated from ore extraction, processing, material handling, and transportation. Based on the preliminary identification of likely Project-environment interactions (Table 4-1), it is likely that the Project will affect the Atmospheric Environment VEC during all phases of the Project (i.e., construction, operation, rehabilitation and closure).

CFI has engaged with stakeholder groups and is committed to being responsive to issues. During engagement activities, CFI identified one issue raised by stakeholder groups in relation to the atmospheric environment. This issue was related to the potential for dust emission during transport of concentrate to the Marine Terminal. Mitigation measures to reduce dust emission during transport of concentrate will be implemented during the operation phase. Additional mitigation measures to reduce likely increase in dust emission associated with the Project are outlined in the following sections.

7.2.1 Construction

Air Quality

Construction activities associated with the Project will affect air quality by increasing dust (particulate) in the atmospheric environment as well as GHGs and other criteria air contaminants (CACs) which include: carbon monoxide (CO), nitrogen oxides (NO_x), sulfur dioxides (SO_2), volatile organic compounds (VOCs), and particulates. There is also a potential risk during blasting activities of formation of CO, nitrogen dioxide (NO_2) or methane (CH_4) depending on the type of explosive selected.

The following activities are considered likely to affect the air quality during the construction phase of the Project:

- stripping;
- construction activities and equipment mobilization;
- staging and storage of construction-related equipment and material; and
- transportation.

Based on the assay composition, particulate emissions generated from the mining activities are likely to contain some elevated metals. The geochemical analysis of the rock indicates that the main elements that may exceed typical crust abundance are iron, arsenic, bismuth, fluorine, lead, lithium, and antimony.

Removal of vegetation and exposing topsoil and overburden during stripping activities creates the potential for wind erosion. Further, the excavation and transport of these materials and creation of topsoil stockpiles and overburden storage can generate dust and increased potential for erosion. To reduce potential for wind erosion during stripping and grading activities, water will be applied to exposed soils as needed.

Vehicle traffic on haul roads and unpaved access roads is considered an important source of dust emissions and the magnitude is directly related to the road composition, maintenance, vehicle weight, speed and number of trips. To reduce the likely dust emissions associated with transportation, regular and adequate maintenance of unpaved roads will be implemented and application of water or other dust suppressants will be considered, as needed. As part of engineering design, trucks will be sized appropriately to reduce the number of trips, and roads will be designed to reduce travel distances. In addition, speed limits will be implemented on access and haul roads, and a non-idling policy will be put in place to reduce combustion emissions.

The degree of drilling, blasting, and excavation during the construction phase is expected to be limited to that required for construction of the Marine Terminal, TMF, and initial development of the open pits. Appropriate best management practices will be implemented to reduce particulate emissions during drilling, blasting and excavation.

The main sources of CACs (excluding fugitive dust emissions discussed above) and GHGs that may affect the air quality during the construction phase of the Project are:

- exhaust from fuel burning equipment such and heavy equipment, vehicles, ships and generators;
- blasting activities as part of the pits development (NO_2, carbon monoxide or methane formation); and
- Electricity consumption coming from the Newfoundland Power grid.

The main air contaminants from fuel combustion are NO_x, CO, VOCs, SO_2, CO_2, CH_4, N_2O and GHGs. All vehicles used for the Project will comply with the *Newfoundland and Labrador Air Pollution Control Regulations (*O.C. 2004-232). In addition, the fuels used will comply with the applicable regulations for specific contaminant content (e.g., lead, sulfur). Routine inspection and regular maintenance of the vehicles and other fuel-powered equipment will help reduce emissions.

Blasting emissions will be dependent on the type of explosives used. It is expected that CO, and NO_2 will be the main air contaminants associated with blasting activities. An incomplete blast can result in plumes of NO_2, which can affect human health. The OH&S Plan for the Mine will address this unlikely scenario and will implement specific mitigation measures to provide a high level of protection for workers and the public during blasting activities.

The electricity needs, extending from the construction phase to Mine Closure, will be supplied from the Newfoundland Power grid. Indirect emissions of GHG will be caused by the electricity consumption. The GHG emission factor for electricity production in NL is 0.020 tons of GHG per MWh[1]. GHG emissions from the emergency diesel generators are considered negligible compared to the emissions from mobile equipment, and other fuel burning on-site equipment and electricity consumption, since the generators will be in operation for routine testing and during power outages.

[1] Regulation respecting mandatory reporting of certain emissions of contaminants into the atmosphere. Government of Quebec

The effect of particulate matter on air quality is expected to be localized (i.e., close to the Project footprint) given particulate fallout at a close distance from emission sources. However, the effects of other CAC air contaminants and GHGs are expected to be regional and beyond. The closest sensitive receptors are cabins located approximately 1 km south of the Mill and the Town of St. Lawrence located approximately 6 km northeast of the Mine Site. Prevailing winds blow from northeast to southwest, thereby limiting the likely effects of air emissions from the Project on sensitive receptors.

Potential sources of air emissions, including GHGs, can be mitigated through various means (e.g., engineered systems, operational and maintenance controls, and industry best practices) to meet regulatory requirements. The mitigation measures to be implemented include:

- prevent wind erosion during stripping and grading activities by applying water to exposed soils as needed (e.g., during high winds);
- regular and adequate maintenance of the unpaved roads;
- application of water or other dust suppressants on unpaved roads, as needed;
- reduce drop heights during material transfers;
- size trucks appropriately to reduce the number of vehicle trips;
- proper design of haul and access roads, to minimize distance travelled;
- stabilize exposed surfaces and stockpiles with filter fabric, rock or mulch, as appropriate, to minimize wind erosion;
- consider the use of fogging systems and wind barriers to reduce wind erosion;
- implement a speed limit on the access and haul roads;
- implement progressive rehabilitation during all Project phases to minimize dust generated from wind erosion;
- maintain vehicles and equipment regularly and adequately;
- implement a no-idling policy to reduce combustion emissions;
- promote the use of block heaters during winter months as part of the no-idling policy; and
- implement an awareness program to promote fuel consumption reduction.

Noise

Mining activities during the construction phase will also affect the atmospheric environment by increasing the level of noise in the vicinity of the Project. The main sources of noise during the construction phase of the Project are:

- stripping activities;
- Excavation and blasting;

- Construction activities and equipment mobilization; and
- Transportation.

The noise generated during construction activities will vary depending of the type of activity being performed and its location with respect to sensitive receptors. It is not expected that noise generated by construction activities or other activities from the Project will affect the closest sensitive receptors (cabins and the Town of St. Lawrence) given the distance between receptors, and the Project site and activities.

Blasting activities can, however, create high levels of noise during short durations. Blasting noise could potentially affect the surrounding receptors. Blasting plans and procedures will be implemented to reduce the potential adverse effects of noise and vibrations. Blasting activities will be coordinated and scheduled during daytime hours and in a manner that reduces the number of blasts required per week.

Mitigation measures to reduce noise generated during the construction phase may include the following:

- when possible, construction activities will be limited to daytime, especially in work areas that are closest to the sensitive receptors;
- consider evaluating the use of newer technologies associated with back-up alarms to reduce to amount of noise from equipment operation;
- reduce vehicle traffic during night-time, where possible;
- maintain vehicles and equipment regularly and adequately;
- in the event that applicable noise levels would be exceeded, implement engineering mitigation and control measures (e.g., perform the activities during favorable wind conditions, install an acoustic berm, barriers, or equipment enclosures) to reduce noise to an acceptable level;
- perform blasting during day time only and, to the extent possible, at a regular scheduled time; and
- implement a Complaints Response Plan to establish a mechanism to record, address and resolve complaints related to Project activities and phases.

7.2.2 Operation

Air Quality

Project activities during the operation phase are likely to affect air quality by increasing dust emission (particulate) in the atmospheric environment as well as emission of GHGs and other CACs. There is also a potential risk during blasting activities of formation of CO, NO_2 or CH_4 depending on the type of explosive selected. The following activities are considered likely to have an effect on air quality during the operation phase of the Project:

- ore extraction (including open pit development, blasting, drilling and excavation, overburden and waste rock material handling);
- ore processing (including material transfer and crushing activities);
- transportation (including vehicle traffic and activities at the Marine Terminal);
- tailings management.

The emission of particulate matter generated by drilling, blasting, excavation and overburden and waste rock piles and pit development are similar to those described for the construction phase. The mitigation measures associated with these activities as part of the construction phase will remain in place for the operation phase.

Dust produced by crushing in the Mill will be controlled in a dedicated baghouse dust collector system before being released to the natural environment. The dust collector system will be equipped to collect dust from various transfer points within the crushing and milling process areas such that emissions from the crushing and milling operation will meet provincial regulatory requirements.

The ore will be transported by truck on unpaved roads between the open pits and the Mill and then concentrate will be transported from the Mill to the Marine Terminal. As for the construction phase, the vehicle traffic on unpaved access roads is considered an important source of fugitive dust (particulate) emissions during the operation phase and the mitigation measures as they related to transportation described for the construction phase will be applied throughout the life of the Project.

The expected particulate size of the concentrate product is estimated to be approximately 80 to 100 microns and would contain approximately 8 to 10 percent water. Given these physical characteristics, it is expected that fugitive emission of concentrate from material handling activities at the Marine Terminal would be minor and would remain localized. In addition, to further reduce potential for particulate emissions, the material will be loaded onto the ships via covered conveyors.

The TMF is not expected to be a large source of emission due to the low solid content in the tailings slurry. The TMF surface is expected to remain sufficiently wet to reduce or eliminate potential dust emissions from this area.

The main sources of CACs (excluding fugitive dust discussed above) contaminants and GHGs that may affect air quality during the operation phase of the Project are the same as for construction phase, in addition to the fugitive emissions losses from the reagents storage tanks in the Mill processing area. Effects related to emissions from this additional fugitive source are expected to be minimal given that the emissions would occur infrequently.

It is important to note that the proposed Marine Terminal is designed to allow large ships to unload some of their ballast water and replace it with AG fluorspar concentrate and thus, increasing their payload. This will effectively reduce the number of ships that would be required to travel to the Marine Terminal, thereby reducing overall fuel consumption and GHGs.

As for the construction phase, the effects of particulate matter emission on air quality are expected to be mostly localized (i.e., close to the Project footprint) given particulate fallout at close distance from the sources, whereas the effects of other CAC air contaminants and GHGs are expected to be regional and beyond. The closest receptors are two cabins located approximately 1 km south of the Mill and the Town of St. Lawrence located approximately six kilometres northwest of the Mine Site. Prevailing winds blow from northeast to southwest, thereby limiting the effects of air emissions from the operation phase of the Project on receptors.

During the operation of the underground mines, miners may be exposed to air contaminants. As previously indicated in Section 6.1.5 Air Quality, there have been historical health issues associated with poor air quality in the underground mines of St. Lawrence. Silicosis and high incidence of lung and respiratory cancers were reported in many miners who worked in the underground mines in St. Lawrence in the 1930s, 1940s and 1950s. These historical air quality issues were mainly due to primitive mining techniques. These issues were effectively addressed by installation of a proper ventilation system in the underground mines, the use of wet drilling equipment, and continuous monitoring units for specific gases including radon. With today's technology and health and safety standards, these issues will be proactively addressed in Project design and planning to protect workers and the public from these health risks.

It is expected that most mitigation measures implemented during the construction phase will remain in place for the duration of the operation phase. In addition to the measures indicated in the construction phase, the following additional mitigation measures will be implemented, as appropriate, during the operation phase:

- operate and maintain the baghouse dust collection system in accordance with the manufacturer's operation manual, including the frequency of the inspection and maintenance for the equipment;
- design of the ventilation system at the Mill to minimize emissions to the natural environment (i.e., maximize collection points to the dust collection system);
- maximize indoor storage of fine AG concentrate and undertake periodic moistening of concentrate piles to reduce fugitive emissions and over-drying of the concentrate in the storage building;
- Consider implementing engineering controls, such as installing enclosures for transfer points and sizing stations, conveyors and bins at the Marine Terminal to reduce product loss and minimize fugitive emissions;
- Evaluate the potential to use the Mine water for milling processes to reduce energy consumption (i.e., mine water would not have to be heated to the same extent as freshwater during winter months providing an additional benefit); and
- installation of ventilation system in the underground Mine, use of wet drilling equipment and continuous monitoring systems.

Noise

During the operation phase, the main sources of noise will be associated with the following activities:

- ore extraction;
- ore processing; and
- transportation.

The activities associated with the operation phase will be carried out on a continual basis year-round. Noise generated by vehicles, heavy-equipment and blasting activities will vary depending on the type of activity being performed and its location with respect to the sensitive receptors. It is not expected that noise generated from these activities will affect the closest sensitive receptors (cabins and the Town of St. Lawrence) given their distance from the Project footprint.

It is expected that noise mitigation measures implemented during the construction phase will remain in place for the operation phase.

7.2.3 Rehabilitation and Closure

Some of the activities during the rehabilitation and closure phase will have adverse effects on air quality and noise similar to those listed for the construction phase; however, given the reduced number and areas of activities that will occur during this phase, the magnitude of the emissions will be less than those discussed above in the construction phase. It is also expected that the revegetation of disturbed areas will reduce fugitive dust emissions from wind erosion across the Project area.

7.2.4 Environmental Effects Summary

A summary of the likely environmental effects and proposed mitigation for the Atmospheric Environment VEC is provided in Table 7-2.

Table 7-2: Environmental Effects Summary and Proposed Mitigation Measures for Atmospheric Environment VEC

Project Phase	Activity	Potential Environmental Effect	Proposed Mitigation Measure
Construction	Stripping	Increase in fugitive dust in the atmosphere	Prevent wind erosion during stripping and grading activities by applying water to exposed soils as needed (e.g., during high winds).
			Regular and adequate maintenance of the unpaved roads.
	Excavation and blasting		Application of water or other dust suppressants on unpaved roads, as needed.
			Reduce drop heights during material transfers.
	Construction activities and equipment mobilization		Size trucks appropriately to reduce the number of vehicle trips.
			Proper design of haul and access roads, to minimize distance travelled.
	Transportation		Stabilize exposed surfaces and stockpiles with filter fabric, rock or mulch as appropriate to minimize wind erosion.
			Consider the use of fogging systems and wind barriers to reduce wind erosion.
	Staging and storage of construction related equipment and material		Implement a speed limit on the access and haul roads.
			Implement progressive rehabilitation during all Project phases to minimize dust generated from wind erosion.

Project Phase	Activity	Potential Environmental Effect	Proposed Mitigation Measure
	Blasting	Potential risk during blasting activities of formation of carbon monoxide, nitrogen dioxide (NO_2) or methane	Implement Project OH&S Plan and emergency response procedures.
	Energy Consumption	Emissions of air contaminants and GHGs in the atmosphere	Regular and adequate maintenance of the unpaved roads.
			Implement a no-idling policy to reduce combustion emissions.
			Promote the use of block heaters during winter months as part of the no-idling policy.
			Implement an awareness program to promote fuel consumption reduction.
	Stripping	Noise level increase in the surroundings of the working areas	When possible, construction activities will be limited to daytime especially in work areas that are closest to the sensitive receptors.
	Excavation and blasting		Consider evaluating the use of newer technologies associated with back-up alarms to reduce to amount of noise from equipment operation.
	Construction activities and equipment mobilization		Reduce vehicle traffic during night-time.
	Transportation		Maintain vehicles and equipment regularly and adequately.
	Staging and storage of construction related equipment and material		In the event that applicable noise levels would be exceeded, implement additional engineering mitigation and control measures.
			Perform blasting during day time only at a regular scheduled time.
			Implement a Complaints Response Plan to establish a mechanism to record, address and resolve complaints related to Project activities and phases.
Operations	Ore extraction	Dust emission increase in ambient air	Same as construction phase.
	Ore processing		Operate and maintain the baghouse dust collection system in accordance with the manufacturer operation manual.

Project Phase	Activity	Potential Environmental Effect	Proposed Mitigation Measure
	Transportation		Design of the ventilation systems at the Mill to minimize emissions to the natural environment.
	Tailings Management		Maximize indoor storage of fine AG concentrate and undertake periodic moistening of concentrate.
			Consider implementing engineering controls at the Marine Terminal such as enclosures for transfer points.
	Ore extraction (blasting)	Potential risk during blasting activities of formation of CO, NO_2 or CH_4	Implement Project OH&S Plan and emergency response procedures.
	Ore milling and energy consumption	Emissions of air contaminants and GHGs in the atmosphere	Same as for construction phase.
			Maximize use of mine water for milling processes in order to reduce energy consumption. Mine water would not have to be heated to the same extent as freshwater during winter months.
	Ore extraction, ore processing, transportation	Noise level increase in the surroundings of the working areas	Same as for construction phase.
	Ore extration	Radon emission in underground Mine	Installation of ventilation system in the underground Mine, use of wet drilling equipment and continuous monitoring systems.
Rehabilitation and Closure	Rehabilitation and Closure	Dust, noise, contaminants and GHG emissions	Same as for construction phase.

7.3 Water Resources

The Water Resources VEC considers water quantity and quality, and fish and fish habitat potentially affected by the Project. The Project-related interactions and likely effects on the Water Resources VEC along with the mitigation measures to minimize or avoid these effects are described below.

Based on the preliminary identification of likely Project-environment interactions (Table 4-1), it is likely that the Project will interact with the water resources during all phases of the Project (i.e., construction, operation and maintenance, rehabilitation and closure). The majority of the effects on water resources are associated with the development and operation of the open pits and underground workings of the Project, as well as the expansion and operation of the TMF during the construction and operation phases of the Project.

A Water Management Plan will be prepared for the Project that will describe the use and flow of water through and around the Mine during all Project phases and the mitigation measures to be implemented to maintain water quality and quantity within each watershed. The Water Management Plan will consider the surface and groundwater flow direction prior to construction and will be designed to maintain the volume of water and flow in each watershed, to the extent practical, to avoid off-site adverse effects such as flooding and erosion.

The Water Management Plan will describe the use and flow of water through and around the Mine during all Project phases. The plan will be developed in detail with the detailed design of the Project, which is ongoing. The key objectives of the Water Management Plan will be to:

- minimize disturbance to, and use of, natural waterbodies (including groundwater);
- ensure water discharged from the site to the natural environment is of suitable quality (i.e., meets regulatory standards and/or meets baseline conditions); and
- avoid or limit the transfer of water from one watershed to another, to the extent practical, and to avoid off-site adverse effects, such as flooding and erosion.

The Water Management Plan will be developed in consultation with the provincial Water Resources Management Division of NL DOEC to ensure that the goals, objectives, and outcomes of the plan satisfy all parties.

The ACCDC information request submitted in February 2015 in support of the Project did not identify any historical occurrences of freshwater species at risk or conservation concern. Species experts at ACCDC consider it possible for the Banded Killfish, which is provincially and federally listed, to occur in the Project area (ACCDC 2015); however, none were identified during the various field surveys within the Project area that have been conducted over the years (SEM 2015; AMEC 2009; ADI Nolan Davis 1996). Field studies have reported American Eel (provincially listing: vulnerable [DOEC 2014b] and COSEWIC status: threatened [COSEWIC 2015]) in all watersheds affected by the Project, and Atlantic Salmon (COSEWIC status: threatened [COSEWIC 2015]) in Salt Cove Watershed and the watersheds around the AGS Vein (i.e., Grebes Nest Watershed, Upper Island Pond Watershed, and Northwest Pond Watershed) (SEM 2015). As these species have similar interactions and likely effects with the Project as non-listed fish species, the analysis of Project-related effects are provided in the same discussion.

No issues related to water resources were raised by stakeholders during consultation activities (Section 5.2).

7.3.1 Construction

Water Quality and Quantity

During the construction phase of the Project, the following activities are considered likely to have an effect on water quality and/or quantity:

- stripping;
- excavation and blasting;
- construction activities and equipment mobilization;
- transportation;
- waste management;
- water management; and
- staging and storage of construction-related equipment and materials.

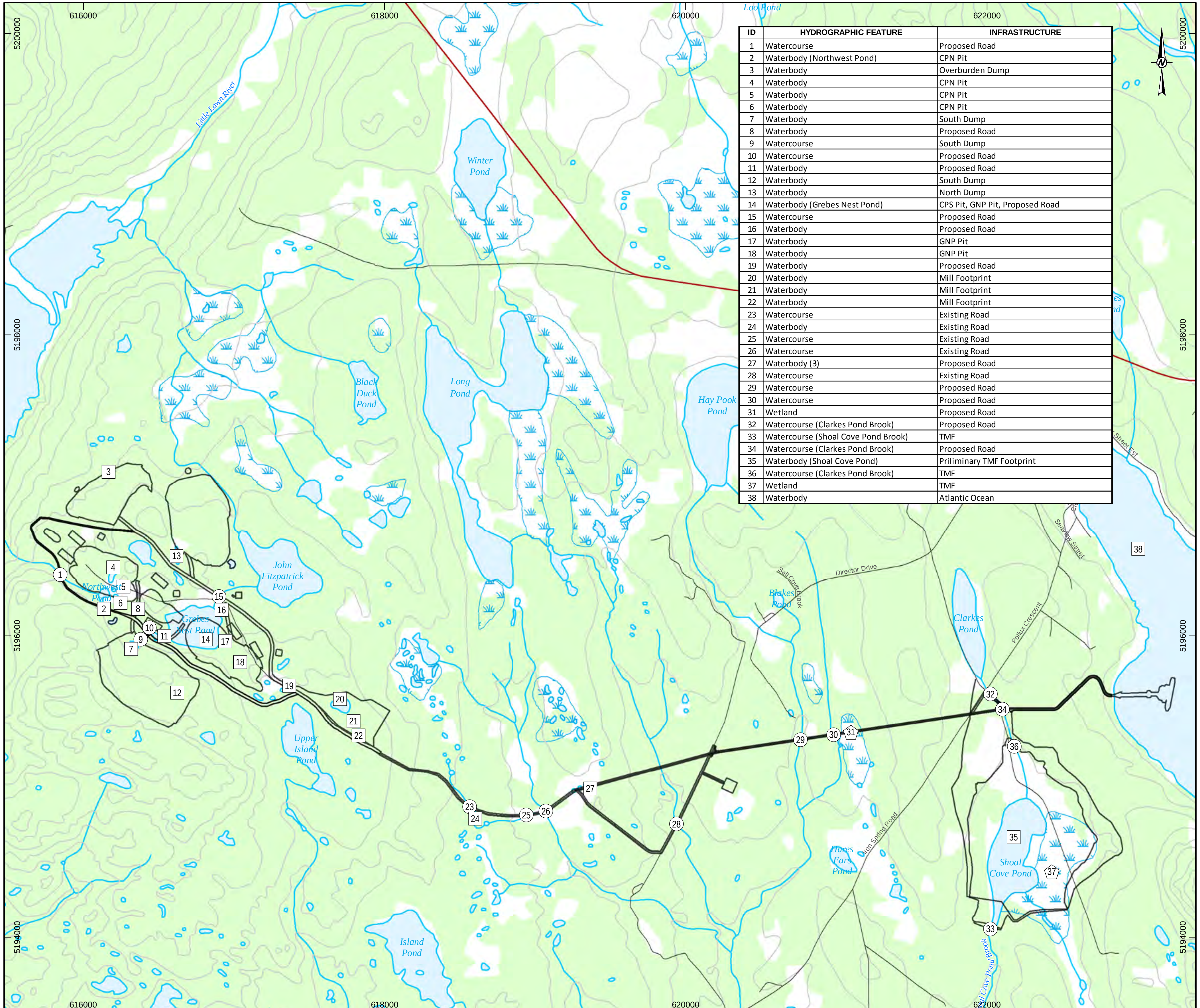
As described in Section 2.0, the activities listed above are required to allow construction of the Marine Terminal, ore processing facility, and staging and storage areas for Project-related equipment and materials, access roads, and preparation and development of the open pits and waste rock storage areas.

Removal of vegetation to accommodate construction, as well as stripping of topsoil and excavation of overburden (where required) will result in exposure of soils to wind and water erosion. Wind erosion of soils, as well as dust generated by heavy equipment operation and transportation of materials, may result in deposition of dust directly onto surface waterbodies or onto other surfaces which are subsequently subject to precipitation and surface runoff that can result in deposition of sediment-laden water into surface waterbodies, if not controlled. This may result in elevated levels of suspended sediment in surface water and potential adverse effects on fish and fish habitat. Dust control during the construction phase will be mitigated as per the measures indicated in Section 7.2.

A Site Grading and Drainage Plan will be developed during the detailed design phase. The Site Grading and Drainage Plan will include the erosion control measures to be implemented across the Project area during construction, such as directing surface flow, constructing drainage channels, and stabilizing erosion prone areas.

Exposed surfaces that are at risk of erosion will be protected by grading and contouring slopes, and by diverting surface runoff away from disturbed areas. After precipitation events, slopes will be inspected and corrective measures will be implemented to prevent soil erosion, as required. Slopes for finished-grade surfaces will be built in accordance with best engineering practices and will be surface-finished / stabilized to provide long-term stability. Final grading will be undertaken immediately after completion of an activity rather than at the end of construction. Revegetation will also be considered for areas adjacent to existing roads where erodible soil has been exposed (i.e., progressive rehabilitation).

There will be construction of new roads of varying design (e.g., single lane light vehicle, dual lane heavy vehicle) around, in and in-between the Mine, Mill, and the TMF. Proper installation or upgrading of culverts and/or bridges across a number of watercourses in the various watersheds will be required. CFI will apply to NL DOEC for approvals for Alteration of a Body of Water pursuant the provincial *Water Resources Act* for the installation of new and upgrading of existing structures and will comply with terms and conditions of approval and guidance materials provided by NL DOEC with respect to the design, construction, and maintenance of the crossing structures to avoid or minimize the potential adverse effects on water quality and fish habitat. Figure 7-1 shows Project infrastructure interaction with waterbodies, water courses and wetland that may require a permit from NL DOEC. CFI will also comply with DFO’s guidance on measures to avoid causing serious harm to fish and fish habitat, in compliance with the *Fisheries Act* (DFO 2013c). In addition to potential surface water contamination from dust and/or sediment laden runoff, improper management of waste (e.g., poor housekeeping) has the potential to result in surface water quality concerns. A Waste Management Plan will be developed for the Project to ensure the proper handling, storage, transport, and disposal of Project-related hazardous materials and wastes.



ID	HYDROGRAPHIC FEATURE	INFRASTRUCTURE
1	Watercourse	Proposed Road
2	Waterbody (Northwest Pond)	CPN Pit
3	Waterbody	Overburden Dump
4	Waterbody	CPN Pit
5	Waterbody	CPN Pit
6	Waterbody	CPN Pit
7	Waterbody	South Dump
8	Waterbody	Proposed Road
9	Watercourse	South Dump
10	Watercourse	Proposed Road
11	Waterbody	Proposed Road
12	Waterbody	South Dump
13	Waterbody	North Dump
14	Waterbody (Grebes Nest Pond)	CPS Pit, GNP Pit, Proposed Road
15	Watercourse	Proposed Road
16	Waterbody	Proposed Road
17	Waterbody	GNP Pit
18	Waterbody	GNP Pit
19	Waterbody	Proposed Road
20	Waterbody	Mill Footprint
21	Waterbody	Mill Footprint
22	Waterbody	Mill Footprint
23	Watercourse	Existing Road
24	Waterbody	Existing Road
25	Watercourse	Existing Road
26	Watercourse	Existing Road
27	Waterbody (3)	Proposed Road
28	Watercourse	Existing Road
29	Watercourse	Proposed Road
30	Watercourse	Proposed Road
31	Wetland	Proposed Road
32	Watercourse (Clarkes Pond Brook)	Proposed Road
33	Watercourse (Shoal Cove Pond Brook)	TMF
34	Watercourse (Clarkes Pond Brook)	Proposed Road
35	Waterbody (Shoal Cove Pond)	Priliminary TMF Footprint
36	Watercourse (Clarkes Pond Brook)	TMF
37	Wetland	TMF
38	Waterbody	Atlantic Ocean

LEGEND

- Waterbody
- Watercourse
- Wetland
- Project Footprint

TOPOGRAPHIC FEATURES

- Highway
- Road
- Contour Line (interval: 50 ft)
- Watercourse
- Waterbody
- Wetland

0 0.5 1
Kilometres
1:26,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE

PROJECT INFRASTRUCTURE INTERACTION WITH SURFACE WATERBODIES

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-19
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT No. 14-07707 Rev. 0 FIGURE **7-1**

As indicated in Section 2.3.2, development of the open pits will require dewatering of Grebes Nest Pond. Water will be transferred into John Fitzpatrick Pond, via a settling pond, if required (i.e., if bottom sediments are disturbed and re-suspended during dewatering).

In addition to dewatering of Grebes Nest Pond, there are a number of smaller, unnamed ponds in the Grebes Nest Pond Watershed, Northwest Pond Watershed and Mine Cove Watershed that will be dewatered or infilled for development of the open pits, the Mill and the waste rock and overburden stockpile areas. For the ponds that will be dewatered during this process, water will likely be used for construction activities rather than discharged into the environment.

Construction of the TMF will result in Project-related effects on Clarke Pond Brook, Shoal Cove Pond (i.e., the existing TMF), and Shoal Cove Pond Brook. A stormwater diversion channel will be constructed around the TMF, as indicated in Section 2.3.4 to divert stormwater. Flow from Clarkes Pond to Clarkes Pond Brook will be managed with the installation of a cut-off wall with a decant structure at the outlet of the Clarkes Pond and a diversion channel along the access road. Water flow will be discharged to Shoal Cove Pond Brook downstream of the TMF. Base flow in Clarkes Pond Brook will be maintained at a level to support aquatic life during low flow conditions. In addition to the stormwater diversion channel, additional channels and ditches will be constructed to divert clean surface water around the TMF. As above, surface water flow will be contained within the Shoal Cove Brook; therefore, the effect on surface water quantity is considered to be limited. The Site Grading and Drainage Plan will include details of the erosion and sediment control measures to be implemented across the Project area during all Project phases.

As outlined previously, a Water Management Plan will be prepared for the Project, in consultation with the provincial Water Resources Management Division of NL DOEC, that will describe the use and flow of water through and around the Mine during all Project phases, and the mitigation measures to be implemented to maintain water quality and quantity within each watershed.

Fish and Fish Habitat

Brook trout is the most-abundant species in the Project area. American eel is also found in many waterbodies and watercourses, as well as Atlantic salmon in select watersheds along the lower reaches below migratory obstructions (Section 6.2). Construction activities will likely result in the alteration or loss of fish and fish habitat. The following Project activities are considered likely to have an effect on fish and fish habitat:

- stripping;
- excavation and blasting; and
- construction activities and equipment mobilization.

Activities such as stripping, excavation and blasting, and other construction activities (e.g., water course crossing) could result in a higher sediment content entering waterbodies and watercourses. These effects are likely to result in the alteration or loss of spawning ground or nursery habitat, leading to a potential decline in fish productivity. Standard and industry-accepted soil erosion and sediment control measures will be implemented during construction to prevent water containing sediment from entering adjacent waterbodies and watercourses and thereby limit the potential for these effects to occur.

Blasting may harm fish in waters close to construction areas. The detonation of explosives in or near water produces rapid changes of pressure that can potential cause damage to internal organs of fish or to incubating eggs. To avoid these effects, blasting charge size will be reduced if the location of blast is near water. CFI will comply with DFO guidance which stipulates that, for large blasts, in the order of 100 kg per hole, a setback of 150 m is required (Wright and Hopky 1998). Blasting activities during the construction phase are expected to occur over several months but will be temporary in duration.

Project construction will result in a loss of fish habitat, mainly associated with the dewatering of Grebes Nest Pond, the use of Shoal Cove Pond for the TMF and the water diversion of tributaries and stormwater in the Shoal Cove Pond watershed. In addition to loss of waterbodies, fish habitat around the Project area is likely to be affected by changes in hydrology. However, it should be noted that Shoal Cove Pond has historically been used for tailings disposal from the early 1930s to the late 1950s. Fish from Grebes Nest Pond will be captured and relocated, with the appropriate permits, during the dewatering process to minimize the short-term effect on fish population. In addition, a Fisheries Offsetting Plan, pursuant to Section 35(2)(b) of the *Fisheries Act*, will be prepared and implemented to offset unavoidable serious harm to fish and loss of fisheries productivity for species that are part of or support a CRA fishery. The plan will include measures to enhance populations and productivity of species contributing to local CRA fisheries.

Potential Project effects on water quality and physicochemical composition of surface water (i.e., pH, transparency, contaminant concentration) are likely to interact with freshwater fish and fish habitat and result in an alteration of fish productivity. However, mitigation measures identified to reduce likely effects on water quality would also reduce the effect on fish and fish habitat.

Accidental spills of hazardous substances during construction activities are likely to affect water quality, fish and fish habitat. These effects are addressed in Section 7.8 Accidents and Malfunctions.

7.3.2 Operation

Water Quality and Quantity

During the operation phase of the Project, the following activities are considered to have likely effects on water quality and/or quantity:

- Ore extraction;
- Transportation;
- Water management; and
- Tailings management.

Project-related effects associated with ore extraction process and transportation are related to dust which can ultimately affect surface water quality as deposition of particulates combined with precipitation and uncontrolled surface runoff may result in subsequent sedimentation of surface waterbodies. Mitigation to minimize this potential effect is the same as for the construction phase (e.g., dust control and erosion and sediment control).

The use of explosives for ore extraction has the potential to increase concentrations of ammonia in surface waterbodies and groundwater as a result of leaching of blast residue from the waste rock piles and open pit walls. A Blasting Plan will be developed for the Project which will describe the type of explosives and method of detonation. DFO's Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998) will be used.

Ongoing dewatering of the open pits can result in elevated levels of suspended sediment in surface waterbodies. Also, increased loading of select metals could occur as a result of leaching from the waste rock storage areas and from the pit walls. Based on the geochemistry results, potential parameters of concern include fluoride, arsenic, copper, iron and lead. The Water Management Plan to be developed for the Project will include the details of the construction and operation of settling ponds to receive runoff from the overburden and waste rock disposal areas and pit dewatering areas. The Water Management Plan will also include the details of water quality monitoring to be implemented for all surface water discharges into the natural environment to ensure that water quality meets the required provincial standards.

During the operation phase, there is potential for discharge from the TMF to have elevated suspended sediments and metals. The TMF will be designed, constructed, and operated to reduce the levels of suspended sediment and metals to within provincial standards. The TMF is being designed to accommodate 1:100 year, 24-hour storm events, with an emergency spillway to accommodate larger storm flows. Also, diversion of stormwater flow from Clarkes Pond around the TMF is incorporated into the design to reduce flow through the treatment system and thereby limiting potential operational effects on surface water quality.

Surface and groundwater flow within the four watersheds located in proximity to the Mine and Mill Site (i.e., Grebes Nest Pond Watershed, Upper Island Pond Watershed, Northwest Pond Watershed, and Mine Cove Pond Watershed) will be altered by pit development and dewatering, as well as diversion of flows around the Project facilities. In some instances, flow in the down gradient tributaries will increase and in others it may decrease. Also, operation of the Mill and TMF is expected to result in increased water levels in Shoal Cove Pond as a result of tailings deposition as well as increased flow rate for Shoal Cove Pond Brook, downstream of the TMF due to process water inflows.

CFI has undertaken a preliminary hydrogeology study in the footprint of the Mine Site. A more detailed hydrogeology study is ongoing to establish a more refined understanding of groundwater flow and direction across the Mine Site. The results of this work will be incorporated into the Water Management Plan (described previously) to provide a better understanding of the effects of the Project on groundwater and outline appropriate mitigation measures for all Project phases.

Fish and Fish Habitat

During the operation phase, the main interaction between the Project and freshwater fish and fish habitat is from potential likely changes in water quality occurring as a result of ore extraction, ore processing, and tailings management activities. As previously indicated, several mitigation measures proposed to address change in water quality will reduce the effects of the Project on water quality, and therefore, on fish and fish habitat.

Blasting during operation is likely to harm fish, mainly in Northwest Pond, Upper Island Pond, John Fitzpatrick Pond and small brooks located close to the Mine open pits. Blasting will be designed to respect the DFO Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky 1998), to avoid harm to fish, as indicated for blasting activities during the construction phase.

7.3.3 Rehabilitation and Closure

The physical activities associated with rehabilitation and closure are described in Section 2.5. Likely effects on the Water Resources VEC during this phase of the Project are expected to be similar to but less than those expected during construction. Rehabilitation and closure methods and activities will comply with all applicable federal and provincial regulatory requirements in force at the time.

Water Quality and Quantity

Upon closure of the Mine, pit dewatering will cease and the open pits and underground workings will be allowed to flood with groundwater and surface water over time. Ground surfaces will be contoured and stabilized (i.e., using overburden, topsoil, and seed) such that surface flow is re-established to pre-mining conditions, to the extent practical. Overflow from the pits, if any, will be directed accordingly within each watershed. The Water Management Plan, developed in consultation with the provincial Water Resources Management Division of NL DOEC, will describe the surface water use and flow across the Project footprint upon closure.

Safety berms will be constructed around the pits, including water management structures. The crest and rims of the berms will be revegetated to minimize sediment-laden surface runoff from entering the pit. Rehabilitation and closure of the TMF will be conducted such that the solid waste material within the engineered impoundment is securely contained and the tailings beach, rim, and surroundings are stabilized and revegetated. The exterior surface of the main embankment will be covered with coarse, durable rock to reduce the potential for erosion.

The cut-off wall and diversion of stormwater from Clarkes Pond Brook will be removed to re-establish pre-mining conditions. Also, the settling pond dyke at the outlet of the TMF will be breached and a drainage channel constructed to allow flow from the Shoal Cove Pond to flow to Shoal Cove Pond Brook. Any remaining exposed sediments will be contoured and revegetated.

Mitigation measures employed during the construction and operation phases for the control of dust and erosion and sedimentation will be implemented during rehabilitation and closure, as appropriate.

Fish and Fish Habitat

Use of machinery during the rehabilitation and closure phase may interact with fish and fish habitat. At some level, it could increase the quantity of sedimentation and erosion into waterbodies and watercourses for a short period of time. However, soil erosion and sediment control measures will be implemented during the activities to limit the potential for this effect to occur.

7.3.4 Environmental Effects Summary and Evaluation

A summary of the likely environmental effects and proposed mitigation for the Water Resources VEC is provided in Table 7-3.

Table 7-3: Environmental Effects Summary and Proposed Mitigation Measures for Water Resources VEC

Project Phase	Activity	Likely Environmental Effect	Proposed Mitigation Measure
Construction	Stripping, construction activities and equipment mobilization, transportation, staging and storage of construction-related equipment and materials	Changes in water quality due to generation of dust and increase potential for erosion and sedimentation Changes in fish habitat due to increased siltation of ponds and watercourses Alteration or loss of fish habitat due to dewatering of water bodies and watercourses, and water diversion Alteration of fish habitat and water quality due to watercourse crossing installations	Minimize the Project footprint to that required for efficient and safe construction.
			Design and implement a Site Grading and Drainage Plan.
			Implement measures to control dust as per Section 7.2.
			Design and implement Water Management Plan in consultation with NL DOEC.
			Fish capture and relocation.
			Obtain and comply with Alteration of a Body of Water permits for bridge and/or culvert installation
			Implementation of a Fisheries Offsetting Plan pursuant to the *Fisheries Act* Section 35(2)(b).
			Comply with DFO's guidance on measures to avoid causing serious harm to fish and fish habitat (DFO 2013c).
			Implement progressive rehabilitation measures.
	Excavation and blasting	Changes in water quality due to generation and deposition of dust and subsequent surface runoff Change in water quantity due to re-direction of surface and groundwater flow Harm of fish and fish eggs	Implement measures to control dust as per Section 7.2.
			Blasting to comply with DFO guidelines for blasting in or near water.
			Design and implement Water Management Plan in consultation with NL DOEC.
	Water Management	Loss of water quantity due to dewatering of ponds Loss of fish habitat due to dewatering of water bodies and watercourses, and water diversion	Fish capture and relocation in compliance with applicable legislation.
			Obtain and comply with Alteration of a Body of Water permits for water withdrawal
			Design and implement Water Management Plan in consultation with NL DOEC.

Project Phase	Activity	Likely Environmental Effect	Proposed Mitigation Measure
			Implementation of a Fisheries Offsetting Plan pursuant to the *Fisheries Act*.
Operation	Ore extraction, transportation	Changes in water quality due to generation of dust and leaching of metals for pit walls and collection and discharge of runoff and leach water from overburden and waste rock piles Harm of fish and fish eggs from blasting	Blasting to comply with DFO guidelines (Wright and Hopky 1998) for blasting in or near water.
			Implement measures to control dust as per Section 7.2.
			Design and implement Water Management Plan in consultation with NL DOEC.
	Ore processing	Change in water quality due to use of water for ore processing Change in water quantity due to use of clean surface or groundwater for processing and discharging to TMF	Effluent treatment in compliance with all applicable legislation prior to release into the environment.
			Design and implement Water Management Plan in consultation with NL DOEC.
	Water Management	Loss of water quantity due to ongoing dewatering of the pit	Design and implement Water Management Plan in consultation with NL DOEC.
			Obtain and comply with Alteration of a Body of Water permits for water withdrawal
	Tailings Management	Changes in water quality due to down stream discharge from TMF (suspended sediments and metals)	Monitor water quality to ensure TMF functioning as designed.
Rehabilitation and Closure	Rehabilitation and closure.	Similar to those to those experienced during construction	Implement Rehabilitation and Closure plan prepared and approved by NL DNR
			Design and implement Water Management Plan in consultation with NL DOEC.

7.4 Terrestrial Environment

The Terrestrial Environment VEC includes wetlands, vegetation communities, and provincially and federally listed vegetation species under the NL *Endangered Species Act,* SARA or COSEWIC. The extent of the Project area used to identify likely effects of the Project on the Terrestrial Environment VEC was defined by the area of potential physical disturbance (Project footprint) and extends to include the potential zone of influence resulting from either potential interactions with infrastructure or activities during each Project phase (i.e., construction, operation, or rehabilitation and closure). Within this area, ecological land classes, identified by the ELC mapping exercise described in Section 6.2, were used to identify the habitat types present (Figure 6-5).

Project-environment interactions which will likely affect the Terrestrial Environment VEC during each Project phase are discussed herein. The adverse effects for this VEC mainly relate to the alteration or loss in productivity of vegetation habitat and wetlands during the construction and operation phases.

Project-environment interactions related to the potential loss of commonly found partridgeberry, bakeapple and blueberry plants and habitat, on berry picking activities are considered within the Socio-Economic VEC (Section 7.8). Likewise, Project-environment interactions on the Terrestrial Environment VEC, related to accidents and malfunctions, are addressed in Section 7.9 of this EA Registration.

A desktop review and ELC mapping, as described in Section 6.2, was used to identify the potential presence of listed plant species. Only species at risk which are known to occur, or to have occurred, in the vicinity of the Project area were considered in this effects analysis. No vegetation species at risk are known to occur within the Project footprint or were identified within the desktop review. Available information presented in Section 6.2 confirmed that the ACCDC database identifies only a historical occurrence of marsh fern, a species that is not provincially or federally listed but is considered vulnerable to extirpation by species specific experts within ACCDC.

A species of particular interest to the region is the boreal felt lichen. This lichen is typically found on the trunks and branches of tree species such as Balsam Fir and Black Spruce found in habitats adjacent to *Sphagnum-rich* wetlands having cool and moist conditions year-round (Maass and Yetman 2002). While it is possible, specific experts within ACCDC consider it unlikely that Boreal Felt Lichen, occurs within the Burin Peninsula (ACCDC 2014).

The ELC mapping was used to calculate the surface area of each ELC identified within the ELC Study Area (Table 7-4). Given that Project activities causing the alteration or loss of wetlands and vegetation communities may occur in both the construction and the operation phase of the Project, the total surface area for the complete Project footprint is presented in Table 7-4 and Figure 7-2. This summary table quantifies all surface areas in hectares (ha) and provides the percentage (%) of each land class found within the ELC Study Area, within the Project footprint and the percentage (%) of each ecological land class altered or lost as a result of the Project, compared to the respective ELC areas within the ELC Study Area.

Table 7-4: Ecological Land Class Surface Areas

Ecological Land Class (ELC)	**ELC Study Area** (A) (ha and [% of total Study Area])	**Project Footprint Area** (B) (ha and [% of total Footprint Area])	**Habitat Type Altered or Lost within the ELC Study Area** (C, where C=B/A*100)
Anthropogenic	175 ha [2 %]	15 ha [7 %]	8.5 %
Barren	660 ha [6 %]	15 ha [7%]	2.3 %

LEGEND

ECOLOGICAL LAND CLASSIFICATION

- Limit of ELC Study Area
- Project Footprint
- Anthropogenic
- Barren
- Broadleaf Dense
- Coastal
- Coniferous Dense
- Coniferous Open
- Coniferous Sparse
- Mixwood Dense
- Mixwood Sparse
- Shrub Tall
- Shrub Low
- Wetlands
- Body of Fresh Water
- Body of Salt Water

0 1 2
Kilometres
1:35,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; GEOSCIENCE ATLAS, GOVERNMENT OF NEWFOUNDLAND AND LABRADOR; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT
CANADA FLUORSPAR INC.

PROJECT
AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE
ECOLOGICAL LAND CLASSIFICATION AND PROJECT FOOTPRINT

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REVIEW	EL
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PROJECT No. 14-07707
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FIGURE 7-2

Ecological Land Class (ELC)	**ELC Study Area** (A) (ha and [% of total Study Area])	**Project Footprint Area** (B) (ha and [% of total Footprint Area])	**Habitat Type Altered or Lost within the ELC Study Area** (C, where C=B/A*100)
Broadleaf Dense	5 ha [<1 %]	<1 ha [<1 %]	N/A
Body of Fresh Water	260 ha [3 %]	24 ha [11 %]	9.2 %
Body of Salt Water	3,580 ha [34 %]	1 ha [<1 %]	N/A
Coastal	240 ha [2 %]	<1 ha [<1 %]	N/A
Coniferous Dense	10 ha [<1 %]	<1 ha [<1 %]	N/A
Coniferous Open	100 ha [1 %]	<1 ha [<1 %]	N/A
Coniferous Sparse	4,430 ha [43 %]	133 ha [62 %]	3.0 %
Mixwood Dense	45 ha [<1 %]	<1 ha [<1 %]	N/A
Mixwood Sparse	2 ha [<1 %]	<1 ha [<1 %]	N/A
Rivers	10 ha [<1 %]	<1 ha [<1 %]	N/A
Shrub Low	660 ha [6 %]	5 ha [2 %]	0.8 %
Shrub Tall	15 ha [<1 %]	<1 ha [<1 %]	5.0 %
Wetlands	200 ha [2 %]	20 ha [9 %]	10.0 %
Total	**10 400 ha** [100 %]	**214 ha** [100 %]	**2.0 %**

N/A: Not Applicable – the habitat type altered or loss within the ELC Study Area has not been calculated for the Project footprint areas interacting with less than 1 hectare of a certain land class.

Source: Natural Resources Canada [NRCan] 2014.

No issues related to the terrestrial environment were raised by stakeholders during consultation activities (Section 5.2).

7.4.1 Construction

The construction activities will result in the direct and indirect alteration or loss of wetlands and vegetation communities. In particular, the following activities are considered likely to have an effect on one or more components of the Terrestrial Environment VEC (i.e., wetlands, vegetation communities):

- stripping;
- excavation and blasting;
- transportation; and
- staging and storage of construction-related equipment and material.

Stripping activities, although kept to a minimum, are necessary during the site preparation for the construction of the AGS Mine and associated infrastructure, as identified in the Project description (Section 2.0), including the Mill Site, TMF and enlargements, and construction of access roads connecting the Mine to the Marine Terminal. Stripping activities will result in the loss of vegetation habitats within the Project footprint and likely alteration of vegetation communities along the edge of the Project footprint. A cutting permit will be obtained from the NL Government and trees will be cut, stockpiled next to roads and made available for locals to use for firewood. Given that the landscape is dominated by the Coniferous Sparse ELC unit, it is anticipated that a limited amount of wood having an appropriate size for this activity is likely available within the Project footprint. Any slash will be stockpiled in windrows and left to naturally decompose, which, in turn, contributes to maintaining the natural nutrient cycles typically found within plant communities. The excavated topsoil will be temporarily stored in a stockpile, and stabilized, and will be used during the Project's reclamation activities.

During the construction phase, dust will be generated from the excavation and blasting activities, from exposed stockpiles (especially during windy conditions) and from the operation of vehicles along un-paved access roads. This dust may travel through the air, over some distance, and be carried from the Project footprint and deposited onto adjacent areas. The deposition of this dust, generally rich in metals as described in Section 7.2, on vegetation habitats may potentially adversely affect the productivity of a vegetation community or may lower the plants' photosynthetic ability.

The footprint used for staging and storage of construction-related equipment and material may also result in the loss of individual plant species or alter the vegetation habitats. A possible example of such alteration in vegetation habitat could be the compaction of overburden from operating heavy machinery if heavy equipment were to operate on land not stripped for mining or building infrastructure.

Effects of the above mentioned activities on identified ELC units were analyzed. The majority of the Project footprint (63%) affected by stripping activities will result in the direct alteration or loss of up to 133 ha, characterized by the Coniferous Sparse land class. Also, this activity may affect 127 ha of the Coniferous Sparse land class adjacent to the access roads or other infrastructure. However, this potential alteration or loss only represents 3% of the Coniferous Sparse land class present within the ELC Study Area, since it is the most common land class (i.e., 43%) in the ELC Study Area.

The alteration or loss of vegetation communities dominated by the low shrub land class may amount to 2% (5 ha) of the Project footprint or 0.8% of the ELC Study Area. However, like the coniferous sparse land class, this alteration or loss of low shrub habitat is not expected to affect the sustainability of shrub communities in the ELC

Study Area,as this corresponds to less than 1 % of all the low shrub land class found within the ELC Study Area. Likewise, a number of other vegetation communities have small percentages of their habitats likely affected by the Project. Such habitats may consist of close to or less than 1 ha and are comprised of the following ELCs: the broadleaf dense, the coastal, the coniferous dense, the coniferous open, the mixwood sparse, the mixwood dense or the tall shrub.

Project effects on wetland habitat is mostly comprised of the alteration or loss of wetland habitat adjacent to Shoal Cove Pond and associated with the construction of the TMF. Although effects on wetland habitat may commence during the construction phase, it will only reach the estimated loss of 20 ha during the operation phase, which represents 10% of the wetland habitat within the ELC Study Area. Wetland habitat is not considered to be limiting, regionally.

The barrens land class (660 ha) is not comprised of extensive or sensitive terrestrial vegetation communities or wetlands within the ELC Study Area. The effect on the alteration or loss of 15 ha of this land class, is expected to have a minimal effect on the Terrestrial Environment VEC during the construction phase.

Effects related to the alteration or loss of wetlands and vegetation communities cannot be completely avoided. Implementation of Best Management Practices (BMPs) for construction is expected to reduce the alteration or loss of wetlands and wetland communities. BMPs include:

- minimize the Project footprint to that required for efficient and safe construction;
- use existing access to the extent practical;
- avoid any off-site equipment and vehicle movement;
- wherever practical, make use of previously disturbed areas for staging and stockpiling;
- stockpile topsoil and keep separate from subsoils to limit admixing, and stabilize against wind and water erosion for future use during reclamation; and
- implement soil erosion and sediment control measures.

Dust emissions associated with excavation, drilling and blasting as well as vehicle and equipment movement can also be minimized with standard BMPs (e.g., use of water for dust suppression). Refer to Section 7.2 for additional mitigation measures to be implemented during the Project construction and operation to reduce the effects of dust on the terrestrial environment.

In addition to the above noted mitigation measures, a listed plant and habitat survey will be conducted prior to construction to confirm the presence of any listed vegetation species and habitats. The results of the survey will be used to modify the Project footprint, if required and feasible and/or to identify additional mitigation to avoid or reduce loss to any listed vegetation species or habitat.

7.4.2 Operation

The operation phase of the Project will likely result in the alteration or loss of wetland and vegetation communities within the Project footprint. The following activities are considered likely to affect one or more components of the Terrestrial Environment VEC:

- ore extraction;
- tailings management; and
- transportation.

The progressive extraction of ore during active mining extends the alteration or loss of vegetation communities within the footprint of the open pits and waste dumps. Although disturbance to these areas will be initiated during the construction phase, it will continue progressively during the operation phase until the entire Project footprint has been developed. Effects on each ecological land class are similar to those described for the construction phase.

As previously stated, approximately 20 ha of wetland habitat within the TMF footprint will be altered or lost as a result of the Project, which represents 10% of wetlands in the ELC Study Area. The effects of the Project on wetlands are limited to the Project footprint, specifically in the TMF area.

Dust generation is a Project-related effect that will extend throughout operation activities. In this phase, dust may be generated during the excavation and blasting activities related to the extraction of ore material from the open pits. Dust may also be generated on a regular basis during the transportation of materials around the Mine Site and to and from the Marine Terminal. Similarly, dust is generated by the movement of employees' vehicles, and the transportation of goods and materials to and from the Mine Site on unpaved roads. As previously indicated, the accumulation of dust particles, which is likely to be rich in metals, could affect vegetation productivity and lower the photosynthetic ability of plant communities adjacent to the Project footprint.

The following mitigation measures with be implemented during the operation phase to minimize the adverse effects of the Project on the Terrestrial Environment VEC:

- progressive rehabilitation including seeding according to the approved Closure Plan;
- minimize the Project footprint to that required for efficient and safe operation; and
- mitigation measures to control dust described in Sections 6.3.1 (as applicable) and 6.3.2.

7.4.3 Rehabilitation and Closure

The Rehabilitation and Closure phase of the Project will consist of similar activities as the construction phase and will therefore have similar effects. The exception to this is that there is not expected to be any direct alteration or loss of vegetation species and habitats during this phase. Once the mining operation is complete, no additional habitat loss is expected to occur. Progressive rehabilitation, reusing stockpiled topsoil and using native species and/or seed mixes containing naturalized species which are well established for this region of the province, will, over time, provide new habitat and effectively mitigate the habitat altered or lost as a result of the Project. This is expected to be enhanced by the natural encroachment of native species from outside the Project footprint, over time.

More specifically, the proposed Rehabilitation and Closure Plan includes plans for revegetation of the waste rock dumps, overburden dump, TMF, and crest rim and berm of open pits. Like the construction and operation phases, dust generation from the operation of heavy equipment and vehicle to transport materials and employees about the site is a Project-related effect for the Rehabilitation and Closure phase. The mitigation measures identified above and in Section 7.3 will be implemented to minimize the dust generation during the Rehabilitation and Closure phase of the Project.

7.4.4 Environmental Effects Summary and Evaluation

In summary, the Project-related effects on the Terrestrial Environment VEC consist of direct and indirect alteration or loss of wetland and vegetation communities across the Project footprint during construction and operations as well as the potential alteration of vegetation species and habitats surrounding the Project footprint that may be affected by dust deposition. A summary of the likely environmental effects and proposed mitigation for the Terrestrial Environment VEC is provided in Table 7-4.

Table 7-5: Environmental Effects Summary and Proposed Mitigation Measures for Terrestrial Environment VEC

Project Phase	Activity	Likely Environmental Effect	Proposed Mitigation Measure
Construction	Stripping	Alteration or loss of wetland and vegetation communities	Minimize the Project footprint to that required for efficient and safe construction
			Avoid any off-site equipment and vehicle movement
	Staging and storage of construction-related equipment and material		Wherever pratcical, make use of previously disturbed areas for staging and stockpiling
			Implement soil erosion and sediment control measures
			Implement progressive rehabilitation measures
			Use existing access to the extent practical
	Stripping	Alteration or loss of habitat due to changes in soil conditions	Implement best practices to prevent soil erosion and sediment control
			Use existing access to the extent practical
	Excavation and blasting		Implement dust control measures as described in Section 7.2
			Stockpile topsoil and keep separate from subsoils to limit admixing, and stabilize against wind and water erosion for future use during reclamation
	Transportation		Implement progressive rehabilitation measures
	Stripping	Alteration or loss in productivity of wetlands and	Implement dust control measures as described in Section 7.2
	Excavation and blasting		
	Transportation		

Project Phase	Activity	Likely Environmental Effect	Proposed Mitigation Measure
	Staging and storage of construction-related equipment and material	vegetation communities due to dust deposition	
	Staging and storage of construction-related equipment and material	Alteration or loss in habitat conditions due to compaction of soil	Minimize the Project footprint to that required for efficient and safe construction
	Transportation	Alteration or loss in productivity of wetland and vegetation communities	Minimize the Project footprint to that required for efficient and safe construction
Operation	Ore extraction	Alteration or loss of wetland and vegetation communities	Implement progressive rehabilitation measures
	Transportation	Alteration or loss in productivity of wetlands and vegetation communities	Implement dust control measures as described in Section 7.2
	Tailings management	Alteration or loss of wetland and vegetation communities	Minimize the Project footprint to that required for efficient and safe operation
			Implement progressive rehabilitation measures
Rehabilitation and Closure	Rehabilitation and Closure	Reestablishment of vegetation communities	Implement Rehabilitation and Closure Plan as approved by NL DNR

7.5 Wildlife

The Wildlife VEC considers birds, both terrestrial and marine, and terrestrial wildlife species at risk. The Project-related interactions and likely effects on the Wildlife VEC, along with the mitigation measures to minimize or avoid these effects, are described below. It is noted that birds and wildlife, in general, exhibit similar interactions and likely effects with the Project as birds and wildlife species considered to be at risk or of conservation concern.

An ACCDC information request submitted in February 2015 identified 15 occurrences of terrestrial wildlife species at risk or species of conservation concern within a 5 km radius of the Project. The 15 occurrences account for the following five bird species: American pipit, chipping sparrow, northern goshawk, northern harrier, and sharp-shinned hawk. None of the five bird species identified by ACCDC are listed provincially or federally and are not considered globally rare outside of the province of Newfoundland and Labrador. As such, likely effects on these species are not discussed separately.

Although not previously identified in the area, it is considered possible for the short-eared owl to occur in the vicinity of the Project, based on the opinion of experts within ACCDC (ACCDC 2015). The short-eared owl is listed as Vulnerable under the provincial *Endangered Species Act*, and as Special Concern under Schedule 1 of SARA and by COSEWIC. Likely effects on this species are discussed separately.

The ACCDC information request did not identify any historical occurrence of marine species at risk or species of conservation concern within the 5 km radius; however, the experts within ACCDC are of the opinion that the Project area is within the range of the Barrow's goldeneye (Vulnerable under the provincial *Endangered Species Act*, and as Special Concern under Schedule 1 of SARA and by COSEWIC) (ACCDC 2015). Furthermore, the piping plover, a provincially and federally listed Endangered species was observed in the St. Lawrence area between 2003 to 2009 by Gail and Norman Wilson. For both of these species, use of the Project area appears to be seasonal, either as spring or fall migrants (N. Wilson 2015, pers. Comm.). Likely effects on these species are discussed separately.

Likely effects on wetlands and vegetation communities (components of wildlife habitat) are considered in Section 7.4 Terrestrial Environment, while likely effects on fish are considered in Section 7.3 Water Resources, as well as in Section 7.6 Marine Environment, which includes marine mammals and marine species at risk. Accidents and malfunctions, including those with effects on wildlife are considered in Section 7.8.

No issues related to wildlife were raised by stakeholders during consultation activities (Section 5.2).

Based on the preliminary identification of likely Project-environment interactions (Table 4-1), it is likely that the Project will affect wildlife during all phases of the Project (i.e., construction, operation, rehabilitation and closure).

7.5.1 Construction

During the construction phase of the Project, the following activities are considered to have a likely effect on wildlife:

- stripping;
- excavation and blasting;
- construction activities and equipment mobilization;
- transportation; and
- staging and storage of construction related equipment and materials.

As described in Section 2.0, the activities listed above are required to allow construction of Project components and infrastructure including the AGS Mine, Mill Site, TMF, Marine Terminal, and access roads.

Birds

While construction activities will occur intermittently at different locations (e.g., Marine Terminal, Mill Site) during the two year construction period, operation activities will be continuous in subsequent years. Therefore, interactions between birds and above ground infrastructure, for example, could occur at any time during the life of the Project, although such events are expected to be rare. The area to be occupied by infrastructure will be minor in relation to the area of available habitat in the Harbour and Placentia Bay as a whole. Furthermore, there is no information to suggest that Blue Beach is an important concentration area for marine birds. It is anticipated that marine birds will land on, rather than collide with, above ground infrastructure, as they are well adapted and habituated to the presence of anthropogenic activities and structures.

Project-related vessel strikes could lead to the direct mortality or injury of marine birds. Also, increased levels of noise may cause some marine birds to exhibit localized and temporary avoidance behaviour in the area of the vessels. The Project will involve the use of large, slow moving barges and vessels during construction. Increased vessel traffic in the Harbour, in addition to existing commercial fishing and industrial vessel traffic, increases the potential for vessel collisions with marine birds, although such events are expected to be rare. As indicated, it is anticipated that marine birds will land on, rather than collide with, Project-related vessels, as they are well adapted to the presence of moving vessels and structures, and are known to land on boats and buoys. The likelihood of vessel collisions with marine birds will be reduced by implementation of mitigation measures including maintaining low navigational speeds.

The Project may also have indirect adverse effects on marine birds through a reduction in the quantity or availability of primary food sources. This may result from the removal of benthic habitat and communities, or by the localized and temporary degradation of marine habitat resulting from disturbance to the seabed during construction of the Marine Terminal, which would likely cause elevated levels of suspended sediments in the water column. Elevated levels of suspended sediments may cause fish to temporarily avoid the immediate affected area until suspended sediments return to baseline levels. Environmental effects of the proposed Project on the Marine Environment are discussed in Section 7.6 Marine Environment.

The main effect on birds will be the alteration or loss of nesting and foraging habitat. Vegetation clearing and stripping activities could also result in the loss of nests and nestlings or eggs if conducted during the bird breeding season, which occurs from April 1 to September 1 in the region (Environment Canada 2014a). Furthermore, increased deposition of dust generated during construction activities, as well as changes to the hydrology of waterbodies as a result of the Project, could also potentially result in habitat alteration or habitat loss for shorebird and waterfowl species that could potentially be nesting in the area (e.g., piping plover).

As noted in Section 7.4 (Terrestrial Environment) and Section 7.6 (Marine Environment), up to 214 ha of terrestrial habitat may be removed as a result of the Project and up to 3 ha of marine habitat, based on preliminary design and depending on the Marine Terminal option selected (north or south). There are a number of birds that are known to be local breeders (e.g., rusty blackbird along the edges of bogs and wetlands). The ground-nesting short-eared owl, a provincially and federally listed species at risk, is also thought to be a local breeder (CFI 2009). The short-eared owl nests are scraped in the ground and lined with grasses. They are one of the few species that seem to have benefited from strip-mining, nesting on reclaimed and replanted mines south of their normal breeding range (Cornell Lab of Ornithology 2015).

The piping plover is also a provincially and federally listed ground-nesting species, preferring open sandy beaches, especially above the tideline and alkalai flats. Given that this habitat type is absent in the Project area, the individual observed in the Town of St. Lawrence are likely a migrant.

The Barrow's goldeneye, another provincially and federally listed species, nests in tree cavities along lakes in parkland (Cornell Lab of Ornithology 2015).The Project area is not within the breeding range for this species, as such, the species is likely a vagrant in the region. In any event, the alteration or loss of preferred habitat for this species associated with the Project will be minimal (due to the small size of the Project footprint) in relation to the area of available habitat on the Burin Peninsula, and within the Harbour or Placentia Bay as a whole.

Terrestrial habitat within the Project area consists mostly of open coniferous tree cover (tuckamore in low-lying areas or scrub conifers along slopes), barrens, wetlands (including bog and marshes) and disturbed habitat (brownfield). A small amount of cut timber will be stockpiled next to roads and slash stockpiled in windrows, potentially providing an enhancement to habitat (e.g., protection from predators) for some bird species (e.g., ruffled grouse). Stripping activities in the Project footprint and any temporary work areas (e.g., staging and storage areas for construction related equipment and materials) will be reduced to the extent possible and will be restricted to areas absolutely necessary to carry out the Project. To reduce potential adverse effects on nesting birds, clearing activities will take place outside of the bird breeding season for most bird species (April 1 to September 1), where possible, to prevent the disturbance of migratory birds or their nests (Environment Canada 2014a). If some clearing is necessary during the bird breeding season, CFI will assess if the work can be conducted without contravention of the *Migratory Birds Convention Act* and a contingency plan (e.g., nest surveys prior to clearing will be developed in consultation with the Canadian Wildlife Service (CWS) to maintain compliance with the act.

Should any tree- or cavity-nesting species be found in areas to be cleared or should any ground- or burrow-nesting species initiate breeding activities on stockpiles or exposed areas, an appropriate species-specific buffer will be established around the nest location once identified and CWS will be contacted for further advice. The appropriate buffer zone will depend on a number of conditions including the nesting species, level of disturbance and the landscape context (Environment Canada 2014c). Potentially disruptive activities will be halted within the buffer area, measures will be taken to reduce potential for erosion of the pile, and the nest(s) will be protected. Periodic monitoring of the nest(s) will be undertaken by qualified professionals until the fledglings have left the area and the nest site is found to be inactive, at which time construction activities in the area will resume. It is of note, that only a limited number of trees will be cleared during stripping activities.

In addition to habitat loss, construction noise (including blasting) may have adverse effects on wildlife in and near the Project area. Construction noise can interfere with normal bird behaviour, such as feeding, migrating, and breeding. Flushing of nesting birds may result in decreased productivity due to increased nest predation and stress on adult birds affecting foraging behaviour (Beale 2007); as well, birds may leave the Project area and be forced to move to less favourable nesting sites (Larkin 1996).

The distance of effect is related to frequency, intensity, and duration of the noise. Research has shown that for birds, overt behavioural responses such as flushing typically occur at sound pressure levels above 80 to 85 decibels (dB) SPL (sound pressure level) (Brown 1990). Adverse effects from noise vary from species to species because of interspecies differences in both hearing abilities and in behavioural and physiological responses to stimuli. In addition to interspecies differences, there is considerable intraspecies variation in vulnerability to effects of noise (e.g., in different times of year [different stages of the breeding cycle] and different life stages [Blumstein et al. 2005]). The likely effects of noise due to construction of the Project are expected to be temporary and short-term. Furthermore, the Harbour has traditionally been utilized by marine vessels, such that noise levels produced by the Project are not expected to noticeably increase the noise levels in the Project area when compared to background noise levels.

Seabird breeding colonies are numerous on headlands and islands along the entire perimeter of the Placentia Bay area, three of which are known IBAs off the southern Burin Peninsula, including Green Island, Middle Lawn Island and Corbin Island (Bird Studies Canada 2015). The nearest IBA is 15 km away, which is sufficiently far from the Project area such that no disturbance at these colonies is anticipated during Project construction. Minor disturbance of foraging birds from blasting and other construction noise is possible; however, this distance is greater than the 1 km buffer recommended by Environment Canada for high-disturbance activities including drilling and blasting (Environment Canada 2013).

Wildlife

Habitat alteration, loss and fragmentation from clearing and construction activities will likely result in displacement of wildlife within the Project footprint, reduction of the available habitat used by terrestrial mammals, and interruption of local movement to and from adjacent areas of suitable habitat. Species that can move easily will likely relocate to similar adjacent habitat. Although some wildlife habitat will be altered or lost, it does not represent a major portion of the habitat available for the wildlife that occurs in the ELC Study area.

The alteration or loss of wetlands, ponds, and riparian areas in the Project area will result in adverse effects on habitat for local amphibians (e.g., frogs) and odonate (dragonfly and damselfly). Increased deposition of dust generated by construction may further adversely affect aquatic habitats. Alternatively, construction activities can positively affect herpetile populations through the creation of habitat (i.e., road side ditch pools which can provide valuable amphibian breeding habitat). Lepidopterans (moths and butterflies) will be most affected by the loss of larval food plants, which varies from species to species; adults are highly mobile and therefore able to avoid areas affected by Project activities.

Based on the results of the ELC study presented in Section 7.4 Terrestrial Environment, the Project footprint will result in the alteration or loss of 2% of the total area encompassed in the ELC Study area and no habitat type will be completely lost. Wildlife species will have the opportunity to relocate to other similar habitat types in the region.

During construction, temporary and reversible effects from noise and dust may also affect terrestrial wildlife in and around the Project area. Project related noise (including blasting) may cause mammals in adjacent areas to temporarily leave the area (e.g., coyotes, fox, bears, rabbits). The mammals in the area of disturbance may temporarily move elsewhere during the construction period. Local populations are likely to return to normal after construction is complete. Furthermore, wildlife (e.g., coyotes, fox, bears) may be attracted to domestic type waste generated by workers potentially increasing the likelihood of direct mortality of wildlife through collisions with Project-related equipment and vehicles. Workers will be instructed to maintain good housekeeping practices and not leave any food or garbage at the Project site to avoid attracting wildlife, including omnivorous predators which may disturb or cause direct mortality or injury to other wildlife (including birds).

7.5.2 Operation

During the operation phase of the Project, the following activities are considered to have a likely effect on wildlife:

- ore extraction;
- transportation;
- waste management; and
- tailings management.

Birds

Increased human activity associated with the operation phase is expected to result in an increase in populations of wildlife species that are adapted to human environments, including American robins, common grackles and rock pigeons. These species may compete with native woodland and forest edge birds, resulting in habitat loss for these species that may be less adapted to human presence. Potential effects of noise and blasting are the same as for the construction phase.

Portions of the Project area must, for worker safety, be well-lit with high intensity lighting at night, and although the lighting will be directed as narrowly as possible by shielding, these lights may have disorienting effects on migrating birds, particularly on foggy and overcast nights, causing potentially fatal collisions. To reduce the risk to migrant birds, the minimum amount of pilot warning and obstruction avoidance lighting will be used on tall structures. White lights will be preferred for use on towers or high structures at night, as recommended by the US Fish and Wildlife Service (2003). Solid red or flashing red lights will be avoided as they appear to attract nocturnal migrants more than white flashing lights (US Fish and Wildlife Service 2003). High intensity lights, including floodlights, will be turned off at night outside of working hours, if possible, especially during the spring and fall migration period.

The presence of the TMF and settling ponds on the site may provide some marginal habitat for shorebirds and waterfowl, although the high level of human activity makes it unlikely that these ponds will be utilized during the operation phase.

Increased human activity around the Marine Terminal may result in increased disturbance to fauna in the surrounding coastal environment, including shorebirds that may feed in the area. Also, increased shipping activity associated with Project operation will cause disturbance to coastal/marine birds in the waters off the Project site and along shipping routes. The possible effects of marine vessel traffic on birds in the offshore environment include behavioural changes (e.g., avoidance, stress response) that may have energetic consequences (Schummer and Eddleman 2003), and loss of suitable feeding habitat as vessel traffic can reduce bird use of vessel disturbed areas (Bramford et al. 1990). Use of existing shipping lanes and areas travelled by local fishing vessels for most of the route is expected to minimize this effect.

Marine traffic associated with the Project will travel within existing domestic commercial shipping lanes, upon entering Placentia Bay, before traveling west into St. Lawrence Harbour. Vessel activity will not occur near any of the three IBAs and as recommended by Environment Canada, ships will maintain a minimum distance of 300 m from any colony or island occupied by seabirds and waterbirds (Environment Canada 2013, 2014b). While day-to-day shipping activities are unlikely to have any effect on coastal and marine birds at the IBAs, accidental spills and releases from marine traffic could result in the direct physical exposure of birds to oil within the affected area with possible lethal and sublethal effects. The effects of accidents and malfunctions are discussed in Section 7.8.

Should seabirds or other species become stranded on vessels or on land, CFI would expect vessel operators to to adhere to appropriate handling protocols, such as best practices for stranded birds encountered offshore Atlantic Canada (Environment Canada 2014b).

Wildlife

Likely effects on terrestrial mammals during the operation phase of the Project are anticipated from increased noise (including blasting) and disturbance from traffic and other human activities in the Project area. Local nocturnal species may be attracted to and/or disoriented by changes in ambient lighting. Moths may be attracted to new artificial lighting in the Project area, increasing the risk of predation. To reducce this effect, the minimum amount of pilot warning and obstruction avoidance lighting will be used.

Project operation may cause changes in the diversity and relative abundance of local mammal populations, such as potential increase in fox, raccoon and skunks that are well adapted to human presence. Therefore, good housekeeping practices will be enforced during all Project operation activities to minimize the potential effects for this.

Adverse effects on turtles and amphibians may occur if water levels or surface water drainage patterns change, and/or if there is a change in water quality from operational procedures. Potential effects of the Project on water quality and associated mitigation measures are outlined in Section 7.3 Water Resources.

7.5.3 Rehabilitation and Closure

The physical activities associated with rehabilitation and closure are described in Section 2.5. Likely effects during this phase of the Project are expected to be similar to but less than those expected during construction. Rehabilitation and closure methods and activities will comply with all applicable federal and provincial regulatory requirements in force at the time. The final result of these activities is the rehabilitation of habitat that will be available for bird and wildlife use.

A Rehabilitation and Closure Plan will be prepared and submitted to the Government of Newfoundland and Labrador under the *Newfoundland and Labrador Mining Act*. The plan will meet regulatory requirements for rehabilitation, and will include closure and rehabilitation of the infrastructure at the AGS Mine, the Mill Site, the TMF, the Marine Terminal and quarries and borrow sources.

During this phase of the Project, increased human activity, noise and dust are expected to have temporary adverse effects on local terrestrial wildlife populations. Local populations are expected to return to sustainable levels following decommissioning activities. Given that the Project location is relatively isolated, it is likely that the site will be rehabilitated to an approximate natural state upon decommissioning. There is potential for increased or new types of habitats, such as ponds and rocky cliffs upon decommissioning.

7.5.4 Environmental Effects Summary

A summary of the likely environmental effects and proposed mitigation for the Wildlife VEC is provided in Table 7-6.

Table 7-6: Environmental Effects Summary and Proposed Mitigation Measures for Wildlife VEC

Project Phase	Activity	Likely Environmental Effect	Proposed Mitigation Measure
Construction	Pre-stripping, excavation and blasting, construction activities and equipment mobilization, transportation, staging and storage of construction-related equipment and materials	Reduction of wildlife habitat Fragmentation of wildlife habitat Mortality of wildlife Disturbance and behavioural changes of wildlife Destruction of active migratory bird nests	▪ Refer to Section 7.2 Atmospheric and Section 7.6 Terrestrial and Marine Environment; ▪ Minimize construction area; ▪ Minimize duration of construction; ▪ Avoid clearing during the breeding bird season (April 1 to September 1), where possible (Environment Canada 2014a); ▪ If clearing during the breeding bird season, consult with the CWS and develop a contingency plan; ▪ Discourage ground- and burrow-nesting species from nesting on denuded soil (e.g., by covering unattended soil piles); ▪ If a nest is identified on the site, establish a species-specific buffer around the nest, halt potentially disruptive activities within the buffer area and protect nests until chicks have fledged (Environment Canada 2014c); ▪ If a nest is identified on the site, consult with CWS for further advise; ▪ Implement 1 km buffer from breeding seabird colonies recommended by Environment Canada for high-disturbance activities (Environment Canada 2013, 2014b); ▪ Maintain proper housekeeping practices and activities that may attract wildlife.
Operation	Ore extraction, transportation, waste management, tailings management	Reduction of wildlife habitat Mortality of wildlife Disturbance and behavioural changes of wildlife	▪ Refer to construction mitigation above and Section 7.3 Water Resources and Section 7.8 Accidents and Malfunctions; ▪ Implement 300 m buffer between ships and breeding seabird colonies

Project Phase	Activity	Likely Environmental Effect	Proposed Mitigation Measure
		Destruction of active migratory bird nests	as recommended by Environment Canada (Environment Canada 2013, 2014b); ▪ Minimize use of pilot warning and obstruction avoidance lighting on tall structures; ▪ White lights will be preferred for use on towers or high structures at night, as recommended by the US Fish and Wildlife Service (2003); ▪ Solid red or flashing red lights will be avoided; ▪ High intensity lights, including floodlights, will be turned off at night outside of working hours, if possible, especially during the spring and fall migration period; ▪ Lighting for the safety of the employees should be shielded to shine down and only to where it is needed, without compromising safety; ▪ Use existing shipping lanes where possible; ▪ Should seabirds or other species become stranded on vessels or on land, adhere to relevant protocols (e.g., The Leach's Storm-Petrel: General Information and Handling Instructions [Williams and Chardine No date]); and ▪ Complete permit application form prior to handling birds (i.e., a permit is required to implement the Williams and Chardine protocol) (email: Permi.atl@ec.gc.ca).
Rehabilitation and Closure	Similar to those used during construction with the exception of blasting	Similar to those to those experienced during construction	▪ Refer to construction.

7.6 Marine Environment

The Marine Environment VEC considers marine fish and fish habitat, marine mammals and marine species at risk potentially affected by the Project. The Project-related interactions and likely effects on the Marine Environment VEC, along with the mitigation to reduce or avoid these effects, are described below. It is noted that marine fish and marine mammals in general exhibit similar interactions and likely effects with the Project as marine fish and marine mammals considered to be at risk or of conservation concern.

The ACCDC information request submitted in February 2015 in support of the Project did not identify any historical occurrence of marine species at risk or conservation concern (ACCDC 2015). As such, marine species at risk are not discussed separately in this analysis. Likely effects on marine birds are considered in Section 7.5 Wildlife, where both terrestrial and marine birds are discussed. Accidents and malfunctions, including those with effects on the marine environment are considered in Section 7.8.

Based on the preliminary identification of likely Project-environment interactions (Table 4-1), it is likely that the Project will interact with the marine environment during all phases (i.e., construction, operation, rehabilitation and closure). The majority of the effects on the marine environment are associated with the construction of the Marine Terminal since the construction of this feature will result in effects on marine habitat. However, the design of the Marine Terminal (north option) includes the installation of armour stone and filter stone around the concrete caissons, which will act as a protection against damage to the Marine Terminal and causeway. The armour stone and filter stone will create marine habitat that is suitable for colonization by a variety of marine invertebrates, such as lobster, which supports local commercial fisheries. The approach for this option is anticipated to offset for the marine habitat that is altered as a result of the construction of the Marine Terminal. A similar marine terminal design for the Newspar project was evaluated in 2010, and it was concluded that the amount and quality of marine habitat created was more than the marine habitat lost at the Marine Terminal footprint, and therefore, the new infrastructure was determined to result in an overall gain in marine habitat (CFI 2010b). Winter flounder habitat, which is found in sand and gravel substrate, will likely be adversely affected by the construction of the Marine Terminal; however, large areas of sand and gravel habitat are present in the immediate vicinity of the Marine Terminal footprint and winter flounder will likely relocate to these other areas (CFI 2010b).

It is important to note that the Marine Terminal was a component of the previously assessed Newspar project. The 2009 EPR included the assessment of the reactivation of existing Tarefare and Blue Beach North underground fluorspar mines, mill upgrade, and construction of a TMF in Shoal Cove Pond and a marine terminal at Blue Beach (CFI 2009). **The Newspar project was released from both provincial and federal EA processes in October 2010. Furthermore, in 2015, Transport Canada issued an approval under the *Navigation Protection Act* for constructing and operating a marine terminal at Blue Beach.**

Both projects (i.e., this proposed Project and the Newspar project) include two options for the location of the terminal at Blue Beach (north and south) and are designed to accommodate Panamax vessels up to 65,000 DWT. Although the conceptual design options are slightly different between the two projects, the Project activities and the size of the terminal footprint are the same as previously assessed and approved by DOEC (2012), the CEA Agency (2012) and Transport Canada (2015) (Section 1.3 Background and Section 1.4 Approval of the Undertaking).

No issues related to the marine environment were raised by stakeholders during consultation activities (Section 5.2).

7.6.1 Construction

During the construction phase of the Project, the following activities are considered to have a likely effect on one or more components of the marine environment (e.g., water quality, marine mammals):

- stripping;
- excavation and blasting;
- construction activities and equipment mobilization;
- transportation; and
- staging and storage of construction related equipment and materials.

As described in Section 2.0, the activities listed above are required to allow construction of the Marine Terminal, shore-based staging and storage areas for Project-related equipment and materials, and construction of the access road connecting the Marine Terminal to the Mine Site and other Project components and infrastructure.

As construction areas are stripped, the vegetation is removed leaving bare surfaces, thereby increasing the potential volume and peak rate of runoff discharged from the Project area and ultimately into the nearshore marine environment. Also, removal of vegetation could increase concentrations of suspended solids within stormwater runoff affecting water quality of the receiving environment and resulting in adverse effects on marine species (e.g., lobster). Dust will be produced during excavation and blasting, construction activities and equipment mobilization, as well as the operation of Project-related vehicles and equipment. Dust will likely be deposited directly on water in the Harbour, surface waterbodies and runoff further increasing suspended solids concentrations. This is also discussed in Section 7.3, Water Resources.

Only a small portion of ground cover adjacent to the Harbour will be disturbed during construction and a buffer of at least 25 m will be maintained between all natural waterbodies and waste rock, overburden, and topsoil piles to minimize the risk sedimentation. The limited area of disturbance, and use of setbacks, combined with the use of standard erosion and control measures (during all phases of the Project) will help prevent sediment laden runoff from entering the marine environment. More importantly, during development of the Mine, TMF and Mill, the ground surface will be contoured so that storm water runoff from construction areas will flow back into the property via a system of ditches and be collected in settling ponds. A Site Grading and Drainage Plan will be developed during the detailed design phase which will include, to the extent possible, re-direction of surface flow around the Project site. The capacity of the settling ponds will be sufficient to contain and treat surface runoff so that discharges meet all applicable water quality standards prior to release into the environment. All permanent drainage control features will be in place and functioning upon completion of construction. The site engineer will be responsible for monitoring these features so they are stabilized and functioning as designed.

As described in Section 2.0, construction of the Marine Terminal will be based on concrete caissons with a mobile ship loader (north option) or an open pile supporting conveyor with mooring dolphins and a quadrant loader (south option). Marine Terminal infrastructure will occupy a maximum footprint of 3 ha within the marine environment, resulting in the alteration or loss of the marine habitat, and associated flora and fauna that cannot move out of the area. Marine construction activities are expected to result in disturbance of bottom sediments, potentially affecting nearby habitats. The likely effects associated with construction of the Marine Terminal are:

- alteration and increase of habitat for fish that are part of or support CRA fisheries and other marine species;
- behavioural changes to fish, invertebrates and other marine species due to noise and vibrations associated with explosives use in the terrestrial environment, construction of the Marine Terminal, and vessel movement; and
- increased disturbance to marine flora and fauna and reduced habitat quality and function for marine species due to suspended sediment and noise from construction-related vessel movement.

Construction of the Marine Terminal will result in the alteration and increase of sea bed habitat, as new habitat is created by the terminal foundations. Based on the preliminary design, and depending on the option selected for the Marine Terminal (north or south), the footprint of the Marine Terminal will be up to 3 ha. The reduction in available habitat associated with the Project will be minimal (due to the small size of the Project footprint) in relation to the area of available habitat in St. Lawrence Harbour or Placentia Bay as a whole. While this habitat is important to the marine biota (flora and fauna) it supports, it is not limiting within St. Lawrence Harbour and does not support any unique characteristics. As indicated previously, the armour stone and filter stone will create new marine habitat that is suitable for colonization by a variety of marine invertebrates, such as lobster, which supports local commercial fisheries. A Marine Fisheries Offsetting Plan will prepared to obtain a Fisheries Act Authorization for the habitat alterations resulting from construction activities at the Marine Terminal. The alteration of this habitat for the Project is anticipated to result in a net increase of suitable available habitat for CRA or other marine species.

Fixed and moored structures typically become a focus for marine production (e.g., reef effect) which tend to attract marine life, including fish and mammals. In some cases, structures can provide alternate habitat for marine benthos such as lobster, the effect of which may even be considered beneficial if these structures provide habitat diversity which in-turn increases benthic species diversity in the area.

Construction of the Marine Terminal may also result in behavioural changes, direct injury or mortality of slow-moving or immobile fauna and flora. Benthic communities have been shown to recover from disturbance related to types of marine construction activities (e.g., dredging) (Dernie et al. 2003); such that it is expected that once construction activities are complete, benthic species will re-colonize the area. Lobsters that are displaced from the Project footprint are expected to return within a fairly short time period after the construction activities are completed, with a minimal effect on catchability, as shown by studies related to seismic surveys (Payne et al. 2008; Martec Ltd. et al. 2004).

Construction of the Marine Terminal will result in the alteration of the substrate and re-suspend sediments into the water column. High suspended sediment concentrations may clog gills, decrease feeding success, reduce rates of growth or embryo development, decrease resistance to disease and reduce the ability of marine fish to see and avoid predators, while also reducing the amount of light reaching any submerged vegetation, thereby decreasing photosynthesis (Park 2007). Increased levels of suspended sediment may be a problem for filter-feeding species; especially those living in relatively clear water, however, these effects will vary depending upon the susceptibility of the species and the nature of the substrate at the site, which is described in Section 7.1 Physical Environment (soil), Section 7.2 Atmospheric Environment (dust) and Section 7.3 Water Resources (water quality). Sublethal effects on a variety of fish species have been recorded by Appleby and Scarratt (1989), when species were continually exposed for a period of several days in waters with suspended sediment concentrations of approximately 650 mg/L or greater. Although this may affect marine plants and cause reduced habitat quality as there is generally a lower amount of dissolved oxygen associated with high suspended sediment values (Ntengwe 2006), fish and marine mammals will likely re-locate to adjacent areas to avoid the temporary disturbance. Consideration will be given to the use of silt curtains or other similar methods in the marine environment during construction to limit the extent of the effects of suspended sediments.

Vibrations associated with blasting onshore, pile driving in the marine environment or other techniques used to install the Marine Terminal foundation may result a zone of increased disturbance to marine flora and fauna. Blasting produces compressive shock waves in water followed by a rapid decay to below ambient hydrostatic pressure. Overpressure can damage fish swimbladders, rupture or hemorrhage internal organs, and result in the alteration or loss of fish eggs and larvae, including crab and lobster eggs and larvae. To avoid these effects, blasting charge size will be reduced if the location of blast is near the water's edge. CFI will comply with DFO guidance which stipulates that, for large blasts, on the order of 100 kg per hole, a setback of about 150 m is required (Wright and Hopky 1998). Shore-based blasting and pile driving during the construction phase is expected to occur over several months but will be temporary in duration and localized.

Additional noise in the marine environment will be created by installation of other components of the Marine Terminal (e.g., the mooring dolphins) as well as from associated vessel traffic. Increased noise (magnitude, frequency, duration and character) above background levels resulting from construction activities may result in short-term changes to behaviour and habitat use of marine fish. Marine fish utilize sound for communication, as well as for predator and prey detection, making use of the rapid propagation of sound through water to perceive and discriminate sounds in the marine environment (Smith et al. 2004). Loud noises may result in behavioural responses, including avoidance of the source of noise which could result in avoidance of feeding or spawning grounds (Popper 2003). Most adult pelagic and demersal fish species will likely avoid such activities due to the associated noise and vibration, thereby limiting direct mortality and injury as a result of the Project.

It has been reported by Richardson et al. (1995) that typical vessel traffic (e.g., barges, tugs and bulk carriers) generally produce sound levels between 168 and 193 dB (1 μPa) at 1 m distance. Vessels used during Project construction and rehabilitation and closure will generally be small in size and limited in numbers. Excessive vibration may cause direct effects on the seabed, including liquefaction, increasing turbidity and the disruption of benthic communities. These potential effects are dependent on the type of seabed and sediment characteristics.

Marine mammals are sensitive to noise, some species more than others. Cetaceans (i.e., whales, dolphins and porpoises) have low reproductive potentials, rendering them particularly vulnerable to anthropogenic effects (National Marine Fisheries Service [NSM] 1996). Small cetaceans have shorter life spans (ranging from 15 to 30 years) compared to larger marine species, which may live to be over a century in age (Hoyt 1984). The noise associated with vessel traffic during the construction phase may disturb marine mammals, causing them to avoid the work area. At close proximity, these sounds have the potential to impair marine mammal feeding efficiency, predator detection, and/or migratory success (Richardson et al. 1995). Marine vessels produce low-frequency sounds with most acoustic energy below 1 kHz. As seals and harbour porpoises are most sensitive to mid-frequency sounds (> 1 kHz), much of the acoustic energy produced by vessel traffic will not be audible to these marine mammals. The behavioural effects described above will subside once the construction activities are complete. Furthermore, consideration will be given to use of bubble curtains or other similar methods in the marine environment during construction to limit the potential effects of noise.

The vessel traffic associated with the all phases of the Project has the potential to either attract marine mammals or frighten them away, depending on the type of activity. Some mammals may be indifferent. Some dolphin species are well known for bow riding, and baleen whales have been known to approach fishing vessels at the sound of trawl doors being raised (Brodie 2001, pers. comm. cited in EnCana Corporation 2002). The concern related to attraction of mammals to vessel traffic is the increased likelihood of collision. Vessel collisions with marine mammals are more likely to occur when vessel speeds are high and with slow-moving marine mammals such as whales, although such events are rare. Collisions with dolphins and harbour porpoises are reduced given that these mammals are fast swimmers and are able to swim away or dive to avoid vessels. The likelihood of collision can be decreased if vessels maintain constant speed and course while in transit (Laist et al. 2001), as will be enforced, to the extent possible, for this Project.

Faster travelling vessels are more likely to cause mortality or injury to whales. Collisions where vessel speeds were above 15 knots (28 km/hr) were found to be lethal to whales nearly 100% of the time, while collisions where vessels were travelling at lower speeds found lethality rates at less than 50% (Vanderlaan and Taggart 2007). Lethal collisions with right whales can occur even with small vessels; however, ships greater than 80 m in length are more likely to cause fatality to fin whales. Vessel traffic speed should be limited as such to reduce the likelihood of fatal collisions (Laist et al. 2001). Vessels used during construction of the Marine Terminal will have a maximum speed of 14 knots while operating in the Harbour and in Blue Beach Cove, regardless of the size of the vessel. In addition, sufficient distance will be kept between Project vessels and whales, whenever possible.

Due to the nature of the Project, unavoidable serious harm to marine fish and fish habitat will result from the construction of the Marine Terminal. To counter-balance unavoidable serious harm to fish and loss of fisheries productivity for species that are part of or support a CRA fishery, CFI will apply for an Authorization pursuant to the *Fisheries Act* Section 35(2)(b), including the preparation of a Marine Fisheries Offsetting Plan,to be developed in consultation with DFO, to offset for the likely effects of the Project on marine fish and fish habitat. Based on the draft Marine Fisheries Habitat Compensation Strategy prepared by CFI in 2010 for the marine terminal for the Newspar project, it is anticipated that the marine habitat created by the installation of the Marine Terminal will be greater than the quantity of habitat lost, resulting in a net gain in marine habitat (CFI 2010b).

7.6.2 Operation

During the operation phase of the Project, the following activities are considered likely to have an effect on one or more components of the marine environment (e.g., water quality, marine mammals):

- ore extraction; and
- transportation.

The likely effects on the Marine Environment associated with the operation of the Project are: behavioural changes to fish, invertebrates and other marine species due to noise and vibrations associated with explosives use in the terrestrial environment to facilitate ore extraction; increased disturbance to marine flora and fauna and alteration or loss of habitat quality and function for marine species due to noise and vessel movement from increased ship traffic (discussed in Section 6.7.1 for the construction phase of the Project); and collision between bulk carriers and marine mammals.

During the operation phase of the Project, blasting will be limited to ore extraction at the Mine Site, which is located approximately 1 km from the Little Lawn Harbour to the west. The likely Project effects, as described in the construction phase above, are therefore limited given the separation distance. CFI will continue to comply with the DFO guidance related to blasting in or near the marine environment (Wright and Hopky 1998).

During operation, noise produced by ships transporting fluorspar concentrate may adversely affect the behaviour of marine species near the ship loading area and in the travel lanes from the Marine Terminal to the main shipping lanes in Placentia Bay. Fish or marine mammals may avoid the area, change migratory routes, and/or alter feeding habits (Lawson et al. 2000). Propeller wash from the larger ships used during the operation phase of the Project may re-suspend sediment affecting marine plants and relatively immobile marine fauna in relatively shallow areas in the vicinity of the Marine Terminal.

Large shipping vessels (i.e., bulk carriers) will be used to transport fluorspar concentrate to markets. These large vessels are expected to be greater than 120 m in length and will therefore have limited maneuverability to avoid collisions with mammals. These vessels are commonly designed for a speed of 13 to 15 knots. Project-related vessels will have a maximum speed of 14 knots in coastal waters (i.e., out to the established shipping lanes in Placentia Bay) to reduce the risk of collision with marine mammals.

7.6.3 Rehabilitation and Closure

The physical activities associated with rehabilitation and closure would include: removal of Project-related equipment and materials from shore-based staging and storage areas; dismantling and removal of the Marine Terminal (or portions of the terminal depending on regulatory approvals); and, reclaiming and/or stabilizing any land disturbed as a result of rehabilitation and closure activities. Likely effects during this phase of the Project are expected to be similar to, but less than, those expected during construction. Rehabilitation and closure methods and activities will comply with all applicable federal and provincial regulatory requirements in force at the time.

A Rehabilitation and Closure Plan will be prepared and submitted to the NL Government under the *Newfoundland and Labrador Mining Act*. The plan will meet regulatory requirements for rehabilitation, and will include closure and rehabilitation of the infrastructure at the Mine Site, Mill Site, TMF, Marine Terminal and quarries and borrow sources.

Fixed and moored structures typically become a focus for marine production (e.g., reef effect) which further attracts marine life, including fish and mammals. In some cases, structures can provide alternate habitat for marine benthos such as lobster, the effect of which may even be considered beneficial if these structures provide habitat diversity which may in turn increase benthic species diversity in the area. As the Marine Terminal foundations will create new habitat, it is anticipated that these structures will remain in place upon closure of the mine; unless otherwise requested and approved by federal agencies at the time of closure and rehabilitation.

7.6.4 Environmental Effects Summary

A summary of the likely environmental effects and proposed mitigation for the Marine Environment VEC is provided in Table 7-7. A Project-specific EPP will be prepared to describe the procedures required meet regulatory obligations, as well as the recommendations, mitigation measures and commitments made in this EA.

Table 7-7: Environmental Effects Summary and Proposed Mitigation Measures for Marine Environment VEC

Project Phase	Activity	Likely Environmental Effect	Proposed Mitigation Measure
Construction	Stripping	Increased volume and peak rate of runoff	Minimize the Project footprint to that required for efficient and safe construction.
			Direct surface runoff to settling ponds.
			Design and implement a site Grading and Drainage Plan.
	Stripping, excavation and blasting, construction activities and equipment mobilization, transportation, staging and storage of construction-related equipment and materials	Increased suspended sediments in runoff	Refer to stripping and mitigation measures indicated in Section 7.2 Atmospheric Environment and Section 7.3 Water Resources.
			Maintain 25 m buffer between waterbodies and waste rock, overburden, and topsoil piles.
			Implement standard erosion and sediment control measures on land-based construction areas.
			Consider use of silt curtain or other measures in marine construction areas.
			Monitor discharge of settling ponds for suspended sediments.
	Excavation and blasting, construction activities and equipment mobilization	Alteration or loss of marine habitat Disturbance and behavioural changes of marine species	Minimize the Project footprint to that required for efficient and safe construction.
			Minimize duration of construction.
			Comply with DFO guidance related to blasting near and in the marine environment (i.e., reduce blasting charge size in coastal areas) (Wright and Hopky 1998).
			Use of bubble curtains or other similar methods in the marine environment to limit the potential effects of noise, as appropriate.
			Maintain 150 m setback from coast for blasts larger than 100 kg per hole.

Project Phase	Activity	Likely Environmental Effect	Proposed Mitigation Measure
			Maintain constant course and vessel speed under 14 knots while operating in the Harbour and in Blue Beach Cove.
			Implement Marine Fisheries Offseting Plan pursuant to the *Fisheries Act* Section 35(2)(b).
Operation	Ore extraction, transportation	Alteration or loss of marine habitat	Refer to construction.
		Disturbance and behavioural changes of marine species	
Rehabilitation and Closure	Rehabilitation and closure.	Similar to those to those experienced during construction	Refer to construction.

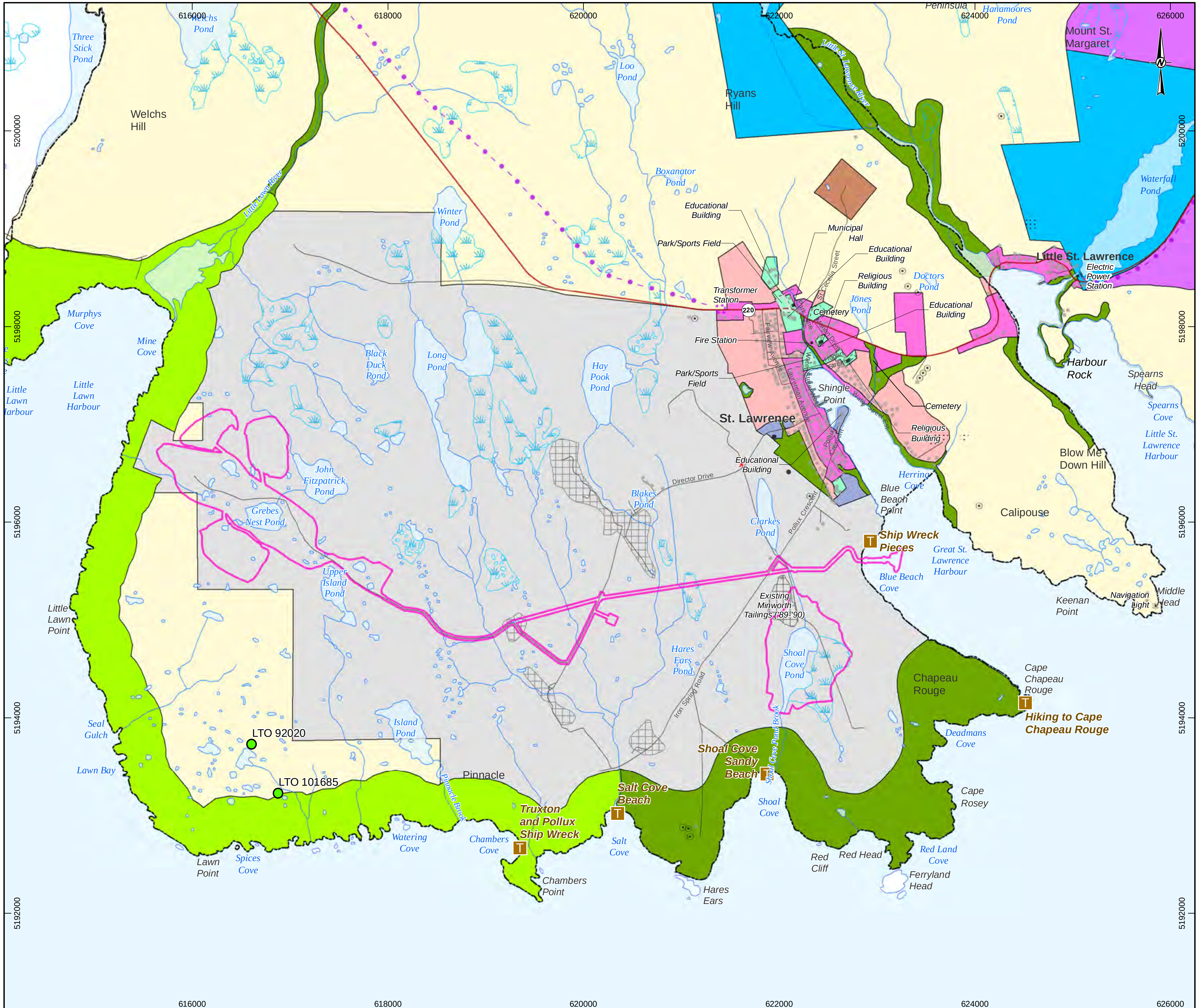
7.7 Socio-Economic Environment

The Socio-economic Environment VEC addresses Human Health, Economy, Employment and Business, Infrastructure and Services, Quality of Life, Historic Resources, Navigation, Commercial and Recreational Fisheries, Land and Resource Use as well as Tourism and Recreation. All of these VEC sub-components will likely be affected by the Project's various activities during construction, operation, and rehabilitation and closure.

The socio-economic study area includes the Town of St. Lawrence (north-east boundary of the study area), the Great St. Lawrence Harbour, and extends along the southern coast of the Burin peninsula to Mine Cove, which is located in Little Lawn Harbour. A straight line between Mine Cove and the northern boundary of the Town of St. Lawrence closes the study area. The various land and resource use activities identified in this area in relation to the Project footprint are shown on Figure 7-3.

Public consultations were conducted during the preparation of this EA Registration (Section 5.2). These consultations enabled the various Project stakeholders to express their comments and concerns regarding the Project activities and potential effects (i.e., positive and adverse). As outlined in Section 5.2, stakeholders expressed several comments related to socio-economic environment. Several stakeholders expressed interest in employment and business opportunities and shared information about their land and resource use practices. Two community members expressed concerns about health and safety and one individual about tourism and recreation. Several mitigation measures will be implemented to maximize local benefits and reduce adverse effects on the socio-economic environment.

The following sections describe the Project's likely socio-economic effects and proposed mitigation measures for each Project phase.



LEGEND

- T Tourist Attraction
- License to Occupy
- Project Footprint (10 m Buffer)

MUNICIPAL ZONING

- Residential
- Mixed Development
- Public
- Solid Waste Disposal
- Rural
- Industrial
- Mining
- Environmental Protection
- Environmental Protection-Management Unit
- Watershed Conservation
- Protected Public Water Supply

TOPOGRAPHY

- Navigational aid (navigation light)
- Building (unknown)
- Building (religious building)
- Building (fire station)
- Building (electric power station)
- Building (municipal hall)
- Tower (communication)
- Tank
- Blocked passage
- Municipal Boundary
- Power transmission line (overhead)
- Highway
- Existing Road
- Manmade hydrographic entity (dam)
- Manmade hydrographic entity (wharf)
- Watercourse
- Waterbody
- Wetland
- Pit
- Mine
- Cemetery
- Park/Sports field
- Transformer station

0 1 2
Kilometres
1:40,000

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT

CANADA FLUORSPAR INC.

PROJECT

AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE

LAND USE AND PROJECT FOOTPRINT

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-14
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT No. 14-07707 Rev. 0 FIGURE 7-3

IF THIS MEASUREMENT DOES NOT MATCH WHAT IS SHOWN, THE SHEET SIZE HAS BEEN MODIFIED FROM: 25mm

7.7.1 Construction

Construction activities will likely affect the Socio-Economic VEC to various degrees. The following activities are considered likely to have an effect on one or more components of the Socio-Economic VEC:

- stripping;
- excavation and blasting;
- construction activities; and
- transportation.

This section presents an analysis of the key likely Project effects on the Socio-Economic VEC and proposed mitigation measures to reduce or avoid the likely adverse effects during construction.

Human Health

The likely Project effects on human health include health of workers (occupation health) as well as the health of the neighbouring population that is likely to be affected by the Project. Effects on occupational health are not anticipated since adequate mitigation measures have been incorporated in the Project design and planning. CFI has established a Health, Safety, Environmental and Social Responsibility Policy (Appendix A) and has incorporated health and safety as part of their Corporate Guiding Principles (Appendix B). In addition, CFI will establish an OH&S Plan, an ERP and contingency plans to avoid or reduce work-related accidents and to respond to any emergencies. The company is committed to providing the safest possible workforce for its employees through the strict enforcement of these policies. Mine personnel will maintain constant vigilance, undergo regular safety training, and follow the procedures outlined in the EPP, OH&S Plan, ERP and all Contingency Plans to prevent and avoid workplace accidents and malfunctions.

During Project construction, the health of surrounding populations may be affected by:

- dust produced during excavation, blasting, construction activities and during staging and storage of construction-related equipment and materials;
- noise from construction activities; and
- potential collisions between Project vehicles traveling through the Town of St. Laurence and other vehicles or individuals (this effect is addressed in section 7.8 Accidents and Malfunctions).

The closest community is the town of St. Laurence, located approximately 6 km from the Mine Site where most of the dust emissions and noise will occur during the construction phase. There are also two cabins located approximately 1 to 2 km south of the Mill Site.

As outlined in Section 7.2, the key dust emission sources during the construction phase will be generated from activities at the Mill, Mine Site and on the Project access roads. As described in Section 7.2 Atmospheric Environment, it is expected that during construction, the dust plume at the Mill and Mine Site will mainly occur over the pit areas without extending outside the Project footprint. The two cabins located near the Mill Site will not likely be affected by dust during construction. There are no identified human settlements along the proposed access road, and mitigation measures to address dust emissions (e.g., watering of roads) will be implemented. Therefore, dust emission from road traffic during construction is not anticipated to adversely affect human health.

A Water Management Plan will be developed and implemented during the construction phase to manage all water discharged as a result of the construction activities. During development of the Mine, TMF and Mill, the ground surface will be contoured so that storm water runoff from construction areas will flow back into the property via a system of ditches and be collected in settling ponds. The capacity of the settling ponds will be sufficient to contain and treat surface runoff so that discharges meet all applicable water quality standards prior to release into the environment. Water quality is not anticipated to have an effect on human health.

Economy, Employment and Business

CFI is committed to maximizing local benefits and hiring locally or provincially as much as possible. It is estimated that, for the design and construction phases of the Project, CFI would directly create approximately 340 jobs at peak during the construction phase, which is planned to span over a period of 2 years. Table 2-6 presents the estimated employment requirements for the construction phase of the Project per type of occupation, with associated NOC code.

A number of skilled trade workers, professionals, and labourers will be required during construction. It is reasonable to assume that a large number of women and men in the region will benefit from indirect employment and business opportunities. However, this additional demand on workers in the Burin Peninsula is likely to increase competition for labour in the area and is likely to alter the availability of workers available for other industrial or commercial activities. The socio-economic cumulative effects are discussed in section 7.9.

CFI has a partnership with the Keyin College that aims at creating a training program specific to mining and processing. This partnership is anticipated to increase local capabilities in the mining and other related sectors, which would in turn, help reduce the competition for labour in the area.

Moreover, CFI will require access to several types of goods and services during the construction phase. The company intends to rely on local contractors and suppliers, to the extent possible, to meet its requirements. It is anticipated that demand will be generated for a range of services throughout the three phases of the Project and this is likely to result in positive effects on the local and regional economy.

Based on the current knowledge of business services in the area, the direct business opportunities that could be created as a result of the Project include:

- Office supply agencies and support services;
- Commercial printing services;
- Courier services;
- Heavy equipment rental services;
- Auto rental, sales and repair services;
- Environmental monitoring;
- Excavation services;
- Snow clearing services;
- Wholesale trade;

- Commercial food services and catering;
- Commercial cleaning services;
- Transportation services;
- Construction services;
- Engineering services;
- Computer sales and service;
- Industrial product sourcing services; and
- Legal services.

Businesses that will most likely experience indirect business opportunities include, among others:

- Accommodation services and real estate;
- Auto sales and services;
- Retailers;
- Personal services providers;
- Entertainment industries;
- Personal finances and other like services;
- Health care goods and service providers (e.g., chiropractic services);
- Restaurants and beverage providers;
- Bakeries;
- Household and commercial cleaning services; and
- Child care providers.

This potential increase in business opportunity as a result of Project activities will contribute to the diversification of the provincial economy by strengthening other industries, resulting in a more sustainable economy as businesses grow.

Moreover, the Project will enhance the tax base of the Town of St. Laurence and the Province of NL, which will result in positive effects for the Town and the Province.

Community Services and Infrastructure

The construction phase of the Project can result in increased demands on community services and infrastructure, such as transportation, accommodation and associated community services.

During the construction phase, materials and equipment are anticipated to be brought to St. Lawrence through existing roads provincial and municipal roads. The increased traffic in the Town of St. Lawrence may result in safety concerns. Potential safety issues pertaining to increased traffic of heavy machinery and associated mitigation measures are provided in Section 7.8 Accidents and Malfunctions.

The Project is anticipated to have a positive effect on local transportation infrastructure through the creation and upgrade of roads in the Project area. As outlined in Section 2.0 Project Description, access to the Mine Site will be achieved through the use of a combination of existing and new roads. There are currently two main access roads that connect the Mine Site to the Town of St. Lawrence. Existing roads will require upgrading, such as grading and ditching, to meet the loading and dimensional requirements of the types of vehicle expected to use the road for construction and operation. This upgrading of existing roads represents a positive effect on the supply of quality transportation infrastructure in the local area. In addition, the construction of new access roads will reduce traffic associated with the Project on other existing roads in the area which are used by locals to access recreational areas.

The Project will also have likely effects on accommodation in the area. The limited supply of housing, either for sale or for rent, was raised as a concern by stakeholders in the 2009 EPR (CFI 2009). Based on available information, it is assumed that the housing situation in St. Lawrence is similar to what it was in 2009. CFI is not currently planning to construct a work camp for construction workers, and therefore, workers will have to find their own accommodation in the area. As possible, CFI will prioritize hiring qualified local workers to reduce the number of incoming workers in the area and limit the potential effects on housing and accommodation during the construction phase. In addition, CFI is working in collaboration with the Town of St. Lawrence to prepare for an influx of workers. As outlined in Section 6.4.4, the Town has prepared a conceptual plan in anticipation of increased demand for housing associated with the Project. As part of this plan, there would be an opportunity to develop 64 new single family dwellings and create a park to accommodate 20 RV units.

As described in the 2009 EPR (CFI 2009), similar housing issues were raised when the White Rose platform was constructed in Marystown. There were approximately 1,400 workers (compared to 369 workers for the CFI Project) who required accommodation during the construction phase. The housing demand for this influx of construction workers was met primarily by the private sector through upgrades to existing apartment buildings, renovation and leasing of vacant public housing, or through local residents who leased all or part of their houses. An evaluation of the White Rose project and its effects on Marystown and the surrounding areas confirmed that although rents were increased, the private sector responded to the need for housing. It is therefore anticipated that housing requirements will be met in St. Lawrence and neighbouring communities, such as Marystown, during the construction phase.

The demand for drinking, domestic and process water is expected to increase as a result of the Project. Bottled water will be made available on site and domestic water for showers, water closets and lavatories will be supplied from a pond located near the Mine or Mill Site. Process water required for the mining operation will be provided by the Mine dewatering system. Overall, the additional water demand that will be created by the Project is not anticipated to incur capacity issues in the Town of St. Lawrence.

Quality of Life

Quality of life generally concerns issues such as dust, odour and noise for workers and for surrounding communities.

Dust and odour are anticipated to be localized effects which will generally be limited to the Project footprint. Therefore, no adverse nuisance effects associated with dust and odor are expected for community members residing in the Town of St. Lawrence or the two cabins located south of the Mill. The noise produced at the Mine and Mill Site during construction activities is also anticipated to be local and not likely to have adverse effects on the two cabins located south of the Mill Site. The noise generated by construction activities for the Marine Terminal is anticipated to remain within acceptable noise levels and will not likely result in adverse effects on the quality of life of community members residing in the Town of St. Lawrence. CFI will implement an EPP and associated mitigation measures and an OH&S Plan to reduce potential effects of dust, odour and noise on the quality of life of its workers, community members and other receptors.

Moreover, the region has been affected by out-migration of population. The proposed Project offers the possibility to resolve some of the social issues associated with out-migration by offering local employment. The prospect of the Project is generally viewed as positive by community members, as described in Section 5.2, as it offers hope of local employment and business opportunities. This job creation will contribute to sustain the community of St. Lawrence and surrounding areas and will provide means for workers to return to the region.

Historic Resources

Historic resources may include cultural/spiritual, paleontological, architectural and/or archaeological resources. The proposed Project is largely located on a brownfield site. An assessment of historic resources, which was conducted for this Project, indicates that only one registered archaeological site (ship wreck) has been identified at Blue Beach and that no other historic resources were identified in the Project area (GPA 2015). The archeological site at Blue Beach is not anticipated to be affected by the construction of the Marine Terminal. Mitigation measures will be incorporated in the Project EPP to address the unexpected discovery of historic resources that could occur during the construction phase, especially during stripping, excavation, blasting and construction activities. In the event of discovery of such resources, construction activities in the affected area will cease immediately and the discovery will be reported to the Provincial Archaeology Office. A mitigation strategy will be developed in collaboration with the NL Government.

Navigation

No navigation activities are anticipated to occur during the construction phase. All Project equipment and machinery is expected to be delivered by land. However, construction of the Marine Terminal may result in an alteration of local marine traffic for short periods of time. However, all activities associated with construction of the Marine Terminal will be completed in compliance with the *Navigation Protection Act* Authorization and all other applicable legislation. Potential safety issues associated with increased activity in the marine environment and mitigation measures to be implemented are presented in Section 7.8 Accidents and Malfunctions.

Commercial and Recreational Fisheries

Construction activities and potential accidental spills may result in adverse effects on fish habitat and on fish communities, which would potentially have an effect on local commercial and recreational fisheries activities in the Project area. However, several mitigation measures have been included in the Project design to avoid or reduce potential adverse effects on fish and fish habitat, as outlined in Section 7.3 Water Resources and Section 7.6 Marine Environment. During consultation activities carried-out for this Project, several community members indicated that there are fisheries activities occurring within the Project area and in the Great St. Lawrence Harbour. As outlined in Section 5.2, fishing locations identified by community members during consultation activities include Grebes Nest Pond, John Fitzpatrick Pond, Bill Hill Pond, Shoal Cove Pond and areas along the road to Little Lawn and along Chamber Cove Road (extension of Pollux Crescent).

As indicated in Section 6.4.5, several commercial and recreational fisheries vessels are located in the St. Lawrence Harbour (DFO 2014). However, in the 2009 EPR (CFI 2009), a local St. Lawrence fisherman indicated that commercial fishing within the Harbour was quite limited. The key fishing activities in the area consist of seasonal lobster fishing at Blue Beach, and herring-bait fishery with gill nets on the east side of the Harbour. In the 2009 EPR, it was indicated that capelin fishing has not occurred in Shoal Cove in recent years and limited recreational squid fishing occasionally occurs in the Harbour when the opportunity arises. Most of the commercial fishing is carried outside of the Harbour (CFI 2009).

All water discharged to the environment will comply with water quality standards and therefore, adverse environmental effects on fish and fish communities, and on fishing activities downstream of any Project discharge point are not anticipated. Information on potential effects on fish and fish habitat, and associated mitigation measures are presented in Section 7.3 Water Resources.

Construction of the Marine Terminal will likely affect marine fish communities and potentially marine fishing activities. As outlined in Section 7.6, CFI will apply for an Authorization pursuant to the *Fisheries Act* Section 35(2)(b), including the preparation of a Marine Fisheries Offsetting Plan, to be developed in consultation with DFO, to offset for the likely effects of the Project on marine fish and fish habitat and increase marine habitat for species that are part or support a CRA fishery. The implementation of this plan is expected to mitigate Project adverse effects on fish communities and fishing activities.

Land and Resource Use

The Project footprint is anticipated to a have direct effect on land and resource use activities. As indicated during the consultation activities (Section 5.2), land and resource use activities occuring in the Project area mainly consist of hunting, fishing and berry-picking. No houses, public infrastructure or services are present within the Project footprint. However, two cabins are located approximately 1 km south of the Mill Site. All community services and infrastructure are concentrated in the Town of St. Lawrence, which is outside the Project footprint (see Figure 7-1). Resource use, such as fishing in Grebes Nest Pond, is discussed under the Commercial and Recreational Fisheries subsection.

Consultations held for the Project indicate that hunting and berry-picking activities can be practiced elsewhere in the region. The community members who shared information about these activities mentioned that these resources are generally available in other areas and it would be possible to shift their resource use activities to these areas. This information on availability of resources found within the Project footprint in other areas is supported by the results of the ELC study, which indicate that the vegetation communities within the Project footprint are also present in other areas within the ELC Study Area and no vegetation community will be entirely lost as a result of the Project (Section 7.4). Moreover, the proposed mitigation measures to address the likely alteration or loss of vegetation communities in the Project footprint will reduce Project adverse effects on hunting and berry-picking activities.

Tourism and Recreation

As indicated in Section 6.4.4, St. Lawrence is an integral part of the Heritage Run in St. Lawrence. The tourism sector is mainly characterized by outdoor activities (e.g., hiking trails, bird watching, sandy beaches, scenic road around the peninsula, umbrella tree) and historical sites (e.g., miner's museum in St. Lawrence, monuments, ship wreck locations at Chamber Cove and Lawn Point). In general, tourism activities could be affected by the Project footprint or by the downstream effects associated with the Project.

During consultation activities, some respondents stated that they practice recreational activities such as hunting, hiking and picnicking in Shoal Cove Beach, Shoal Cove Pond, Clarkes Pond, brook at Salt Cove and Chambers

Cove area. Some of these participants also indicated that these activities could easily be practiced elsewhere in the area should the Project proceed. Thirty-one out of the 42 respondents at the Public Information Session (72%) indicated that they do not practice any recreational activities near the Project area. Also, when asked to rate their valuation of Grebes Nest Pond on a scale of 1 to 5 (1 being “I place very little value on Grebes Nest Pond and rarely use the area around the pond” and 5 being “I place a high level of value on Grebes Nest Pond and use the area around the pond frequently”), 60% of respondents indicated that they place little or no value on Grebes Nest Pond.

No downstream Project effects are expected during the construction phase, since the Project design for that phase will address treatment and monitoring of water prior to discharge to the environment. All water discharged to the environment will comply with water quality standards, and therefore, no adverse effects are anticipated on tourism activities that exist downstream of the Project area, namely the Shoal Cove Sandy Beach located south of the TMF.

Hiking trails, identified as a touristic attraction in the Heritage Run, lead to Blue Beach where construction of the Marine Terminal will occur. As described previously, construction activities will likely result in noise and dust generation, which is expected to be localized. Activities at the Marine Terminal will be concentrated in a small proportion of Blue Beach and several mitigation measures to reduce potential nuisance effects will be implemented, as previously indicated under Quality of Life. Given the nature of construction activities and the implementation of proposed mitigation measures, adverse effects on touristic and recreational activities at Blue Beach are not expected.

The increase in employment opportunities and potential influx of workers during the construction phase will likely result in the creation of indirect business opportunities in the tourism sector. Tourism-related businesses such as hotels, restaurants, travel and recreational agencies will likely see an increase in activity and revenue as a result of Project-related influx of workers.

Mitigation

The following mitigation measures are proposed to address the likely socio-economic Project effects during the construction phase. As a general socio-economic measure that would manage potential effects on the local population, CFI will prepare and implement a Complaints Response Plan that will delineate a mechanism to record, address and resolve complaints related to Project activities and phases. The Complaints Response Plan will be implemented at the start of the construction phase and will be kept in place during operation and rehabilitation and closure phases.

To maximize the Project’s positive effects on employment, CFI will provide on-the-job training to improve and create new skills in the workforce. This capacity building will also include training on the various environment, health and safety plans that will be prepared by CFI (EPP, OH&S Plan, EPR and Contingency Plans).

To maximise the Project’s beneficial effects on the local economy, CFI will engage with local suppliers to share information on their requirements for equipment and services. Engagement will consist of meetings with local business organizations and posting of procurement opportunities on the Project website. The objectives of these measures are to inform entrepreneurs of needs and opportunities so that they can prepare and respond accordingly.

Quality of life issues related to dust, noise and odour will be mitigated through the implementation of CFI's EPP, waste management plan, OH&S Plan, as well as through additional mitigation measures identified in Section 7.2 Atmospheric Environment.

Mitigation measures to address the unexpected discovery of historic resources will be incorporated in the Project EPP. In the event of discovery of such resources, construction activities in the affected area will cease immediately and the discovery will be reported to the NL Government. A mitigation strategy will be developed in collaboration with the NL Government.

During the construction of the Marine Terminal, CFI will comply with all applicable legislation, including the *Navigation Protection Act* Authorization issued by Transport Canada in 2015. In addition, CFI will transmit the exact geographical coordinates of the Marine Terminal construction area to the Canadian Coast Guard, who will in turn inform CFI of any vessels travelling in the Great St. Lawrence Harbour. With this information in hand, the vessels will be able to avoid that specific area.

7.7.2 Operation

The operation phase of the Project will likely affect the Socio-Economic VEC to various degrees. The following activities are considered likely to have an effect on one or more components of the Socio-Economic VEC:

- ore extraction;
- waste management; and
- transportation.

Human Health

As previously indicated in Section 6.1.5 Air Quality, there have been historical health concerns associated with poor air quality in the underground mines in St. Lawrence. Silicosis and a high incidence of lung and respiratory cancers affected many underground miners. These historical air quality issues were mainly due to primitive mining techniques, which were later addressed by installation of ventilation system in the underground mines and the use of wet drilling methods. With today's technology and health and safety standards, these issues will be proactively addressed in Project design and planning to protect workers and the public from these health risks. The stakeholders consulted during the engagement activities have not identified these issues as part of their concerns, but rather indicated that they are encouraged by the potential use of safer open pit mining activities and understand that several health and safety measures will be implemented by CFI to protect workers and the public during operation of the Mine.

Regarding water quality, the Project design will ensure that the water discharged by the Project to the environment during operation will comply with water quality standards and should therefore not have an adverse effect on human health during the operation phase.

A Water Management Plan will be developed and implemented during the operation phase to manage all water discharged as a result of the operation activities. Water to be discharged to the environment will be treated and monitored to meet applicable water quality standards prior to release into the environment. Water quality is not anticipated to have an adverse effect on human health.

Other than occupation health issues that will be mitigated through the implementation of CFI's OH&S Plan, health effects on the community members and neighbouring populations are not expected to occur during the operation phase.

Employment and Economy

CFI intends to maximize local benefits and local hiring, wherever possible. During the operation phase, the Project is expected to generate 164 full-time jobs over the 10 years period. Table 2-7 presents the estimated occupational requirements for each year of the operation phase, per type of occupation.

As for the construction phase, a number of skilled trades persons, professionals and labourers will be required during operation. It is reasonable to assume that a large number of women and men in the residing in the area will also benefit from indirect employment and business opportunities during this phase of the Project.

During the operation phase, requirements for goods and services for the Project are anticipated to be lower than those associated with the construction phase. However, there will still be a likely positive effect for the local and regional economy. CFI intends to rely on local contractors and suppliers, to the extent possible, to meet its operating requirements.

Infrastructure and Services

The operation phase of the Project can result in increased demands on community services and infrastructure, such as transportation, accommodation and associated community services. However, these demands are anticipated to be lower than during the construction phase due to the lower number of workers, and the greater proportion of resident workforce. No likely adverse effects have been identified in the operation phase as additional demands are expected to be met by the existing community infrastructure and services in the area without anticipated capacity issues.

Quality of Life

Quality of life generally includes issues such as dust, noise and odours for workers and for surrounding communities.

As for the construction phase, dust and odours are expected be localized and generally limited to the Project footprint. Noise generated during ore extraction and processing activities is not expected to have an adverse effect on the two cabins located south of the Mill Site due to their distance from the Mine and Mill Site. The operation of the Marine Terminal will generate intermittent noise during ship loading activities, but noise is expected to remain within acceptable noise levels. Therefore, no adverse nuisance effects are expected on the Town of St. Lawrence or the two cabins located south of the Mill. As previously indicated for the construction phase, CFI will implement an operation-specific EPP and associated mitigation measures and an OH&S Plan to reduce potential effects of dust, odour and noise on the quality of life of its workers, community members and other receptors.

Moreover, the region has been affected by out-migration of population. The Project's operation phase offers the possibility to increase local employment and retain workers for the duration of the Project. The prospect of the Project is generally viewed as positive by community members, as described in Section 5.2, as it offers hope of local employment and business opportunities. This job creation will contribute to sustain the community of St. Lawrence and surrounding areas and will provide means for workers to return to the region.

Navigation

As described in Section 6.4, St. Lawrence is a core fishing harbour andvessels within the Harbour are primarily used for commercial and recreational fisheries activities (DFO 2014). Crab vessel traffic is relatively high in the Harbour, particularly along the eastern side, as it is home to the Supplementary Crab Fleet during the fishing season which lasts from May to September. Approximately 15 to 20 shipments of fluorspar are anticipated to be shipped every year from the Marine Terminal during the operation phase. The location of the Marine Terminal offers several advantages, such as being located in an area sheltered from open ocean waves and swells, its close proximity to the required water depth without dredging, and the possibility for safe navigation access to the Marine Terminal.

Given the few number of shipments anticipated each year and the strategic location of the Marine Terminal in the Blue Beach area, interference with the existing marine and navigation operations in the St. Lawrence Harbour are anticipated to be minimal. Therefore, it is expected that the marine traffic associated with Project activities will not have an adverse effect on local commercial or recreational navigation in the Great St. Lawrence Harbour.

Commercial and Recreational Fisheries

As noted in Section 7.6, noise generated by ships during operation may adversely affect the behaviour of marine species near the ship loading area and in the navigation travel lanes from the Marine Terminal to the main shipping lanes in Placentia Bay. However, fish may avoid the area, change migratory routes, and alter their feeding habits (Lawson et al. 2000). No adverse environmental effects on commercial or recreational fishing activities in the Harbour are anticipated. In addition, CFI will implement a Marine Fisheries Offseting Plan under the *Fisheries Act* to offset for the likely effects of the Project on marine fish and fish habitat.

Tourism

The Project is likely to attract more visitors to the area. Tourists will likely look for accommodation, food and other entertainment opportunities in the Town of St. Lawrence during their stay. This likely increase in visitors offers local business with an interest in tourism an opportunity to expand and/or diversify the range of services offered to meet the demand. The Project would, therefore, have a likely positive effect on tourism-related activities and businesses in the area.

Mitigation

The following mitigation measures will be implemented to mitigate Project effects during the operation phase. CFI will maintain the implementation of the Complaints Response Plan during the operation phase to resolve Project related complaints filed by workers or community members. Regarding employment and the local economy, the various mitigation measures to be implemented during the construction phase will continue during the operation phase. Quality of life issues related to dust, noise and odour will be mitigated through the implementation of CFI's EPP, waste management plan, OH&S Plan, as well as through additional mitigation measures identified in Section 7.2 Atmospheric Environment.

7.7.3 Rehabilitation and Closure

As indicated in Section 2.6, a Rehabilitation and Closure Plan will be prepared and submitted to the NL Government under the *Newfoundland and Labrador Mining Act*. The plan will meet regulatory requirements for rehabilitation, and will include rehabilitation and closure of the infrastructure at the Mine Site, Mill Site, TMF, Marine Terminal and quarries and borrow sources.

This plan will include methods for progressive rehabilitation activities to be implemented during all Project phases, when disturbed areas are no longer required. Rehabilitation and closure of borrow pits and quarries will be done progressively. Finally, after a certain amount of lifts of the dumps are completed and when it is safe to proceed, vegetation of the benches will be carried out.

At the end of operation, revegetated berms will be built around the pit crests for safety reasons. After a certain period, which will be defined once more hydrogeological information is available, the pits will become naturally flooded and create water bodies. Overburden piles will be reused for revegetation activities. All new roads will be scarified and revegetated and existing roads will remain. As the Marine Terminal foundations will create new habitat, it is anticipated that these structures will remain in place upon closure of the mine; unless otherwise requested and approved by federal agencies at the time of closure and rehabilitation. All pipelines will be dismantled and potential contaminated soil will be treated. The foundations of the buildings at Mill Site will be removed and the site will be revegetated. The TMF will contain a pond, and the tailings beach and polishing pond will be reseeded and revegetated. The diversion channel at the TMF will be dismantled and natural flow will re-enter the tailings pond and be discharged to Shoal Cove through a new spillway following adequate testing of discharge water.

Although all Project components will be rehabilitated and closed, access to the Mine Site will remain restricted for security reasons. Practice of existing land and resource use activities (e.g., hunting, berry-picking, hiking, fishing) will therefore, not likely occur within most areas of the Project footprint following Mine closure. As outlined previously, the results of the ELC study indicated that vegetation communities located within the Project footprint are also present in other areas within the ELC Study Area and no vegetation community will be entirely lost as a result of the Project (Section 7.4). Moreover, as for other Project phases, the proposed mitigation measures to address the likely alteration or loss of vegetation communities in the Project footprint will reduce Project effects on hunting and berry-picking activities.

Project closure will leave many workers in search for new jobs. The training and experience that Project workers have gained during their employment is expected to help them find similar jobs on other projects in the region, province or abroad.

7.7.4 Environmental Effects Summary

A summary of the likely environmental effects and proposed mitigation for the Socio-Economic VEC is provided in Table 7-8.

Table 7-8: Environmental Effects Summary and Proposed Mitigation Measures for Socio-Economic VEC

Project Phase	Activity	Potential Environmental Interaction	Proposed Mitigation Measure
Construction	All Project activities	Potential nuisance effects (dust, noise, odour)	Prepare and implement a Complaints Response Plan during construction phase
			Implement an EPP, waste management plan, OH&S Plan to reduce potential effects of dust, odour and noise on the quality of life of its workers
			Implement mitigation measures identified in Section 7.2 Atmospheric Environment to address likely adverse effects associated with dust and noise
		Job creation (positive)	Provide on-the-job training
			Prioritize hiring of qualified local workers
		Development of local economy (positive)	Engage with local suppliers to share information on their requirements for equipment and services
	Stripping, excavation, blasting and construction activities	Potential alteration or loss of historic resources	Incorporate measures to address unexpected discovery of historic resources in the Project EPP
			In the event of discovery of such resources, construction activities in the affected area will cease immediately and the discovery will be reported to the Provincial Archaeology Office
	Construction of Marine Terminal	Necessity for vessels to modify their trajectories in the Great St. Lawrence Harbour to avoid the marine terminal construction area	CFI will transmit the exact geographical coordinates of the Marine Terminal construction area to the Canadian Coast Guard to help them manage marine traffic in the Harbour
Operation	All Project activities	Potential nuisance effects (dust, noise, odour)	Continue implementation of the Complaints Response Plan during operation phase
			Implement an EPP, waste management plan, OH&S Plan to reduce potential effects of dust, odour and noise on the quality of life of its workers

Project Phase	Activity	Potential Environmental Interaction	Proposed Mitigation Measure
			Implement miitigation measures identified in Section 7.2 Atmospheric Environment to address likely adverse effects associated with dust and noise
	All Project activities	Job creation (positive)	Provide on-the-job training
			Prioritize hiring of qualified local workers
	All Project activities	Development of local economy (positive)	Continue to inform local suppliers of Project goods and services requirements
Rehabilitation and Closure	All Project activities	Potential nuisance effects (dust, noise, odour)	Continue to implement the Complaints Response Plan until the end of the rehabilitation and closure phase

7.8 Accidents and Malfunctions

The likely effects of potential accidents and malfunctions on workers, the public and environmental, socio-economic and cultural resources are considered in this EA Registration. Accidents and malfunctions could occur during any and all Project activities during the construction, operation, and rehabilitation and closure phases. The Project has been designed, and will be constructed and operated following applicable standards, industry BMPs and the Project-specific mitigation identified in this EA Registration and the Project-specific EPP. These measures are expected to limit the potential for occurrence of an accident or malfunction during Project construction, operation, and rehabilitation and closure. As part of CFI's EHSMS, an ERP will be developed and implemented during all phases of the Project. The ERP will provide an appropriate and consistent response to emergency situations that may occur over the life of the Project.

This EA Registration does not address all conceivable accidents or malfunctions, but only those that are expected to have a reasonable probability of occurring, and which may have an adverse effect on the natural or socio-economic environment, considering the design of the Project and the site specific conditions. Accidents and malfunctions may also be instigated by external factors (natural or manmade). The likelihood of such instigating events as well as the resulting effects of such events are considered. For these "likely" accidents and malfunctions, the resulting effects identified represent the worst case scenario. Highly unlikely or hypothetical events (e.g., failure of contingency and back-up systems) are not addressed in this EA Registration.

The objective of the analysis is to determine if any "likely" Project-related accident or malfunction could be expected to result in a likely adverse effect on the natural or socio-economic environment. Assuming that some of the activities undertaken during Project operation, or rehabilitation and closure (e.g., excavation, grading, contouring) are similar to those completed during construction, potential accidents and malfunctions related to these activities are expected to be similar through all Project phases. As such, they are not re-addressed in the operation (Section 7.8.2) and rehabilitation and closure (Section 7.8.3) subsections.

Likely Project-related accidents and malfunctions associated with the Project include open pit and underground mine failures, mill failures, marine terminal failures, TMF dam failures, failures of erosion and sediment control measures, stockpile slope failure, vehicle and vessel accidents/collisions, small terrestrial or marine spills of deleterious substances (e.g., fuels, lubricants), large marine spills of deleterious substances (e.g., fluorspar concentrate), and fires or explosions. It is difficult to predict the exact nature of events and their severity should they occur; however, the probability of serious accidental events causing adverse environmental effects is low since both construction and operational procedures will be designed to incorporate contingency and emergency response planning.

7.8.1 Construction

7.8.1.1 Erosion or Sediment Control Failure

A potential exists for failure of erosion and sediment control structures due to extreme precipitation events during all phases of the Project. Such a failure could result in the release of silt-laden runoff to receiving watercourses with adverse effects on water resources, wetlands, and both terrestrial and marine fish and fish habitat. Erosion and sediment controls will be implemented according to industry best practices, and standard requirements and practices. Plans for erosion and sediment control measures will be developed in the Project-specific EPP and response procedures in the event of a control failure as a part of the ERP. These plans and response procedures will be developed prior to the commencement of construction activities and will be implemented to minimize adverse effects on water quality from construction activities. These measures could include:

- scheduling site activities to minimize disturbance;
- avoiding leaving excavations open for long periods and compaction/covering loose materials;
- compacting soils as soon as excavations, filling or levelling activities are complete;
- installation of silt fences, hay bales, etc. to minimize the transport of silts;
- implementing measures to control sedimentation and erosion and ensuring that construction personnel are familiar with these practices and that they conduct them in the appropriate manner;
- controlling runoff during the construction phase; and
- monitoring any runoff to ensure TSS levels are within acceptable ranges.

Erosion and sediment control measures installed on-site over the life of the Project will be regularly inspected and monitored, particularly during and after extreme precipitation events. Erosion and sediment control structures found to be damaged or inefficient will be repaired immediately and any other remedial action will be taken as necessary. Fines storage areas will be confined to areas within the site so that any control failures would not result in an off-site release of material.

In the unlikely event that runoff exceeds acceptable ranges for TSS as determined through monitoring, contingency measures may include pumping of sediment laden water to vegetated areas (away from down gradient water systems) or through filter bags for additional filtration and/or the implementation of additional settling ponds or erosion and sedimentation control structures. Remedial action will be taken as quickly as practical, and as necessary. In the event of a failure, Project construction will be shut down until appropriate controls are restored.

7.8.1.2 *Vehicle and Vessel Collisions*

A potential exists for Project-related vehicle collisions during all phases of the Project. Vehicles operating at the site will primarily be Project-related mining equipment, bulldozers, haul trucks, loaders, service vehicles (pick-up trucks) and worker cars. A vehicle collision has little potential to lead to substantial environmental damage, with the most important risk being to worker health and safety. Fuel spills from vehicle collisions are expected to be localized near the source, will be minimal in volume, and be addressed by site personnel using available spill response equipment.

Vehicle collision mitigation begins with adequate worker training, and by employing experienced workers to the extent possible. Vehicles accessing the site will be required to check-in at the scale house. Other controls include: access and haul roads are sufficiently wide to allow safe passage of two vehicles side by side; adequate line-of-sight around corners and at road junctions; posting and enforcing speed limits; use of in-vehicle radios linked to a central dispatch; and regular maintenance of brakes, tires and other vehicle components. Emergency response in the event of a vehicle collision or accident would follow procedures outlined in the ERP.

A potential also exists for Project-related vessel collisions during all phases of the Project. During Project construction and operation, considerable vessel activity by multiple ships and boats may occur for limited periods of time around the Marine Terminal. Collisions may involve Project-related vessels, other marine users, the terminal and submerged rocks. In the event of a vessel fuel tank rupture following a collision, marine fuel could be discharged to the marine environment. Fuel containment would be addressed by vessel personnel using available spill response equipment. In warm weather, fuel spills to the marine environment would be expected to degrade and evaporate quickly, but would be slower during colder periods of the year.

The management of marine traffic is the responsibility of the Canadian Coast Guard. It is mandatory for large vessels to report to the Coast Guard at specified points and take local pilots on board. The potential for collisions will be minimized by: controlling vessel speed; scheduling and coordinating activities with other marine users, as well as Transport Canada and the Coast Guard; and posting Notices to Mariners, as necessary. The Marine Terminal will have navigational aids and anti-collision radar will provide early warning of collision hazards. Weather reports and wind speed information will also be used to monitor changing weather conditions that could increase the risk of collisions during vessel navigation to or from the terminal. Tugs and pilots may also be used for guiding vessels during docking, as required.

Emergency response in the event of a vessel collision is coordinated by the Canadian Coast Guard with support from local land based emergency responders, as needed. The Coast Guard will be advised of the timing and type of activity associated with Project operation and will be informed of the construction schedule by CFI before work begins. The ERP will contain a section regarding response to incidents at sea; however, the ship's Master is ultimately responsible for the safe operation and emergency response in case of an accident.

7.8.1.3 *Spills and Leaks of Deleterious Substances*

Terrestrial Spills

A potential exists for terrestrial spills during all phases of the Project. During the construction phase of the Project, terrestrial spills would be limited to fuels and servicing fluids. The operation phase of the Project will also include blasting agents and waste materials generated during equipment maintenance. Spills and leaks could result from equipment failure, damage to storage or piping systems, mobile equipment accidents, or failure to follow proper procedures related to fuel and other bulk material transfers or equipment maintenance activities.

The amount of any potential spill is limited to the size of fuel, storage and equipment tanks. Small volume spills of less than 70 litres (L) are predicted to have minimal environmental effects. In the event of a large spill (more than 70 L), soil, groundwater and surface water contamination may occur. It is unlikely that a spill or leak would adversely affect the quality of habitats and/or result in ingestion or uptake of contaminants by vegetation and/or wildlife, as working areas of the industrial Project site will be largely devoid of vegetation, and wildlife are not expected to be found in these areas.

CFI will continue to enforce strict procedures for the safe transportation of all deleterious (hazardous) materials on-site. Materials stored on-site in bulk will be stored in above ground storage reservoirs with secondary containment. Storage tanks and facilities will be designed to conform to NL DOEC regulations, as required. Workers will use best practices during material transfer operations including monitoring and oversight of the transfer activities and verification to ensure that the receiving container has adequate capacity prior to beginning the transfer procedure. Such spills in the event that one occurred, would probably be small (less than 70 L), and emergency response and clean-up procedures would be initiated. Any spillage inside the containment will be recovered and managed in accordance with provincial waste management regulations.

Onshore, refueling of mobile equipment will need to be conducted onsite on a regular basis. Refueling will take place in designated areas, on areas of low permeability. Equipment operators will be required to remain with the equipment during refueling at all times. All Project equipment and vehicles will meet industry standard requirements and be safety certified and fit for their intended use. Regular pre-shift inspections and maintenance programs will help provide continued reliability and integrity of Project equipment. Necessary critical spares will be maintained in the event that change out of parts or equipment is required.

Most spills or leaks would be localized near the source and be addressed by site personnel using available spill response equipment. All deleterious substances will be handled in a manner that reduces or eliminates the risk of spillage and accidents. Contingency planning will be in place to enable a quick and effective response to a spill or leak. Personnel will be trained in response measures, and spill response equipment (e.g., absorbents, pads, socks and booms) will be readily available in the event of an accidental spill or leak. In the case of spill or leak of a deleterious substance, emergency response and clean-up procedures will be implemented. Immediate action will be taken to stop the leak and contain the spilled material. All contaminated material will be collected and stored in an appropriate manner so as to not re-release to the environment until such a time as it will be transported to an approved treatment/disposal facility. The procedures and requirements of the WHMIS program and other applicable government regulations will also be enforced (Health Canada 2015).

Marine Spills

A potential also exists for marine spills during all phases of the Project. The severity of the adverse effects resulting from a spill or leak of a deleterious substance to the marine environment depends on the spill volume and composition, wave, current and wind conditions, and the promptness and effectiveness of response efforts. Small spills or leaks are most likely to occur at valves and hose connections. Any such spills will likely be small in quantity and frequency, and will disperse rapidly. Effects of localized, minor spills on the marine environment would be minimal, as any such spills would be rapidly cleaned up in accordance with emergency response and contingency plans.

Larger marine spills could occur as a result of damage to a ship's hull sufficient to rupture a fuel tank, bilge water tank, or other ships structure. If large quantities of deleterious substances were to be spilled into the marine environment, there is potential for effects on marine fish and fish habitat, marine mammals, and marine birds, as well as commercial fisheries (e.g., effect on the health of target species and either actual or perceived tainting of the species fished commercially). The likely effects of such an event may include spilled materials expanding to cover an area beyond the immediate spill location, creating a “slick”. Over the short term (i.e., from the spill to approximately 10 days) the adverse effect of such a spill might include fish kills, coating of the fur and feathers of marine mammals and birds, and loss of lobster and other marine species in the immediate area of the spill, as well as in areas where the spill migrates before being contained. Over the longer term (i.e., one month and beyond) likely adverse effects following clean-up of the spill might include impairment of fisheries productivity. Certain mobile marine species could relocate to other areas, such that effects on breeding areas could lead to decreases in fisheries productivity over time.

Marine fish and fish habitat includes plankton because it is a source of food for larvae and some adult fish; thus, a release of a deleterious substance (i.e., hydrocarbons) on plankton could affect fish. Dispersion and dissolution cause the soluble, lower molecular weight hydrocarbons to move from the slick into the water column. Effects of spills on pelagic organisms need to be assessed through examination of effects of water-soluble fractions of oil or light hydrocarbon products.

Effects of hydrocarbons on plankton are short-lived, with zooplankton being more sensitive than phytoplankton. Zooplankon accumulate hydrocarbons in their bodies, which may be metabolized and depurated. Hydrocarbons accumulated in zooplankton during a spill would be depurated within a few days after a return to clean water, and thus, there is limited potential for transfer of hydrocarbons up the food chain (Trudel 1985). There is a potential for transfer of hydrocarbons up the food chain in an environment subject to chronic inputs of hydrocarbons, but there is no potential for bio-magnification. In summary, individual zooplankton could be affected by a hydrocarbon release through mortality, sub-lethal effects, or hydrocarbon accumulation if hydrocarbon concentrations are high enough. Under some circumstances, hydrocarbons released in nearshore waters can become incorporated into nearshore and intertidal sediments, where it can remain toxic and affect benthic animals for years after the spill (Sanders et al. 1990).

Planktonic fish eggs and larvae are less resistant to effects of contaminants than adults because they are not physiologically equipped to detoxify themselves or to actively avoid the contaminants. In addition, many eggs and larvae develop at or near the surface where hydrocarbon exposure may be the greatest (Rice 1985). Generally, fish eggs appear to be highly sensitive at certain stages, becoming less sensitive just prior to larval hatching (Kühnhold 1978; Rice 1985). Larval sensitivity varies with yolk sac stage and feeding conditions (Rice et al. 1986). Eggs and larvae exposed to high concentrations of hydrocarbons generally exhibit morphological malformations, genetic damage, and reduced growth. Damage to embryos may not be apparent until the larvae hatch. However, the natural mortality rate in fish eggs and larvae is so high that large numbers could be destroyed by anthropogenic sources before Project effects would be detected in an adult population. Hydrocarbon-related mortalities would probably not affect year-class strength unless >50% of the larvae in a large proportion of the spawning area died (Rice 1985).

There is an extensive body of literature regarding the effects of exposure to hydrocarbons on juvenile and adult fish. Although some of the literature describes field observations, most refer to laboratory studies. Reviews of the effects of hydrocarbons on fish have been prepared by Armstrong et al. (1995), Rice et al. (1996), Payne et al. (2003) and numerous other authors. If exposed to hydrocarbons in high enough concentrations, fish may suffer effects ranging from direct physical effects (e.g., coating of gills and suffocation) to more subtle physiological and behavioural effects. Actual effects depend on a variety of factors such as the amount and type of hydrocarbon, environmental conditions, species and life stage, lifestyle, fish condition, degree of confinement of experimental subjects, and others. Whales may interact with spilled hydrocarbons but are not considered to be at high risk to the effects of hydrocarbons. Whales present in the affected area could experience sub-lethal effects but these effects are reversible and would not cause permanent damage to the animals. Effects of hydrocarbons on sea turtles would also be reversible, although there is a possibility that foraging abilities may be inhibited by exposure to hydrocarbons.

The risk of a spill or leak of a deleterious substance into the marine environment is limited given there will not be any transfer of fuel, ballast water, sewage, waste or other materials apart from fluorspar concentrate between the ship and the shore at the Marine Terminal. Ships will arrive ballasted and ballast water will be discharged during loading in accordance with the Canadian *Ballast Water Control and Management Regulations* (SOR2011-237; Government of Canada 2011) and the IMO *International Convention for the Control and Management of Ships' Ballast Water and Sediments* (IMO 2004). Vessels will not be refueled at the Marine Terminal.

Adherence to BMPs and proper equipment selection, inspection and maintenance will act to prevent potential accidental marine spills. Storage areas for deleterious substances onboard vessels will have secondary containment to prevent discharges onto decks and into the marine environment. Emergency response and contingency plans for accidents scenarios will be in place by the vessel contractors to contain any spilled material.

Spill response planning will reduce the likelihood of contamination of the marine environment. Spill containment and clean-up materials (e.g., absorbent pads and dry chemicals) will be available for trained personnel to handle small spills. The ERP will provide details regarding procedures for responding to larger or more serious marine spills, including contacts for first responders and clean-up crews. The appropriate regulatory authorities (e.g., Coast Guard) will be notified of spills, as appropriate.

All shipping and offshore activities will be conducted in compliance with the *Canada Shipping Act* requirements for vessel inspection and certification, and training and appropriate certificates of competency for operators. Collisions between marine vessels are considered unlikely to occur given the lack of significant large-ship traffic in the area of the Marine Terminal, and a collision with a fishing vessel would not likely result in damage severe enough to cause a release. Furthermore, the potential for collisions will be further reduced by using tug and pilot assist for docking at the Marine Terminal, and offer adequate lighting.

Vessels and operators will be required to have procedures in place to safeguard against marine pollution including, but not limited to awareness training of all employees, means of retention of waste oil on board, and capacity of responding to and clean-up of accidental spills caused by vessels involved in the Project. All vessels will have spill mitigation and clean-up equipment on board to respond to any deck spills or leaks, including booms, absorbent pads and dry chemicals. These measures will reduce the potential of spilled material entering the water. In the event of a spill, the ERP will be implemented to respond to and investigate the occurrence and follow up with corrective actions to reduce the likelihood of repeat spills.

7.8.1.4 Fires and Explosions

A potential for a fire to occur at the Project site also exists. Fire could be caused by lightning, or forest fire, human error or electrical/equipment malfunctions. The extent and duration of a fire depends on meteorological conditions, the fuel source and the success of the response effort. The immediate concern for a fire is human safety and damage of property. As well, in addition to destruction of habitat or direct loss of wildlife, emissions, particulate matter, and other contaminants may be generated. Smoke emissions from the fire would contain particulate matter, CO_2, CO, NO_x, SO_2, volatile organic carbons, poly-cyclic aromatic hydrocarbons or other contaminants. Total particulate matter would increase and contribute metals to aquatic environments. Runoff would contain ash and sediment and increase alkalinity and TSS. A fire could also increase stream bank erosion and alter the temperature of small water bodies. Habitats would begin to recover from a forest fire after a single generation and continue through the natural phases of succession; however, return to the natural state pre-fire may take several generations. A large fire could create air contaminant levels greater than the ambient air quality standard over distances of several kilometres; however, the likelihood of such a large fire is considered low and if such a fire was to occur, the duration would likely be short due to implementation of emergency response procedures and suppression response efforts.

As with all accidents and malfunctions, the most important step in preventing effects of fires is to prevent fires from occurring. Material management and operational procedures will reduce the frequency and extent of accidental fires related to the Project. Burning of vegetation and debris will not be permitted. In the unlikely event of a fire, contingency plans will be in place to enable a quick and effective response to an on-site fire, reducing the severity and extent of damage. Personnel will be trained in fire prevention and response, and appropriate firefighting equipment will be readily available in the event of a fire. This capability will also serve to reduce the environmental effects of fires caused by lightning and other natural phenomena in the vicinity of the Project area.

Fire protection systems will be installed at the Project site. The ERP will be implemented immediately upon the detection of a fire. Firefighting equipment and an emergency response vehicle equipped with firefighting equipment will be deployed immediately from the St. Lawrence Fire Department. Evacuation of personnel from the area will be the highest priority. Meeting places for site workers will be established and headcounts taken to account for all personnel. The appropriate Forest Management Unit office and RCMP office will be notified immediately and in the unlikely event of a large fire, local emergency response and firefighting capability will be called to respond, reducing the severity and extent of damage and to protect the safety of workers. The possibility of a large fire is low.

Explosions at the Mill or Marine Terminal could result from an accident, failure of process equipment, over-pressure, sabotage, or as the result of a fire. As with accidental fires, the immediate concern for explosions is human safety and damage of property. A spill of blasting agent has the potential to contaminate local ground and surface water. Given the use of explosives exclusively within the open pit area, any release would likely be to water collected in the pit sump. This provides the opportunity to treat and test the water prior to discharge, minimizing the risk of environmental effects. A spill from a truck in transit to the open pit area (i.e., on the access road) has a greater possibility of reaching soil and surface watercourses. Should such a spill occur, the spill will be managed as per instructions within the ERP and under the direction of the blasting contractor.

No explosives are planned be manufactured on-site. Preventive measures aimed at reducing the effects of blast accidents include: ensuring that all personnel have evacuated the blast area prior to detonation; using adequate blasting shelters for employees whose presence is required; controlling and monitoring all entrances to the blast area; ensuring that the blast is properly designed, drilled, and loaded; and emphasizing education and training to enhance skill levels for implementation of engineering control techniques. A comprehensive leak and gas detection system will be in place to detect possible sources of ignition. A permit-to-work system will be implemented in all areas of the plant and “hot work” will be strictly controlled in areas with a potential to have an ignition source. Site security will control access to the site (i.e., limited to approved personnel). The fire detection and alarm system will be monitored from the central control room and the fire brigade to minimize response time so that small fires are detected and extinguished before developing into a major incident.

7.8.2 Operation

7.8.2.1 Mine Failure

Open Pit Slope Failure

Slope failures in open pits could occur during Project operation with potentially adverse effects on human health, resulting from failure of the bedrock faces caused by improper mine design and operational procedures, or from failure of overburden slopes. Apart from the safety hazard, no apparent environmental effects, outside of or in addition to those that would eventually occur through quarry development, are evident. The maximum effects due to slope failure are most likely to occur during the rehabilitation and closure phase (i.e., just after quarrying is completed and the pit is allowed to start filling) because groundwater inflow will continue to occur while day-to-day observation of the slopes will be less frequent, since the quarry crew will no longer be operating in the pit.

The design of side slopes will follow best management and accepted engineering practices of using benched surfaces that provide slope stability and adequate space for Project access (e.g., site roads). The final as-built design of the open pit will be engineered and approved at the regulatory stage prior to construction. Slopes will be continually inspected and monitored to adjust the design of the pit slopes prior to encountering unstable conditions. Should open pit slope failure occur, corrective measures will be implemented immediately to reduce the extent of the likely effect.

Underground Mine Failure

Various forms of underground mine failures could occur during Project (e.g., ventilation system failure, rock burst, mine flooding), operation with likely effects on human health. Apart from the safety hazard, no apparent environmental effects, outside of or in addition to those that would eventually occur through quarry development, are evident.

Failure of ventilation systems due to improper design or operation could result in exposure to and potential worker inhalation of hazardous substances, such as dust, equipment exhaust, and radon gas. Functioning backup systems will be incorporated into Project designs should the primary ventilation systems fail. Workers will be trained and equipped with personal protective equipment to use in the event of such a failure.

Rock mass instability associated with underground excavation may result in rock bursts and associated mine failures. Measures to prevent such failures begin with a good understanding of rock mass quality and the proper design of mine openings. Monitoring of stresses and strains at various locations will be critical to ensure stable mine workings. Such monitoring activities will be carried out as required for the Project.

Given the large quantities of water that must be continuously pumped to keep the underground mines dry, failures of the pumping systems may result in flooding of underground openings if backup systems are not available or functioning properly. Backup systems will be in incorporated into Project designs to endure continuous pumping should the primary system fail.

7.8.2.2 Mill Failure

Failures associated with Mill processes and equipment during Project operation may be the result of improper design or operational procedures, or may occur over time as joints loosen or metal becomes worn, weakened or corroded. Mill failures may result in the unplanned release of hazardous substances to the environment, such as liquid reagents, unacceptable dust and gaseous emissions, and untreated effluent. These releases will be prevented by proactive design where possible, as well as maintenance programs and monitoring to ensure that all emissions and discharges are in compliance with all relevant government requirements. Any structure or equipment found to be damaged will be repaired immediately and any other remedial action taken as necessary. Should Mill failure occur, corrective measures will be implemented immediately to reduce the extent of the adverse effect.

7.8.2.3 Marine Terminal Failure

Marine Terminal failure could result in materials being released into the marine environment and possibly human injury. Equipment wear-and-tear is expected over the life of the Project, particularly in a coastal environment subject to salt spray and consequent corrosion. Given this, a regular inspection and maintenance program will be initiated as a matter of course so that worn or inefficient equipment can be replaced on a regularly scheduled maintenance rotation.

Emergency response procedures will primarily be those responses applicable to accidents and worker injury. These procedures will be contained within the Workers Occupational Health and Safety (WOH&S) Plan and ERP.

7.8.2.4 Tailings Management Facility Dam Failure

Dam failure of the lower dam within the TMF has the potential to adversely affect freshwater and marine fish and fish habitat. The contents of the clarification pond would be released into the lower section of Shoal Cove Brook; the quantity and constituent would be dependent on the nature and severity of the dam failure. The maximum quantity would be the volume contained within the polishing pond, as well as any increase in migration from the upper treatment cell. The degree of severity will depend on the location of the failure, water level, amount of suspended solids, and the degree of treatment of tailings. It is predicted that the effect would not be catastrophic, but that there may be adverse effects on fish and fish habitat downstream (mainly due to increase in TSS).

In the event of a structural failure in the TMF, the effluent reaching the marine environment would likely contain inert, fine-grained particles. The treated tailings pore water will contain low levels of fluorspar and silt-clay size particles (e.g., granite), in addition to those chemicals and substances already in the naturally occurring water of the Shoal Cove Brook freshwater system. Fluorspar (i.e., calcium fluoride) is relatively insoluble in water and therefore does not pose a threat to marine biota in the sense of chemical contamination. However, fluorspar could have effects on marine biota in terms of increased turbidity.

TMF dams will be designed and constructed to stringent standards in accordance with probable maximum precipitation events. A total dam failure scenario is considered as a worst case event; however, total dam failure is considered to be highly unlikely. All dams will be built to meet the design criteria of the *Dam Safety Guidelines* (CDA 2007). It should be recognized that dam failures are avoidable by proper design, routine inspection, and maintenance. Inspections and monitoring will occur during and after extreme precipitation events. Any structure found to be damaged will be repaired immediately and any other remedial action taken as necessary. Should a dam failure occur, corrective measures will be implemented immediately to reduce the extent of the adverse effect. Such measures would include additional dam development, stream diversion, removal of displaced solids, and storage and clean-up, as required and appropriate.

7.8.2.5 Stockpile Slope Failure

Stockpile slope failure could result in materials being released into the environment and possibly human injury. Given the low maximum height, low slope angles and the rapid stabilization expected once the stockpiles are revegetated, the risk of slope failure is minimal. In the event that slumping occurs, soil will be confined within the property boundary thereby limiting effects.

Stockpiles will be located greater than 50 m from the coast. A Site Grading and Drainage Plan will be implemented prior to operation to ensure clean runoff is intercepted and diverted from dump areas to minimize likely effects of Project activities on the environment. The remainder of the stormwater control process is to intercept runoff water from the site and treat it in a manner appropriate to the potential contaminants and sediment loadings, so that it can be discharged back into the environment. Overburden stockpiles will be compacted using loaders and dump trucks.

If stockpile failure were to occur, the first response will be to cease all work in the area and ensure worker safety. When the failure area is secured, and depending on the scale of the failure, stockpile slope would be re-contoured in place. Slumped material would be excavated and returned to the stockpile, and if required drainage ditches would be repaired. An investigation into the causes of the failure would be completed so that the conditions leading to failure could be avoided or mitigated in the future.

7.8.2.6 Spills of Fluorspar Concentrate

Fluorspar concentrate will be transferred by a ship loader to marine vessels docked at the Marine Terminal. In the unlikely event that a ship or any loading systems are damaged, fluorspar concentrate may be released to the environment. Fluorspar (i.e., calcium fluoride) is relatively insoluble in water and therefore does not pose a threat to marine biota in the sense of chemical contamination; however, it could have effects on marine biota in terms of increased turbidity.

The concentrate would tend to slowly settle to the seabed due to its density. Currents in the area would likely disperse some material from the spill site. The majority of the material would sink in place and remain. Should an accident occur at the loading facility, large quantities of fluorspar concentrate could enter the St. Lawrence Harbour, potentially smothering benthic communities. Accidental releases of concentrate into the marine environment could also occur along the shipping route if a collision occured.

In all cases, the response will conform to CFI's ERP. The procedures will be designed to reduce, contain, and recover spilled material to ensure that adverse effects are at most short-term and localized.

7.8.3 Rehabilitation and Closure

The physical activities associated with rehabilitation and closure are described in Section 2.6.2. Likely effects during this phase of the Project are expected to be similar to but less than those expected during construction. Rehabilitation and closure activities will comply with all applicable federal and provincial regulatory requirements in force at the time.

A Rehabilitation and Closure Plan will be prepared and submitted to the NL Government under *Newfoundland and Labrador Mining Act.* The plan will meet regulatory requirements for rehabilitation, and will include rehabilitation and closure of the infrastructure at the AGS Mine, the Mill Site, the TMF, the Marine Terminal and quarries and borrow sources.

The maximum effects due to quarry pit slope failure are likely to occur during the closure period (i.e., just after mining is completed and the pit is allowed to start filling with water). This is because groundwater inflow will continue to occur while day to day observation of the pit slope will be less frequent, since the crew will no longer be operating. Spills and leaks of deleterious substances could also occur during the rehabilitation and closure phase, as noted for the other phases of the Project; however, during rehabilitation and closure, the reservoirs used to store these materials will be dismantled so that only limited amounts of raw and waste liquids will be stored on-site.

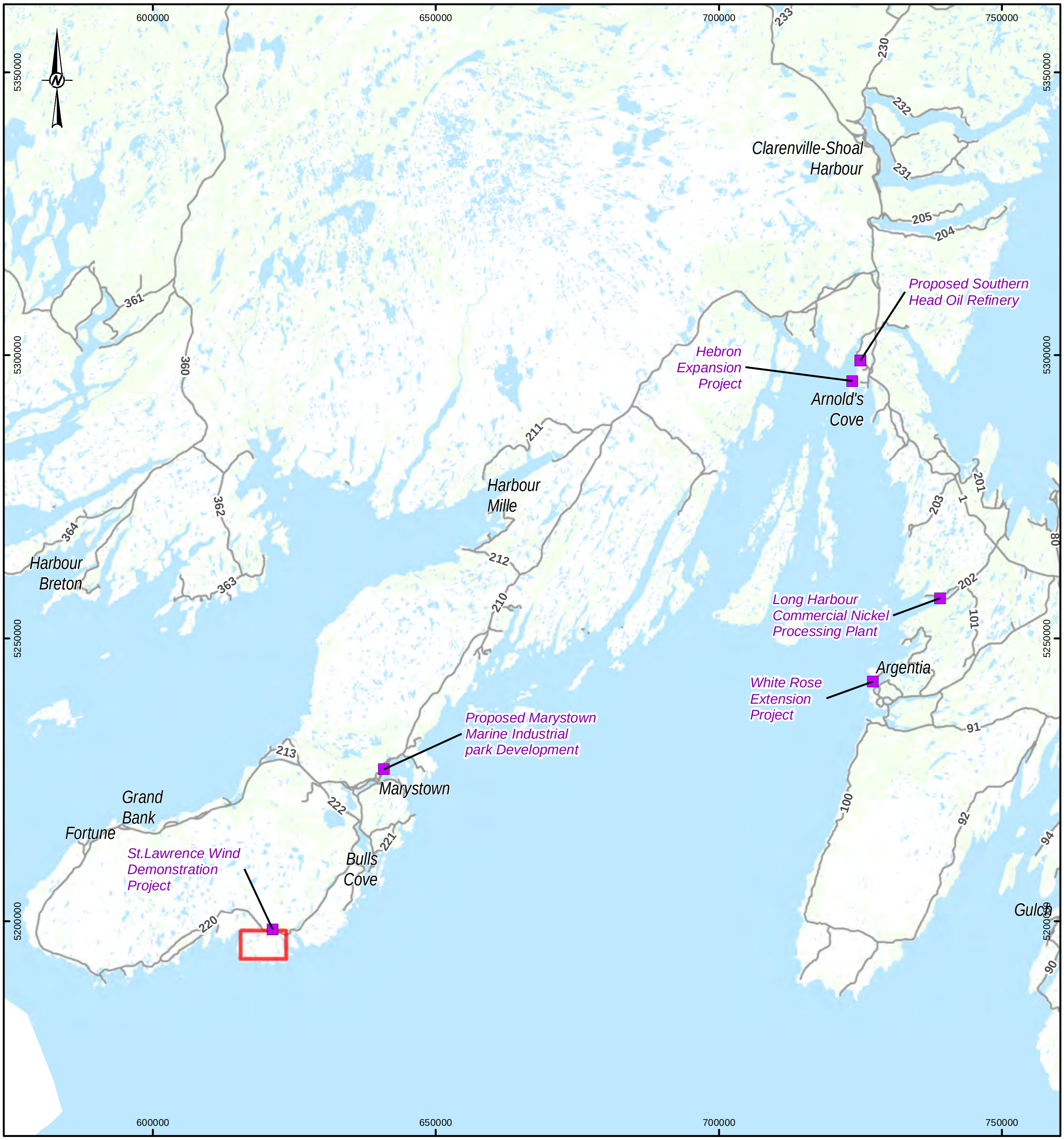
7.9 Cumulative Effects Analysis

Cumulative effects can be defined as changes to the environment resulting from an action, project or activity in combination with other existing or future projects or activities (CEA Agency 2015).

The cumulative effects analysis considers likely environmental effects associated with the Project, after consideration of mitigation measures. Likely environmental effects that are considered in this analysis are associated with the following VECs:

- atmospheric environment (air quality and noise); and
- socio-economic environment (community services and infrastructure, employment).

A spatial analysis of the Burin Peninsula and northwestern Avalon Peninsula was conducted to identify existing and future projects that may interact with the proposed Project. The only major project located in the vicinity of the Project area is the St. Lawrence Wind Demonstration Project. This wind project, due to its nature, is not anticipated to have cumulative effects with the proposed Project because their respective footprints and areas of influence (i.e., extent of the effects) do not overlap or are not inter-related. Other existing or future projects located in the Burin Peninsula and northwestern Avalon Peninsula include the proposed Marystown Marine Industrial Park Development, Hebron Expansion Project in Arnold's Cove, Proposed Southern Head Oil Refinery, Come by Chance Refinery, Husky Energy White Rose Extension Project and Long Harbour Commercial Nickel Processing Plant. As shown on Figure 7-4, most of these projects are located between 40 km and 300 km from the proposed Project, and therefore, no cumulative biophysical effects, other than cumulative effects on the atmospheric environment, are anticipated. General information about the projects considered for the cumulative effects analysis is provided in Table 7-9.



LEGEND

- Project
- AGS Fluorspar Mine Project Area

0 25 50
Kilometres
1:1,000,000

REFERENCE

SOURCE(S): NATIONAL TOPOGRAPHIC DATABASES, 1:250 000 SCALE, NRCAN.
PROJECTION: NAD 1983 UTM ZONE 21N

CLIENT
CANADA FLUORSPAR INC.

PROJECT
AGS MINE PROJECT, ST. LAWRENCE NL
EA REGISTRATION

TITLE
PROJECTS

CONSULTANT
Golder Associates

YYYY-MM-DD	2015-05-19
DESIGN	CG
GIS	ED
REVIEW	EL
APPROVED	DJ

PROJECT 1407707 | REV 0 | FIGURE **7-4**

Table 7-9: Projects Considered for Cumulative Effects Analysis

Project	Status	Job creation	Location	Relevance
St. Lawrence Wind Power Project	In operation	20 to 25 jobs during construction 2 to 3 full-time jobs during operations	St. Lawrence 46°55'46.63'' N 55°24'28.95''W	Project effects do not overlap or interact with the effects of the CFI Project
Marystown Marine Industrial Park Development (Burin Peninsula ship yards)	In operation	Less than 50 workers during construction peak No information available on number of workers during operations	Marystown 47°10'49''N 55°08'30''W	Project effects do not overlap or interact with the effects of the CFI Project
Hebron Expansion Project (Whiffen Head Oil transhipment facility)	In operation	Maximum of 250 jobs during construction peak No information available on number of workers during operations	Whiffen Head 47°46'26''N, 54°00'58''W	Project effects do not overlap or interact with the effects of the CFI Project
Come By Chance Oil Refinery	In operation	Approximately 500 employees	Come By Chance 47°48'22''N 53°59'40.5W	Project effects do not overlap or interact with the effects of the CFI Project
Vale Inco's Long Harbour Commercial Nickel Processing Plant	In operation	Will employ 475 employees at full production	Long Harbour 47°25'26.36''N 53°49'48'' W	Project effects do not overlap or interact with the effects of the CFI Project
Husky Energy White Rose Extension Project	Under construction	Estimated 138 workers for graving dock construction and 670 workers for construction of concrete gravity structure	Argentia 47°17'44"N 53°59'41"W	Project effects do not overlap or interact with the effects of the CFI Project
Proposed Southern Head Oil Refinery	Future	3,000 jobs during construction peak 750 jobs during operations	Southern Head, Placentia Bay 47°48'22''N 53°59'40.5"W	Project effects do not overlap or interact with the effects of the CFI Project

Atmospheric Environment

Likely Project effects on the Atmospheric Environment VEC are associated with air emissions and noise. These have the potential to overlap both spatially and temporally with the residual effects of the projects and activities identified in Table 7-8. More specifically, the ongoing and future projects that potentially have overlapping effects with the Project on the Atmospheric Environment VEC are the Come By Chance Oil Refinery, Vale Inco's Long Harbour Commercial Nickel Processing Plant, Husky Energy White Rose Extension Project and the proposed Southern Head Oil Refinery.

Air emissions or noise from these ongoing or future projects are not likely to overlap with those from the Project due a distance of more than 40 km distance between the projects. Emission of air contaminants from the Project is likely to disperse quickly within the Project area, and are unlikely to overlap with emissions from other existing or future projects.

The Project-related contribution to GHG emissions is minimal in relation to global GHG concentrations and the likely overlap with the other projects identified in this assessment is not anticipated to result in a substantive effect on climate.

Socio-Economic Environment

Overall, likely Project effects on the Socio-Economic Environment VEC are associated with community services and infrastructure; and employment. These have the potential to overlap both spatially and temporally with the ongoing and future projects identified in Table 7-9.

Cumulative effects on community services and infrastructure are anticipated to be greater during the construction phase of the Project due to the increased traffic on provincial and municipal roads, and a greater demand on community services and infrastructure in St. Lawrence associated with the number of Project workers.

During the construction phase, increased traffic on the TCH, Highway Route 210 and municipal roads in the Town of St. Lawrence is anticipated as a result of the Project. The Long Harbour Nickel Commercial Processing Plant, Come By Chance Refinery, Husky Energy White Rose Extension Project and proposed Southern Head Oil Refinery may have overlapping effects as they contribute to additional traffic on the TCH. The Burin Peninsula ship yards may have overlapping effects on traffic on Highway Route 210 and the St. Lawrence Wind Demonstration Project may overlap on roads within the Town of St. Lawrence. However, cumulative effects of this traffic on transportation infrastructure are expected to be minimal. The current transportation infrastructure is expected to be adequate to meet any cumulative demand during all phases of the Project; and therefore, cumulative effects on transportation infrastructure are expected to be within the capacities of the main highways and roads.

Increased marine traffic in Placentia Bay and the Great St. Lawrence Harbour as a result of the Project is expected to be more substantial during the operation phase. However, it is not anticipated to result in cumulative effects because the Marine Terminal dedicated to the Project will be constructed, avoiding increased pressure on other existing marine terminal facilities used for the other projects identified in Table 7-9. In addition, the increased marine traffic as a result of the Project will be minimal, with approximately 15 to 20 ships per year traveling in Placentia Bay and the Harbour to load fluorspar.

Cumulative effects on community services and infrastructure (e.g., housing, health, policing and fire services) in the Town of St. Lawrence are not anticipated due to the location of the other projects, which are outside of the Municipal Boundaries and are not anticipated to rely on community services and infrastructure in the Town of St. Lawrence.

Cumulative effects on employment in the region are likely to occur due to an eventual competition for experienced and skilled workers in the region. A number of skilled trades persons, professionals, semi-skilled persons and labourers will be required by the various projects in the region. The demand for workers in the Burin Peninsula is likely to increase competition for labour in the area. Most of the projects in the area will require workforce levels similar to the proposed Project. Since most of the projects in the region are currently already under construction or in operation, only the Husky Energy White Rose Extension Project and Southern Head Oil Refinery would have a likely effect on labour demand during their construction phases. Construction of the graving dock for the White Rose Extension Project was completed in early 2015. The next phase of construction for this project is the construction of the concrete gravity structure, which has been delayed to 2016. The key occupations during this phase are anticipated to be ironworkers, concrete finishers, carpenters and trades helpers (Husky Energy 2012). Workforce requirements during that phase are quite different than the proposed Project, and therefore, no cumulative effect with the Project is expected to occur.

The temporal boundaries of the Southern Head Oil Refinery and the proposed Project are not anticipated to overlap. In 2006, a provincial EA was initiated for the Southern Head Oil Refinery project and release from the EA process was achieved in 2008. To date, the oil refinery project has not been initiated. If the project were to be revived, it would likely need to go through the EA process again since its provincial environmental approval is currently expired. Considering that CFI is planning to start construction activities in late 2015, an overlap of the two projects' construction phases, which would potentially increase the labour demand, is not anticipated.

The existing training partnership agreement between CFI and the Keyin College is ongoing. This partnership is anticipated to increase local capabilities in the mining and other related sectors, which would in turn help reduce the competition for labour in the area.

Cumulative effects associated with the Project in relation to the Socio-Economic VEC are expected to be limited due to the nature and extent of the Project effects in relation to other ongoing or future projects.

8.0 FUNDING

The Project will be mainly funded through private financing. The primary funders of the Project are investment funds affiliated with Golden Gate Capital. Financial assistance from the NL Government has been secured through a Government Loan Agreement for the development of the Marine Terminal.

June 11, 2015

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Date *Phonce Cooper, General Manager*

9.0 PROJECT RELATED DOCUMENTS

Documents prepared in support of the proposed Project and referenced in this EA Registration include:

Agnerian (Agnerian Consultants Limited). 2015. Technical Report on the AGS Vein Deposit, St. Lawrence Property, Newfoundland and Labrador. Author: Agnerian, Hrayr. NI 43-101 Report, March 27, 2015.

Golder (Golder Associates Ltd.) 2015a. Phase I Hydrogeology Study, Canada Fluorspar Inc. St. Lawrence, NL for the Proposed AGS Mine Project. Report Submitted to Canada Fluorspar (NL) Inc., January 2015.

Golder 2015b. Geochemistry Testing Report, Canada Fluorspar Inc. St. Lawrence, NL for the Proposed AGS Mine Project. Report Submitted to Canada Fluorspar (NL) Inc., May 2015.

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APPENDIX A

Health, Safety, Environmental and Social Responsibilities

CANADA FLUORSPAR (NL) INC.

Safety and the Environment
Our Top Priority

Supplying the World with Fluorspar!

Health, Safety, Environmental and Social Responsibilities

We live here.... We work here

Canada Fluorspar (NL) Inc. (CFI) intends to become a leader within the global fluorspar industry setting standards of excellence in mining, processing and the marketing of our products. We will maintain the highest standards with respect to health and safety, environmental protection and community awareness and benefits.

All mining comes with an inherent risk for environmental damage but CFI is committed to minimizing the impact by keeping abreast of current technology and will remain interactive with its workforce, local residents and regional communities. We will strive to be environmentally and socially responsible in our undertakings.

CFI is committed to stewardship of the environment in which it is privileged to operate, and will design and execute the Project in a manner that will eliminate or minimize the potential adverse effect on the environment in all areas of the Project. CFI will ensure the Project activities are carried out in full compliance with applicable environmental, health and safety laws and regulations in addition to corporate governance and accountability.

The company commits to treating its employees with respect and dignity, and to encouraging, measuring and rewarding exceptional performance. We commit to providing adequate worker training along with a safe and healthy work environment in which all employees have opportunities to accomplish their full potential.

CFI is committed to being an exceptional corporate citizen, embracing the community spirit by supporting community initiatives and providing a firm foundation to ensure the well-being of its employees and their families.

Lindsay Gorrill
President
Canada Fluorspar (NL) Inc.

APPENDIX B

CFI Design, Construction and Operations Guiding Principles

CFI DESIGN, CONSTRUCTION AND OPERATIONS GUIDING PRINCIPLES

Health & Safety

As our commitment states: **We live here…. We work here**.

CFI understands the concerns and deficiencies in past practices with mining in St. Lawrence. The health and safety issues connected to dry drilling and radon gas underground has been well researched and documented. Now that these problems are fully understood, CFI will ensure that problems of the past will remain in the past. To prevent silicosis, all drilling activities will be conducted wet – not only is this common sense it is the law. To prevent the build-up of radon gas carried by mine underground water, new flow-control techniques on each level will reduce the risk of spreading the gas and sufficient ventilation will provide adequate dilution and extraction. These techniques will also provide a drier working environment in the stopes and improve ground conditions.

In the Mill the major concern was the crushing section. The crushers will be removed and housed in a new, purpose-built facility ensuring a dust-free working environment within the Mill.

In the past problems associated with airborne dust during the storage and transport of product is recognized as a concern by local residents. CFI will ensure that dust emissions are kept to a minimum. The new wharf, to be built in the Greater St. Lawrence Harbour, will minimize vehicular traffic through the Town and eliminate the loading of vessels in the inner harbour. All product will remain under cover both during storage and transport whether in a truck or on a conveyor. Airborne dust is a loss of revenue to the company.

CFI will incorporate the highest health and safety standards in design, construction and operations. A detailed safety management system will be implemented to continuously identify, reduce and manage safety risks. All levels of the workforce will have a responsibility to safety. Safety procedures will be established, tracked and monitored. Regular safety audits will be carried out. This safety culture will be recognized as an integral part of every single employee's duties.

CFI is committed to a healthy and safe working environment both on surface and underground. The company's most valuable asset is its workforce.

Applying Best Available Technologies Economically Achievable

The design and construction of the Project facilities will incorporate the best available technologies economically available (BATEA) principle to provide a safe, robust and environmentally friendly company that complies with all national and provincial regulations and industry codes and standards. The principle of BATEA will be applied to all phases of the Project to ensure that the facilities are constructed and operated efficiently and with minimal impact on the environment. For example, mining and processing methods, new to the St. Lawrence area, will be used to address efficiency and maximize safety within the working environment. BATEA will also be used in the design and implementation of safety systems, security and emergency response.

Applying Best Environmental Protection Practices

CFI will apply the precautionary approach in the design and implementation of the Project. Where there is a potential threat or serious or irreversible damage to the environment all potential alternatives will be considered. Long-term data will be evaluated both from the immediate area and similar Projects globally.

CFI is committed to stewardship of the environment in which it seeks to operate, and will design and execute the Project in a manner that will eliminate or minimize the potential adverse effects on the environment in all phases of the Project. CFI is committed to prevent pollution and to continually improve the integration of environmental protection practices in all its activities and will ensure that Project activities are carried out in full compliance with all applicable environmental, health and safety laws and regulations by applying the best available technologies and highest standards.

The company has taken a proactive approach to environmental protection at an early stage of Project planning. Examples include the use of the north alternative in the construction of the wharf. This will be the more expensive option but will not impact the more favourable marine habitat adjacent to the shoreline that the south alternative would have done. The use of Shoal Cove Pond, used in the past by a previous operator for mill tailings, will not destroy virgin habitat such as the alternative of storing close to Director Mine would have done. A further discounted alternative was the construction of hillside berms since they would involve the destruction of huge areas of unspoiled land in the Shoal Cove Pond area. CFI has also adopted the "offsetting" principle for replacing and enhancing fish productivity.

Commitment to Community Participation and Maximizing Local Benefits

CFI understands the importance of consultation with former workers, local residents and the community in general. It is only through discussion and understanding that past deficiencies can be eradicated and lessons learned. CFI understands the past health and safety issues and intends to provide a strong foundation to ensure the well-being of its employees and affiliates.

Not only is the company committed to local employment, it intends to be an exemplary corporate citizen embracing the community spirit. CFI wishes to become part of the local community and where possible will support community initiatives. CFI is committed to maximizing local benefits, both through direct employment, training and by giving assistance and preference to local suppliers.

Sustainable Development – Project Sustainability

Sustainable development is the principle whereby development meets the needs of the present without compromising the ability of future generations to meet their own needs. CFI intends to become established within the community and will grow along with it. In the past companies mining fluorspar in the area have not needed to commit to exploration since there has always been sufficient known ore to sustain their activities. CFI will not use this approach but will continue exploration to ensure long-term viability. The Project is incorporating the principle of sustainable development into Project design and operations through planned integration of environmental, social and economic considerations.

APPENDIX C

Consultation Materials

Consultation Materials

Public Notice

PUBLIC NOTICE

Canada Fluorspar (NL) Inc. is proposing to develop a fluorspar mine in St. Lawrence, NL

A Public Information Session on the Proposed
AGS Fluorspar Mine
will be held on
Thursday, April 16, 2015

Canada Fluorspar (NL) Inc, would like to welcome the public to an Open House,
from **6:00 pm to 9:00 pm** (with a presentation at 6:15 pm) at the
St. Lawrence Recreation Centre

This session shall be conducted by the Proponent,
Canada Fluorspar (NL) Inc. (709) 873-3331,
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

Consultation Materials

Display Boards

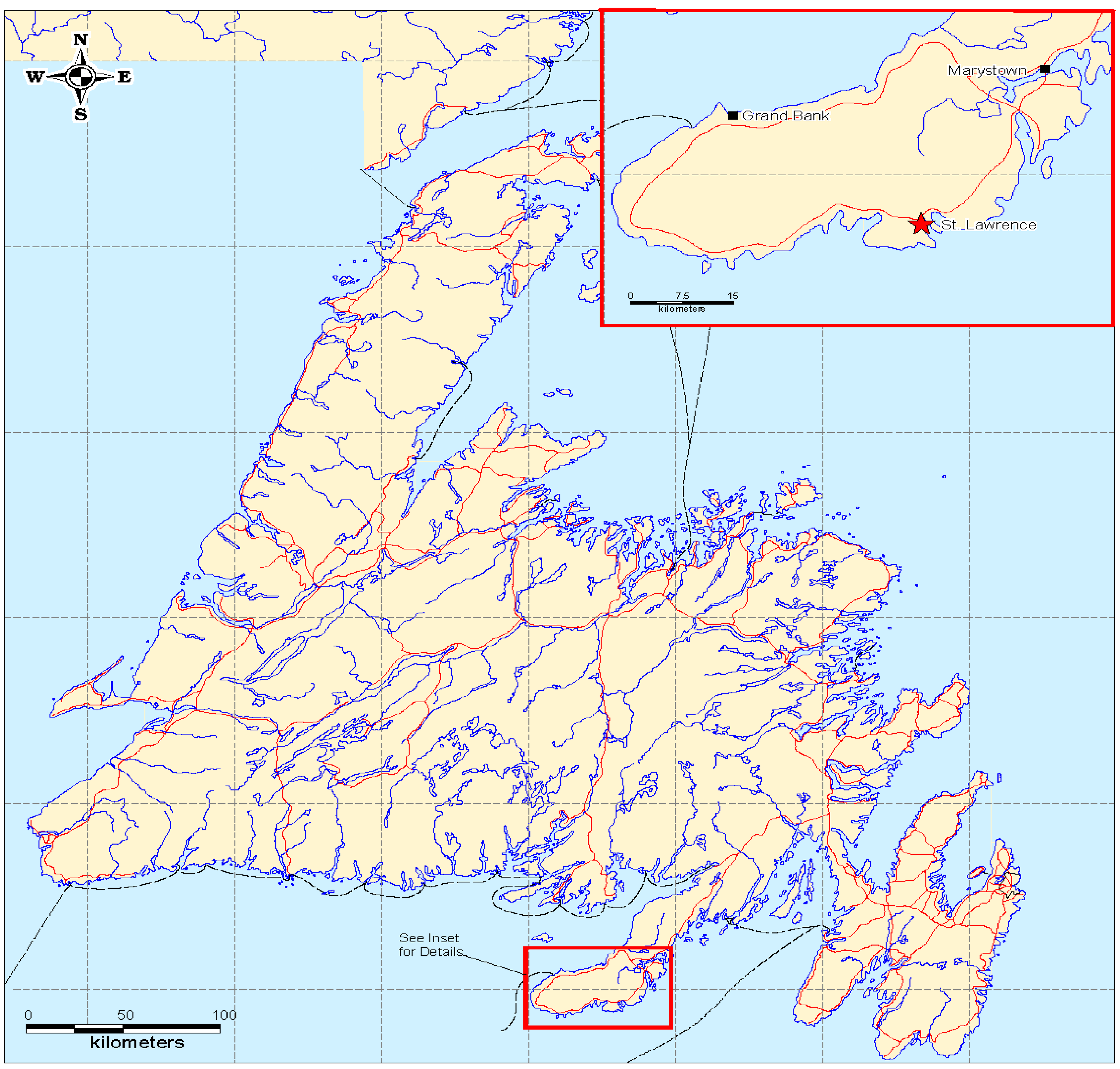
Canada Fluorspar Inc.
AGS Fluorspar Mine

Welcome

Canada Fluorspar Inc. (CFI) is proposing to develop the AGS Fluorspar Mine in St. Lawrence

Who is CFI?

- Privately owned entity
- 100% ownership by Golden Gate Capital



AGS Fluorspar Mine Project Location

What is Fluorspar?

Fluorspar (also called fluorite) is the mineral calcium fluoride (CaF_2). It is used to make insulating foams, refrigerants, glass, jewelry, aluminum and steel.

Canada Fluorspar Inc.
AGS Fluorspar Mine

History of the Project

1933
Black Duck Mine start

Newfluor (Alcan) opened Director Mine
1942

1957
St. Lawrence Corporation closed operations

Alcan acquired all fluorspar properties
1965

1977
Alcan closed operations

St. Lawrence Fluorspar Limited (Minworth - UK) created
1986

1991
Minworth went bankrupt

Burin Minerals Ltd. awarded mineral rights
1995

2009
Burin merged to become Canada Fluorspar Inc. (CFI)

CFI initiated EA process for reactivation of mining activities

Release from federal and provincial EA process
2010

2011
Partnership of CFI and Arkema to form Newspar

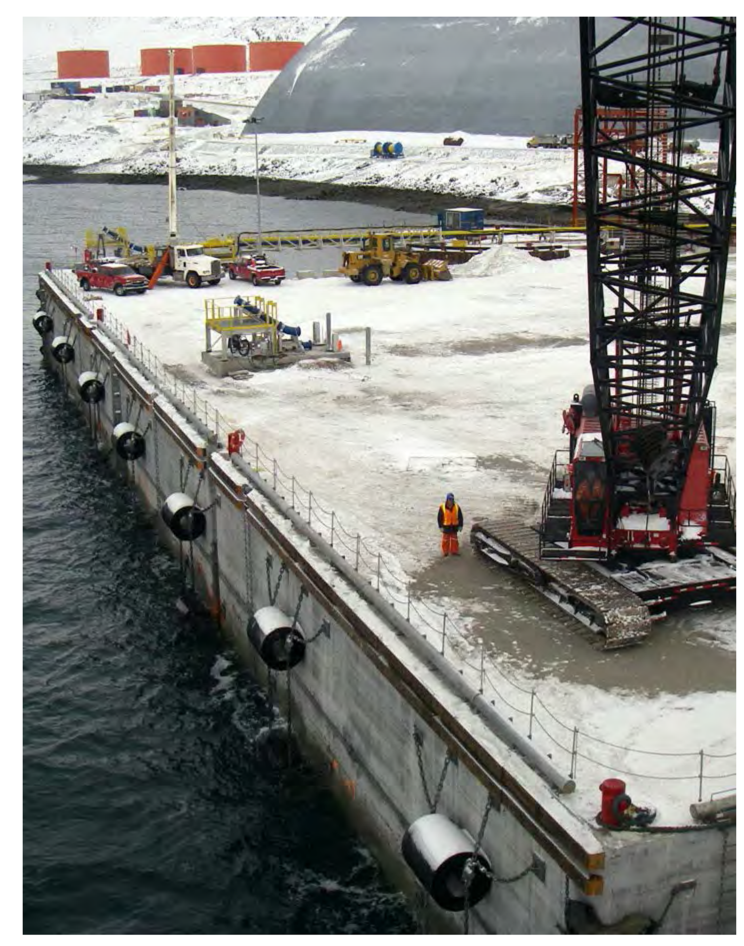
2014
CFI initiated process for AGS Fluorspar Mine

CFI acquired by Golden Gate Capital
2014

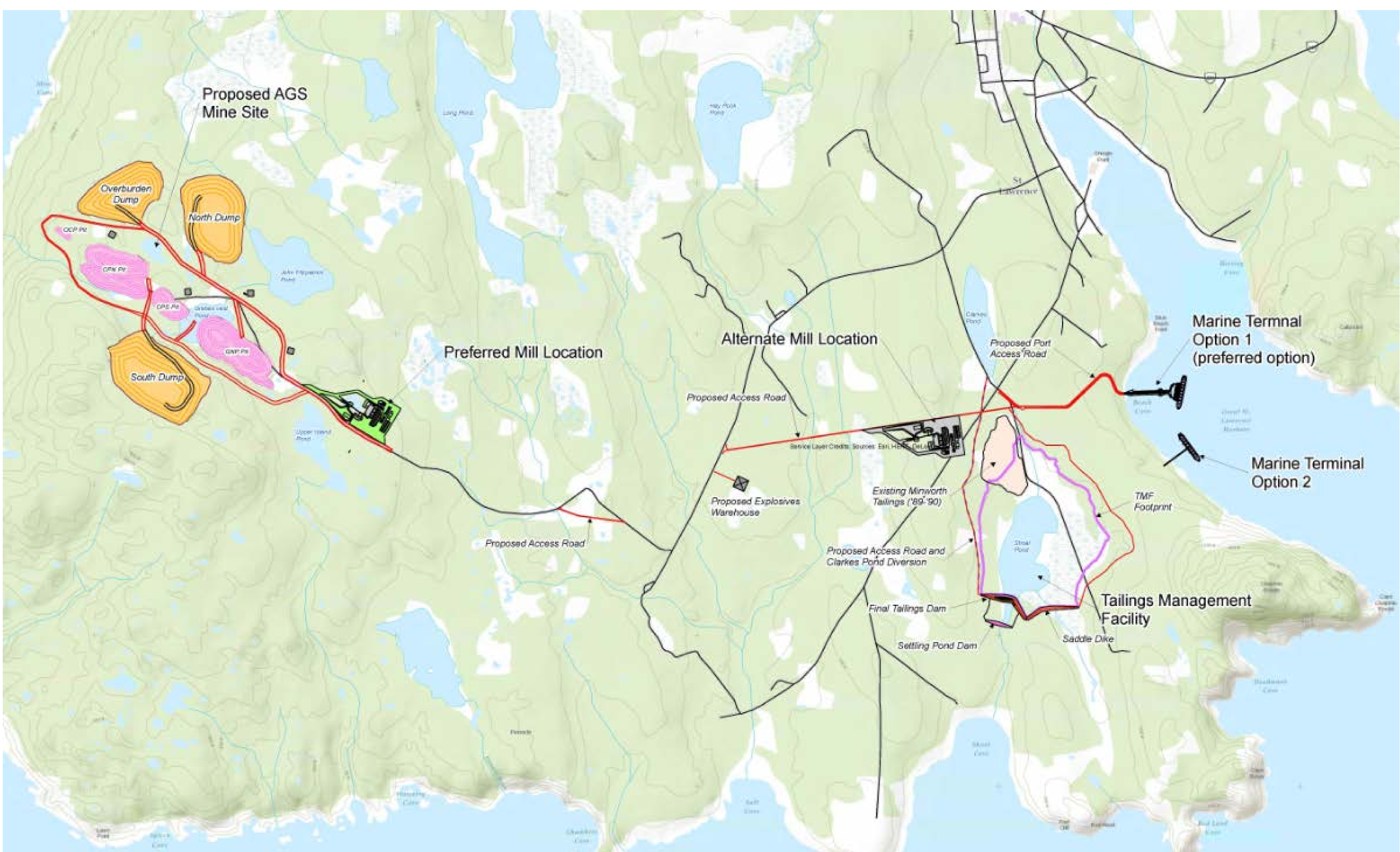
Canada Fluorspar Inc.
AGS Fluorspar Mine

AGS Project Overview

- Surface and Underground Mining of AGS Vein
- Annual mill production capacity:
    - 200,000 tonnes acid grade concentrate
    - 200,000 tonnes aggregate

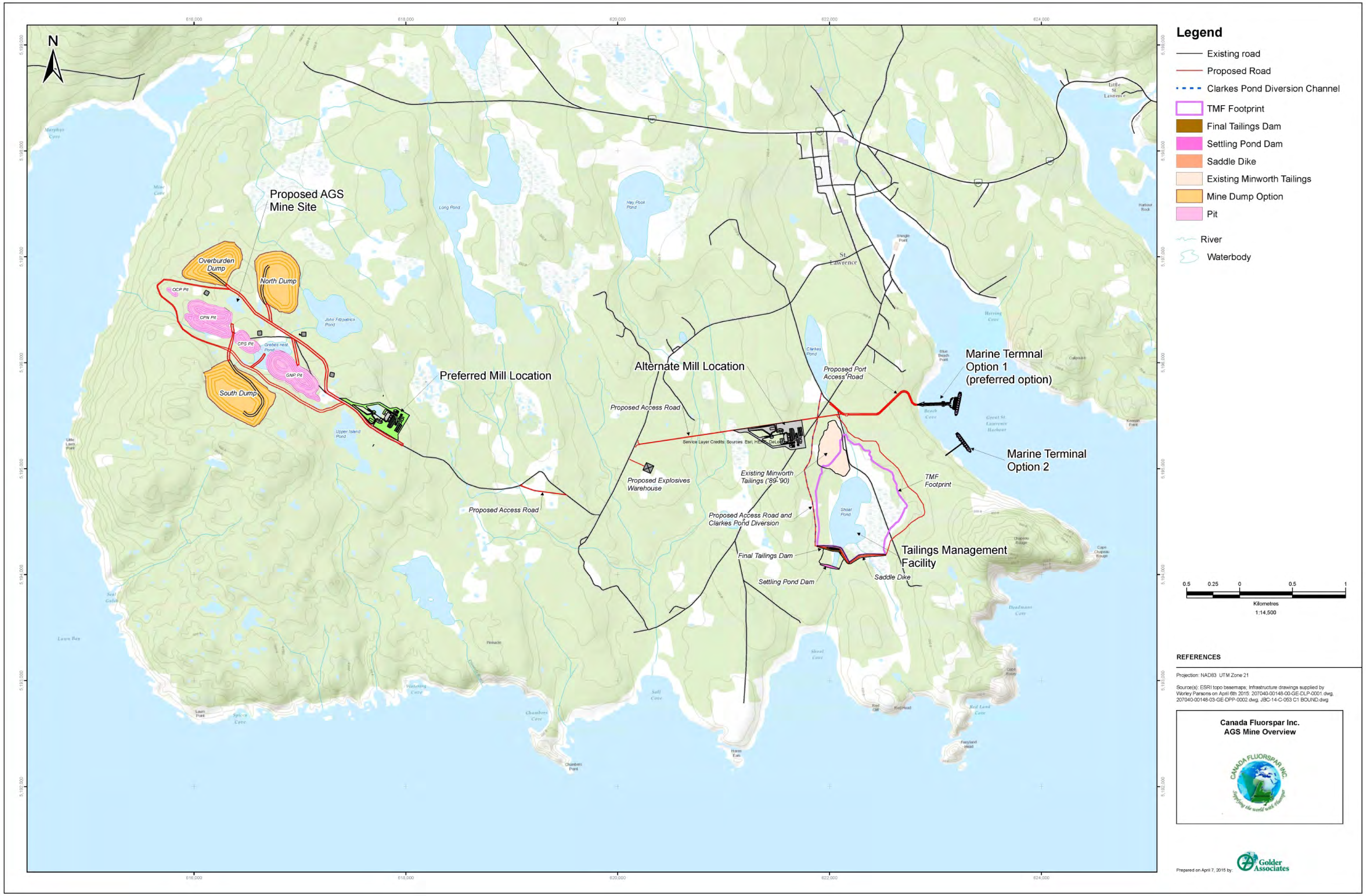


- Key infrastructure :
    - AGS Mine
    - Tailings Management Facility
    - Mill
    - Marine Terminal
- Life of AGS Mine: about 10 years

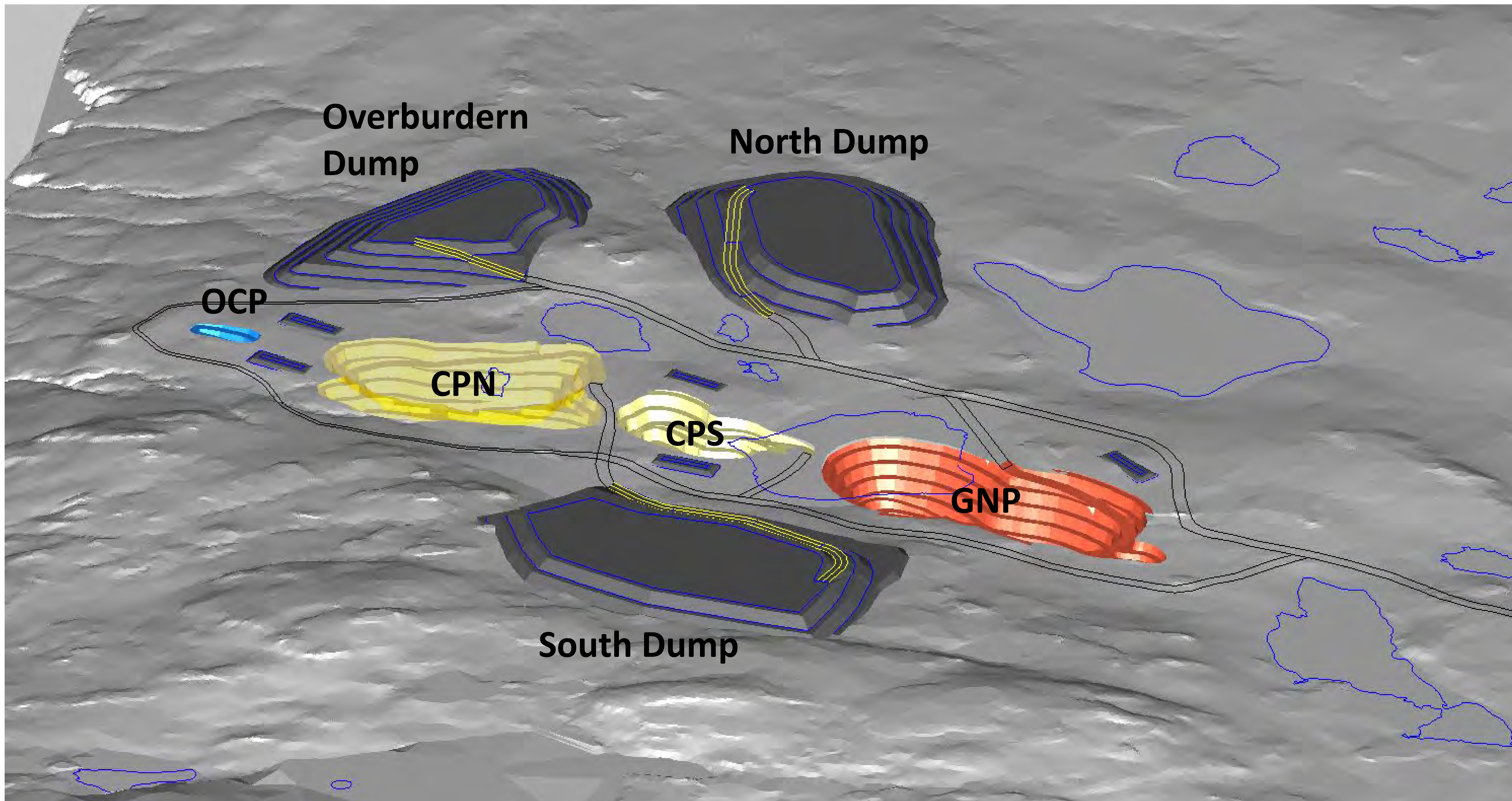


Project components and associated infrastructure

Canada Fluorspar Inc.
AGS Fluorspar Mine
Project Components and Associated Infrastructure



AGS Pit Design

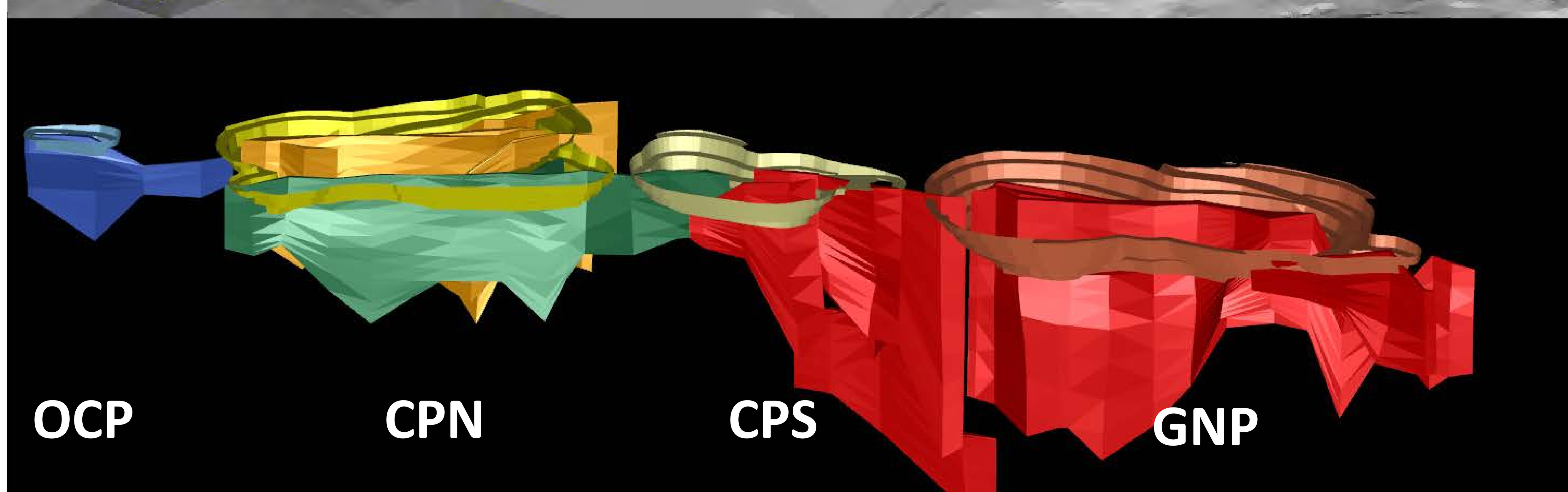


Four single pits to be developed:

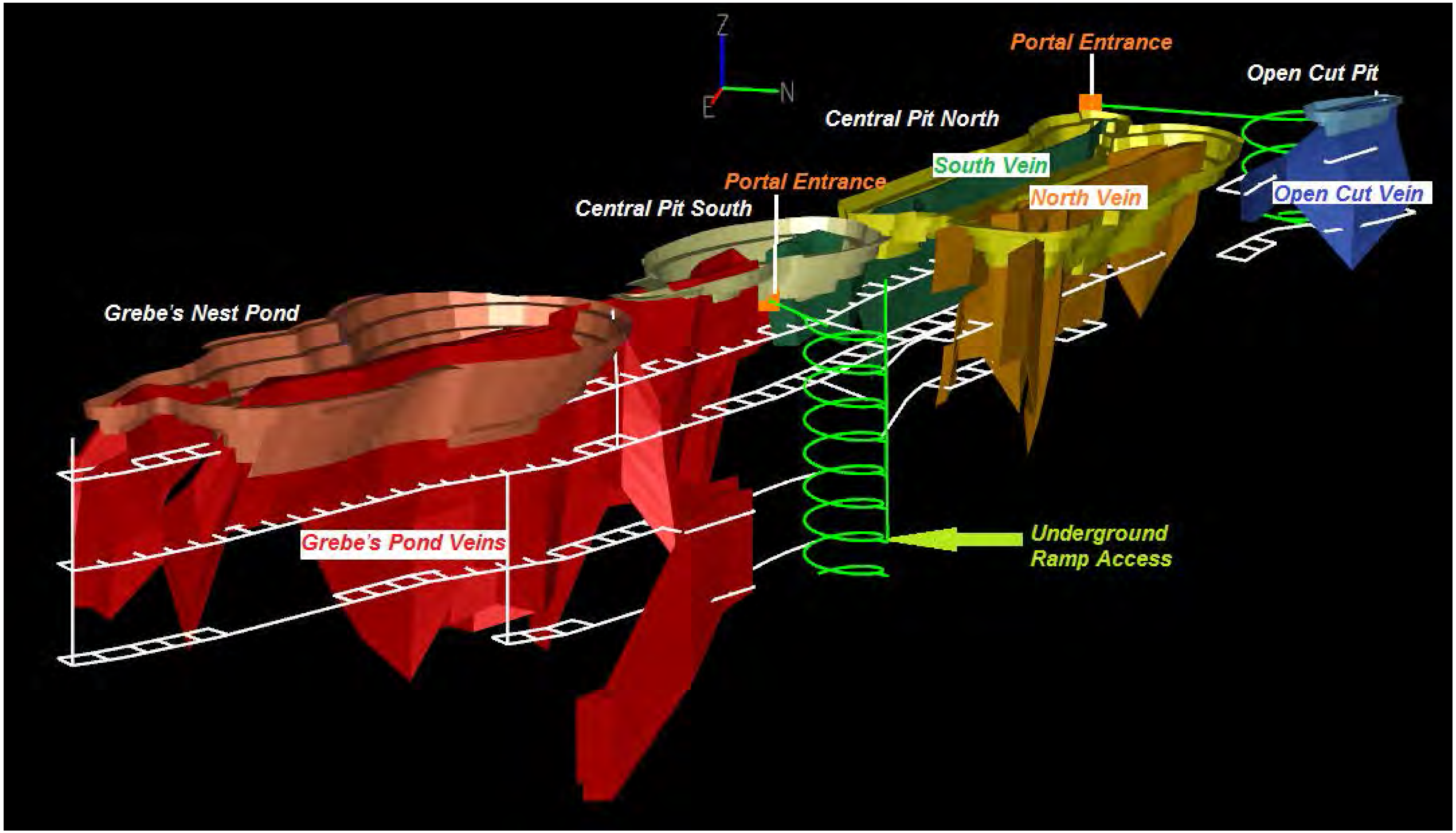
1. OCP
2. CPN
3. CPS
4. GNP

Three waste rock disposal areas:

1. Overburden Dump
2. North Dump
3. South Dump

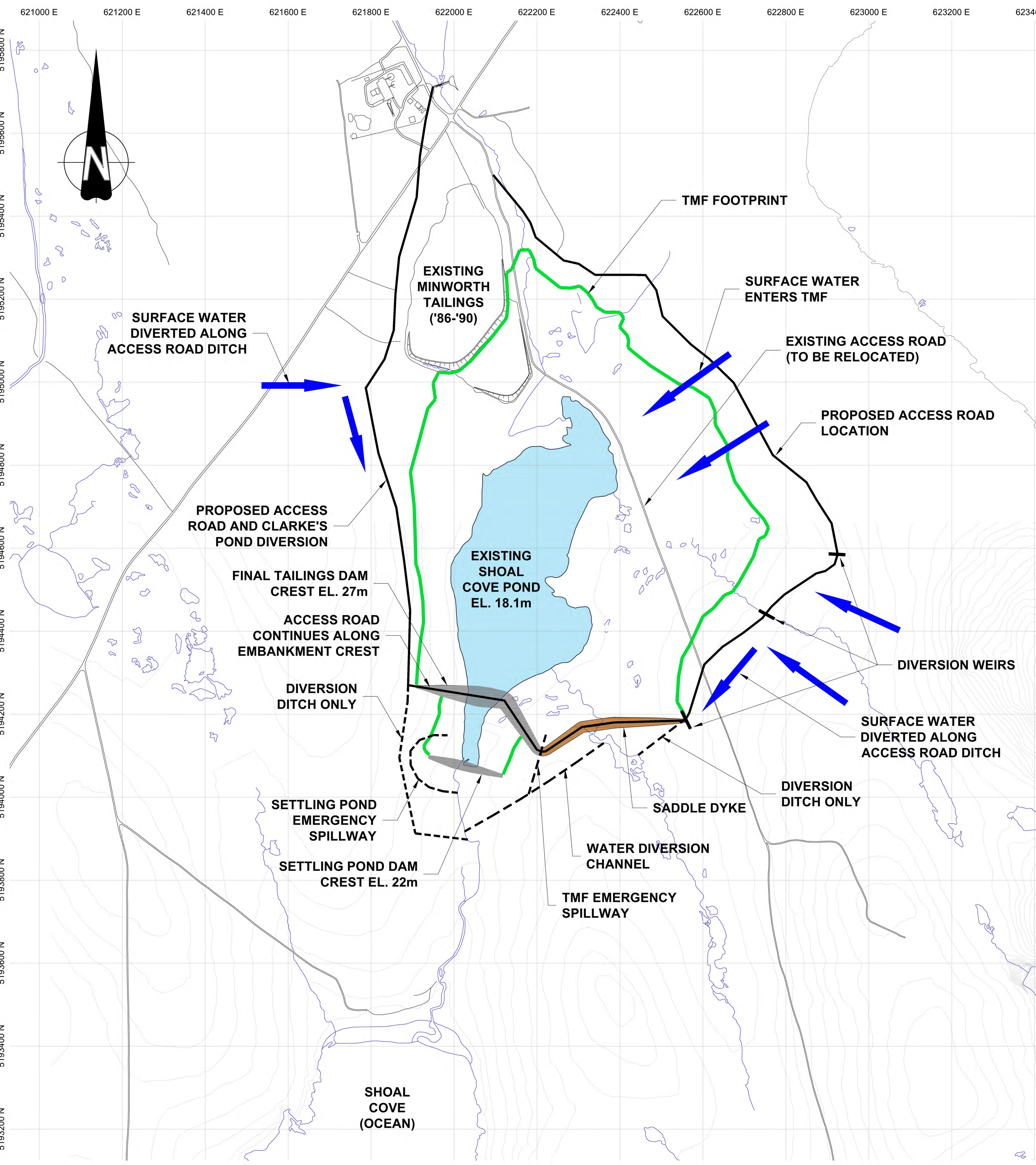


AGS Underground Mine



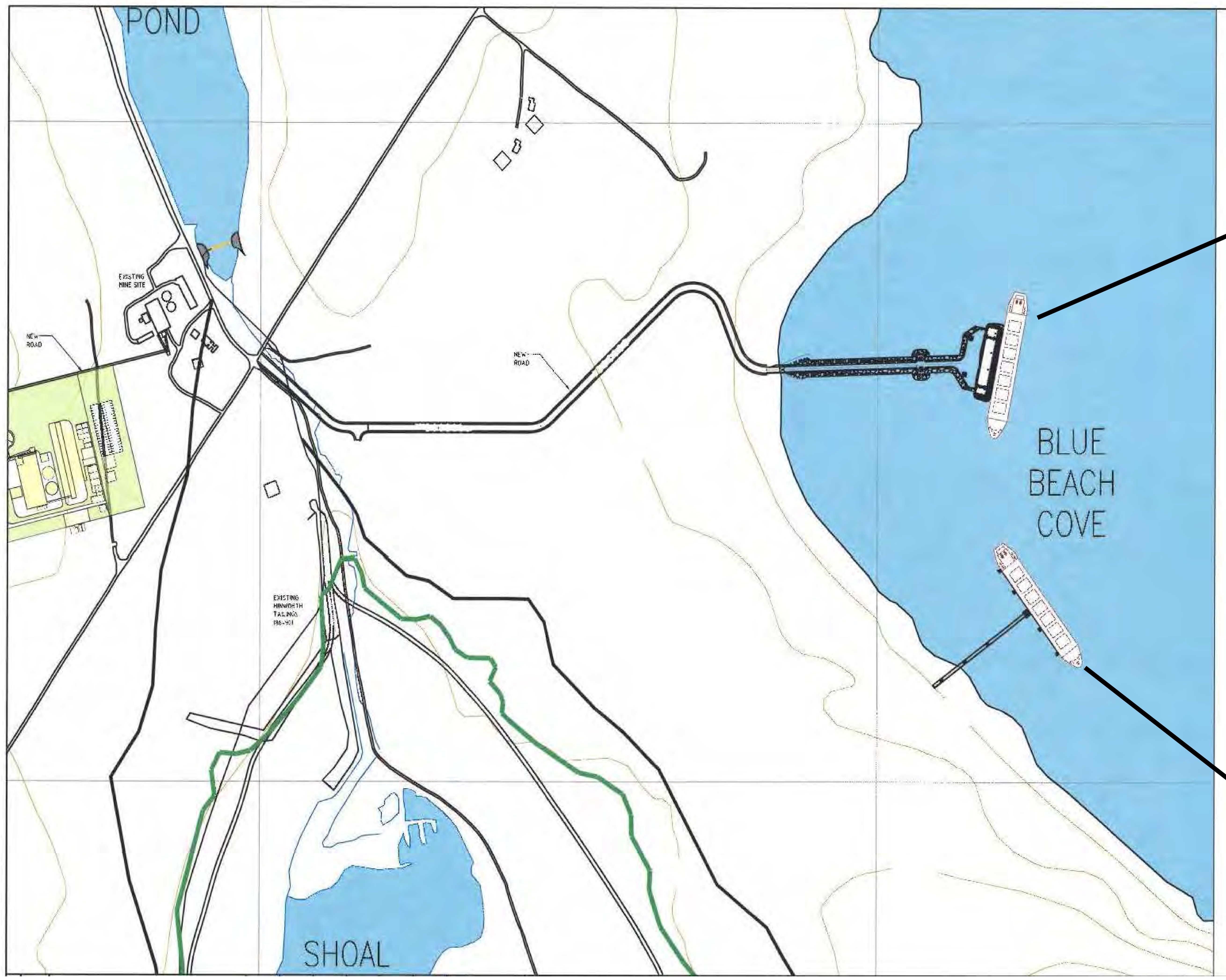
Canada Fluorspar Inc.
AGS Fluorspar Mine

Tailings Management Facility

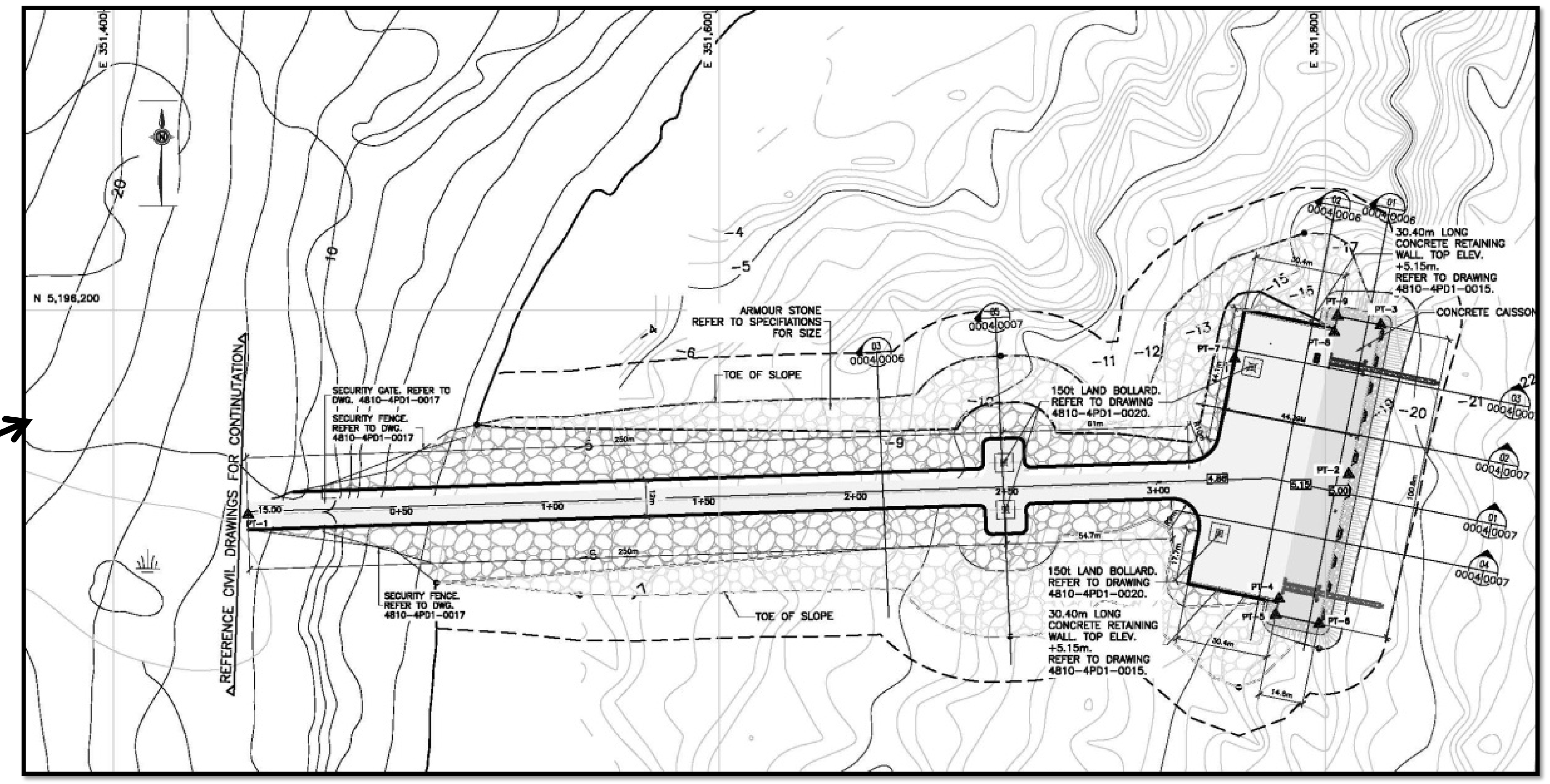


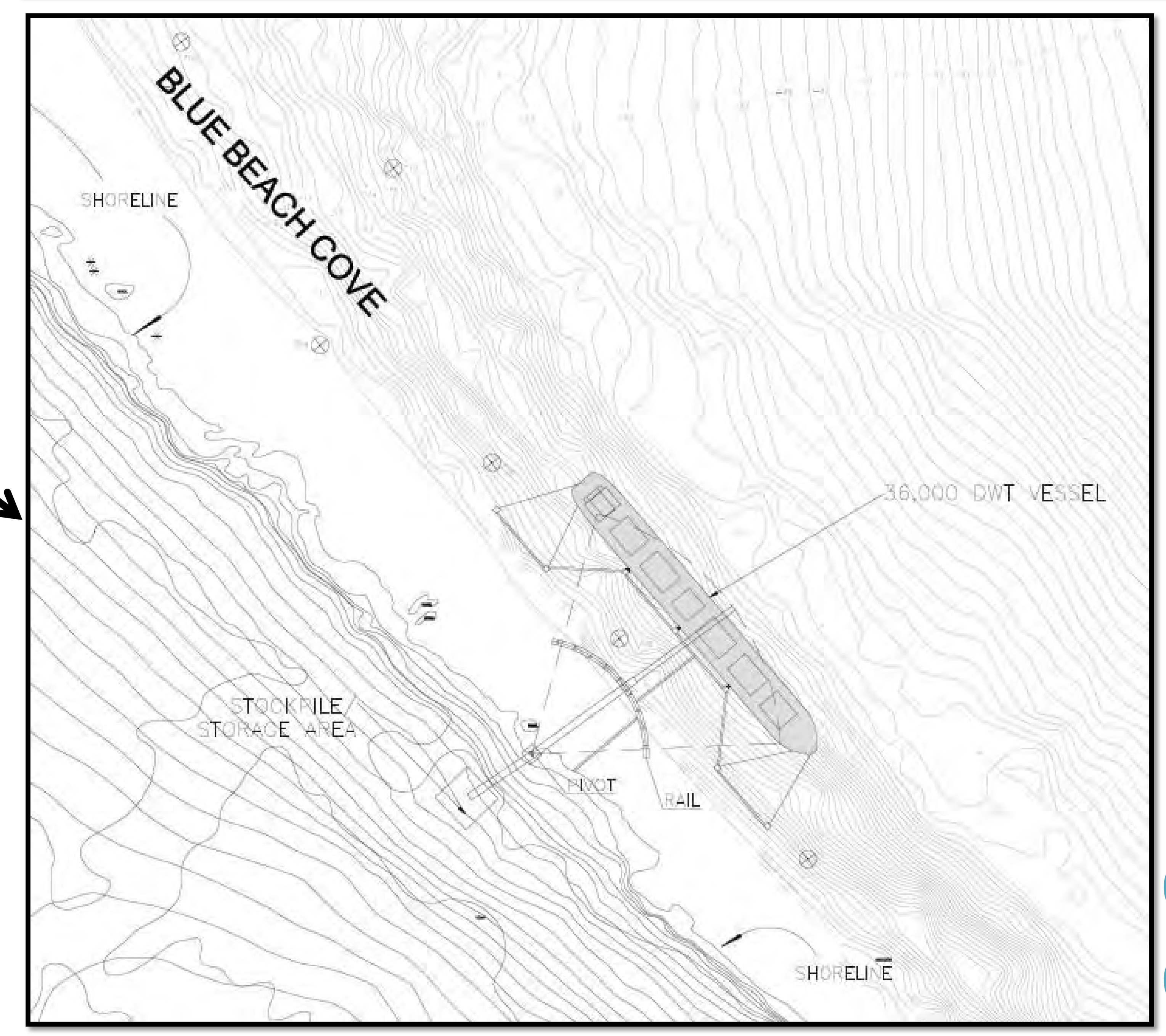
Canada Fluorspar Inc.
AGS Fluorspar Mine

Marine Terminal



Option 1 : Concrete Caissons (Preferred Option)





Option 2 : Quadrant Loader

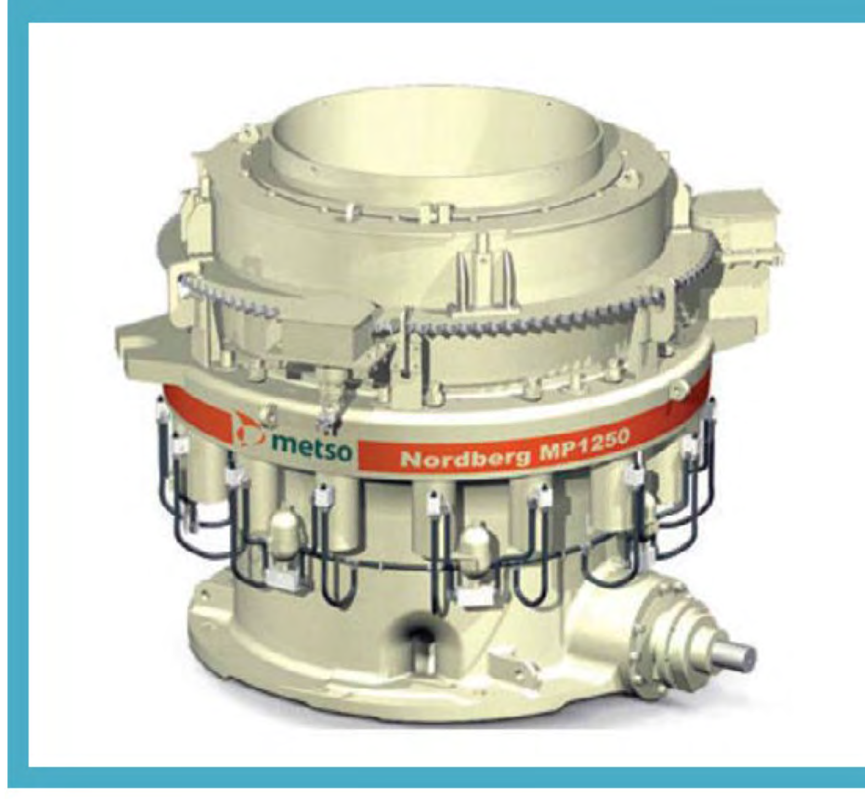
Canada Fluorspar Inc.
AGS Fluorspar Mine

Ore Process Diagram

Mining, Load & Haul

Jaw Crusher

Cone Crusher



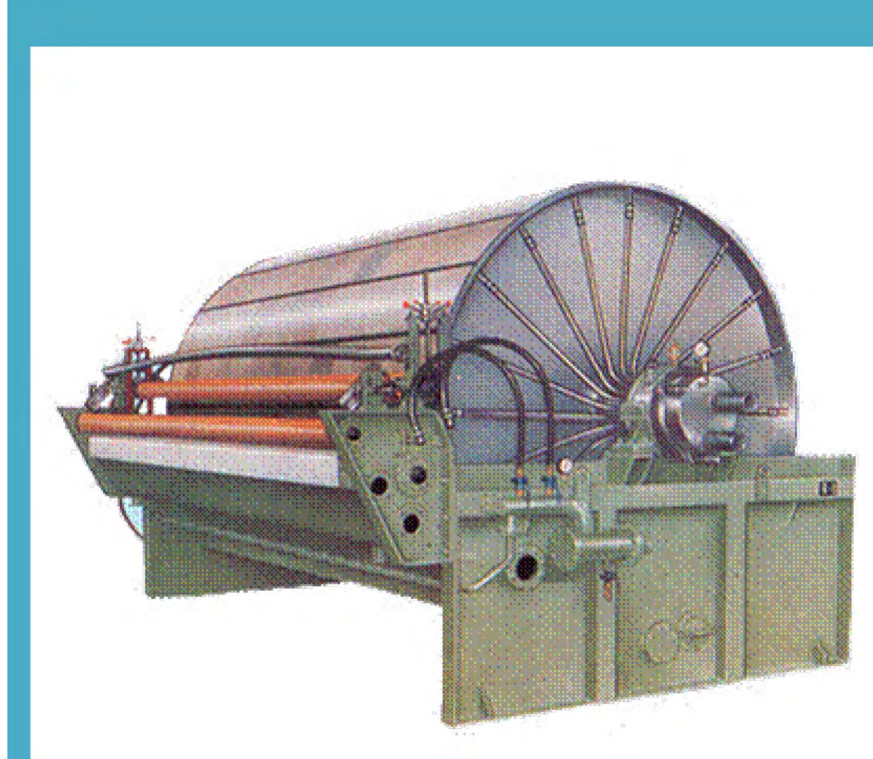
Dense Medium Separation

Grinding

Froth Flotation

Thickening

Filtration



Ship Loading

Environmental Assessment (EA) Process

Project Initiation and EA Planning

- Preliminary Project Design and EA Scoping

EA Registration

- Prepare Project Description and EA Registration
- ☆ Open House to Present and Collect Input on Project Description and Potential Environmental Effects

Minister's Decision

EA

- Determination of EA Requirements by Government
- Preparation of EPR or EIS Guidelines, if required
- Preparation of EPR or EIS, if required
- ☆ Open House to Present and Collect Input on Draft EPR or EIS

Minister's Decision

Post EA

- Identify and Procure Environmental Approvals/Permits

Ongoing Public and Stakeholder Consultation

Canada Fluorspar Inc.
AGS Fluorspar Mine

Environmental Studies

Hydrogeology

- Groundwater study program started
- Further testing in 2015

Fisheries Study

- Survey of fish habitat and fish populations in Project footprint completed

Geochemistry

- Field tests initiated to study waste rock samples

Water Quality

- Water quality sampling program ongoing

Historic Resources

- Analysis of historic resources completed
- No historic resources found on Project site

Canada Fluorspar Inc.
AGS Fluorspar Mine

Community

Employment

- AGS Construction (2 years): 350-375 workers
- AGS Operations (10 years): 150-175 workers
- Prioritize local employment and procurement
- Maintain strong employment standards
    - Gender equity
    - Workforce diversity
- Emphasis on health and safety of workers

Cynthia Farrell Photo

Company donated science kits to St. Lawrence Academy and Lawn's Holy Name of Mary Academy

Community Investments

- Tax Agreement with Town of St. Lawrence
- Training Partnership with Keyin College
- Support various local community initiatives and events

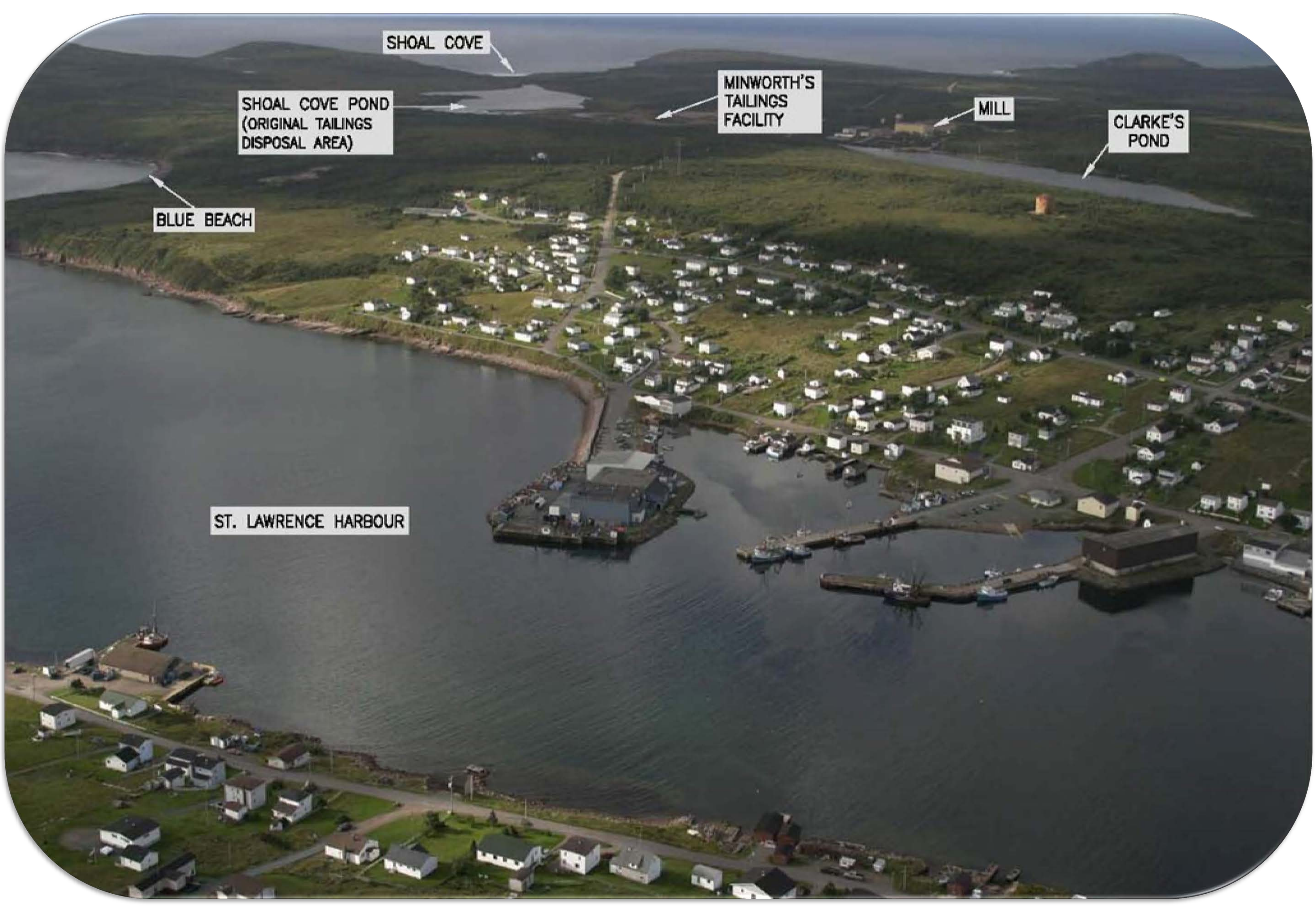


Photo credit: DFO, Small Craft Harbour Program

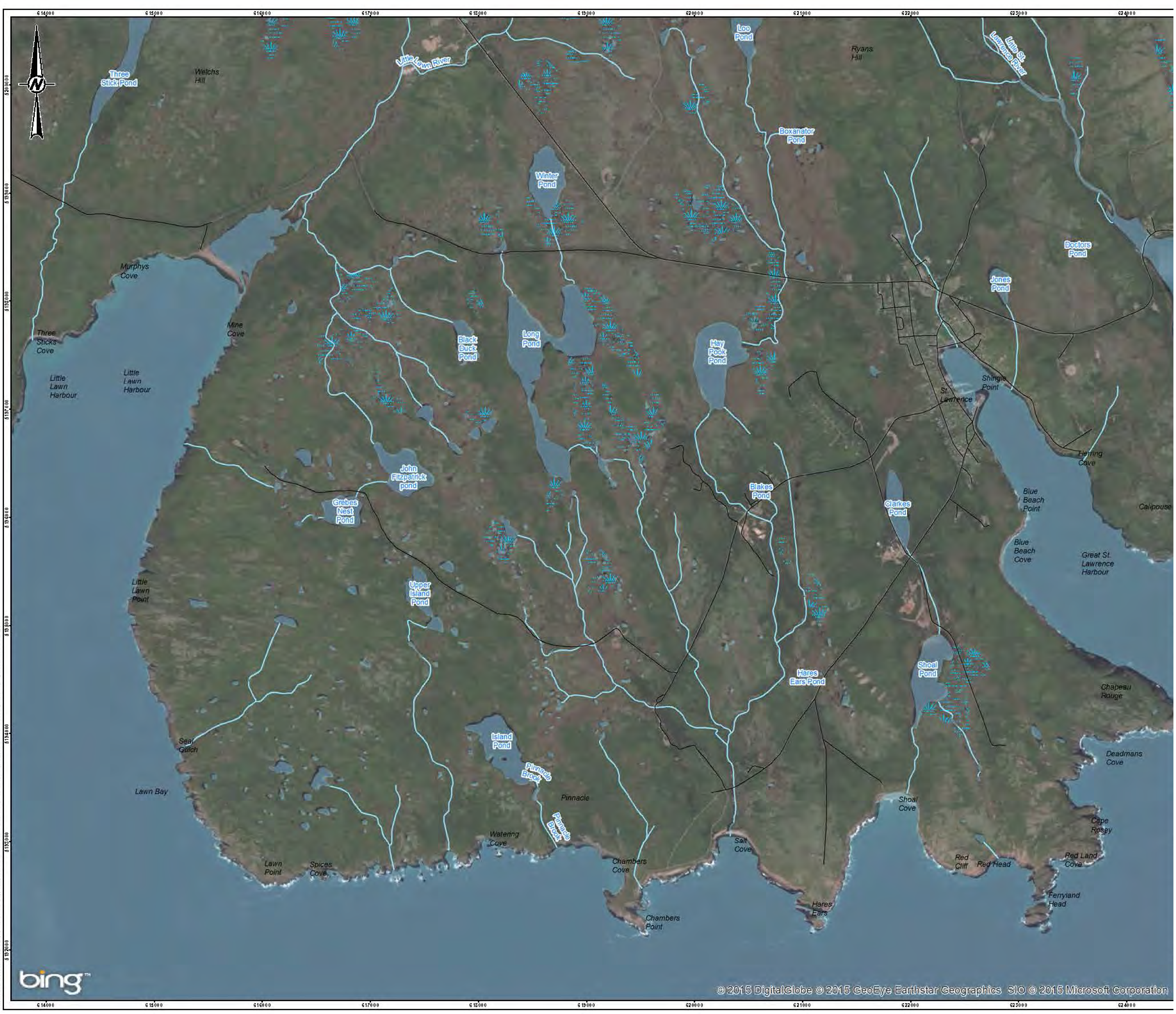
Canada Fluorspar Inc.
AGS Fluorspar Mine

Fisheries Offsetting Plan

Fisheries Offsetting Plan:

- Requirement under *Fisheries Act*
- Developed to maintain or improve impacted commercial or recreational fisheries
- We would like to obtain local knowledge regarding potential fishery enhancement options that may be available and supported:

Please identify any water bodies you use for commercial or recreational activities below.



Canada Fluorspar Inc.
AGS Fluorspar Mine

Thank You

Your feedback is important to us. Please take a moment to fill out a comment form before you leave.

Your input will guide project planning, engineering and design.

Next Steps

- Completion of Pre-Feasibility Study
- Submission of Project Registration to Provincial Government
- Public Review Period for Project Registration after submission
- Minister decision on EA within 45 days
- CFI will continue to engage with you throughout the EA Process

If you would like additional information please contact CFI (NL):
(709) 873-3331

Consultation Materials

Public Presentation

Public Information Session – St. Lawrence Recreation Centre

AGS Fluorspar Mine Project Overview

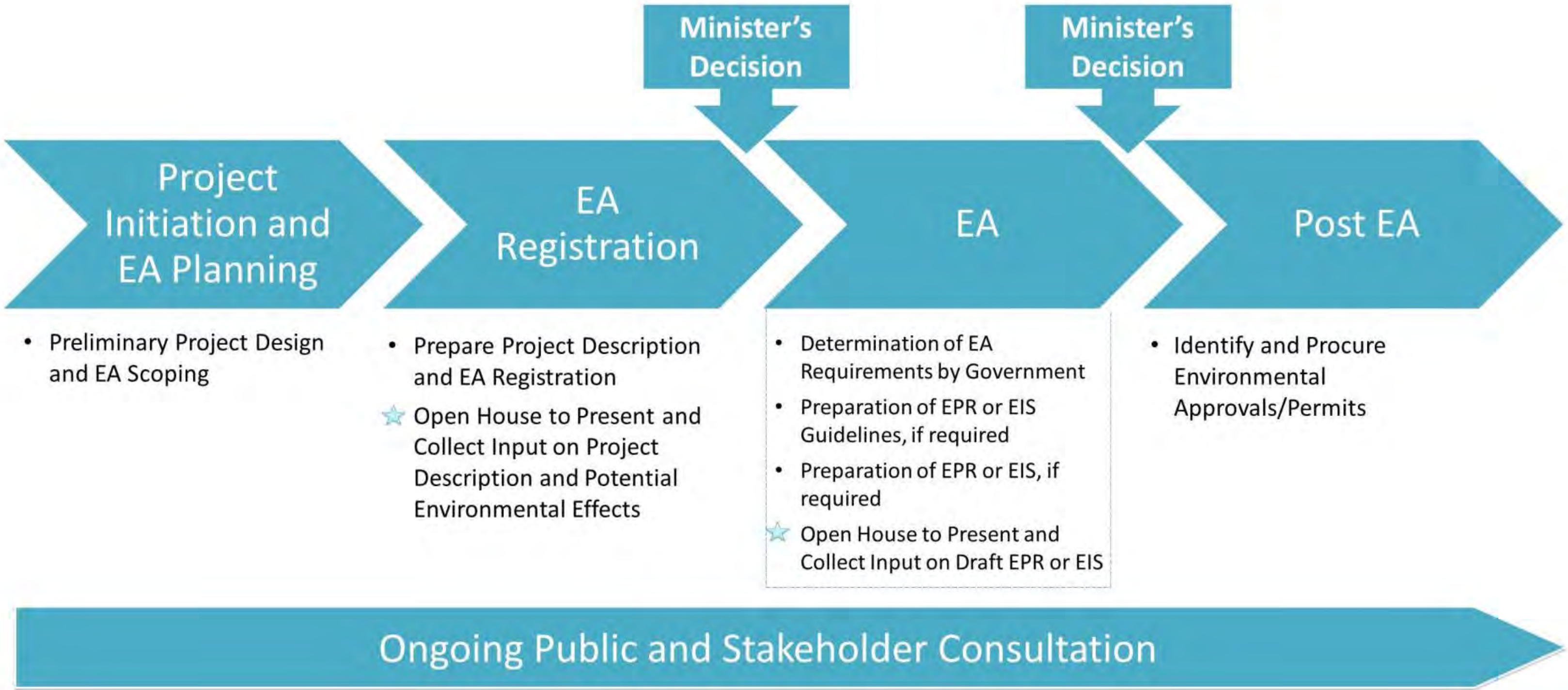
April 16, 2015

Agenda

- Meeting Purpose
- Project Overview
- Environment
- Community
- Next Steps

Visit us at the various Project stations to ask questions to our experts!

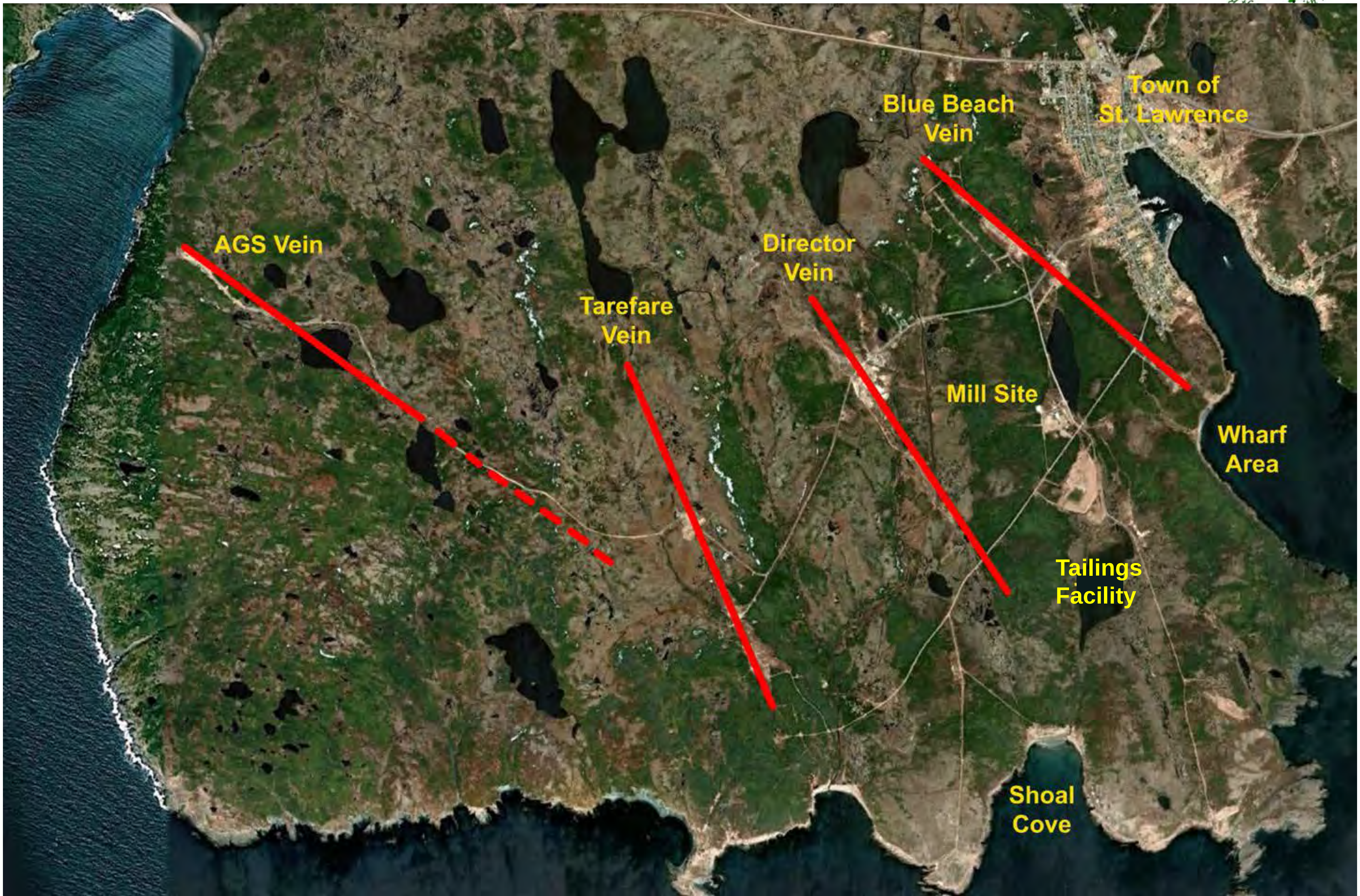
Environmental Assessment (EA) Process



Project Location

- Canada Fluorspar Inc (CFI) is proposing to develop the AGS Fluorspar Mine in St. Lawrence, NL
- CFI is now 100% owned by Golden Gate Capital
- Long mining history in St. Lawrence dating back to 1933
- In 2011, CFI partnered with Arkema to form Newspar
- Newspar holds permit for previously approved EA

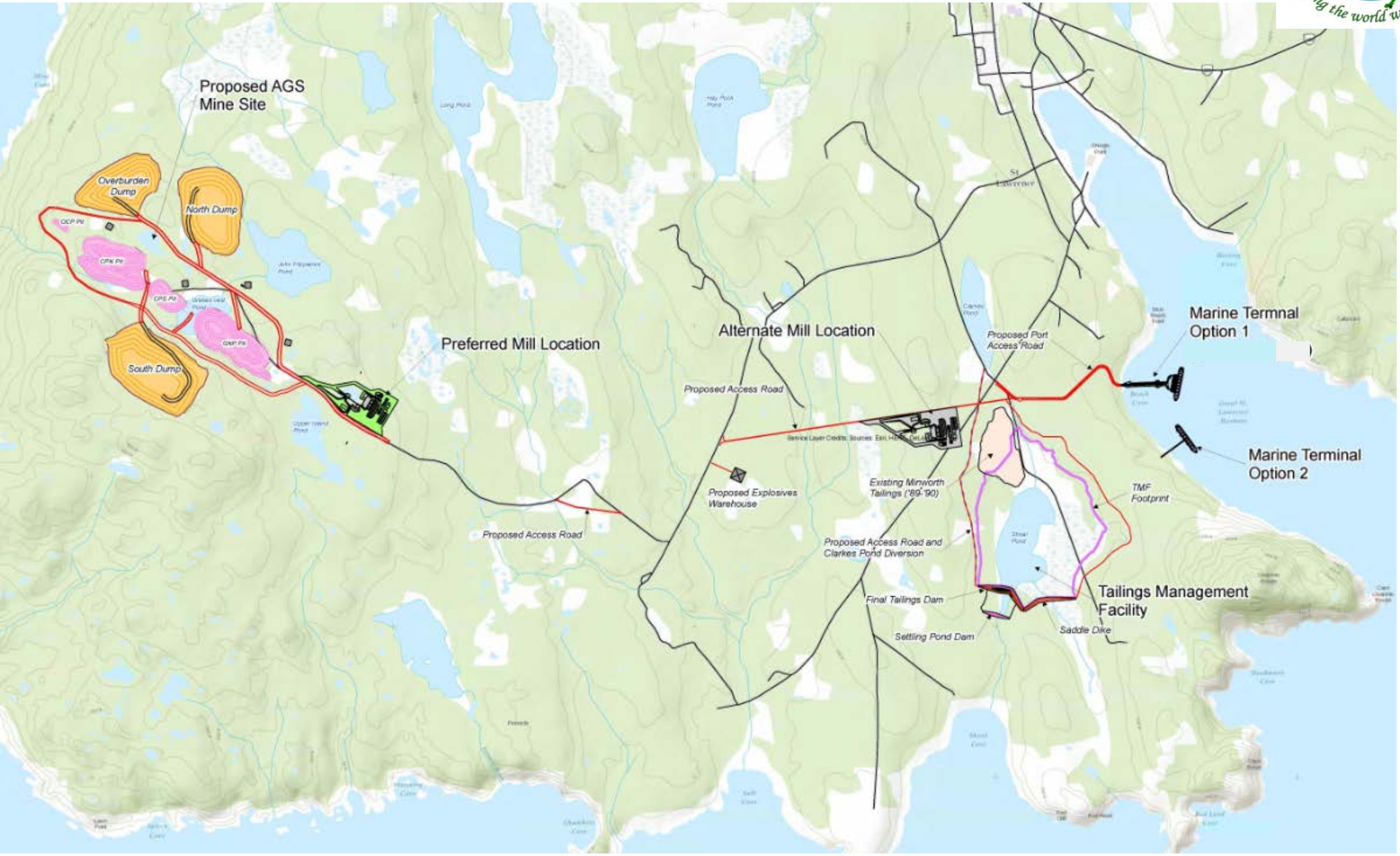
Major Fluorspar Veins



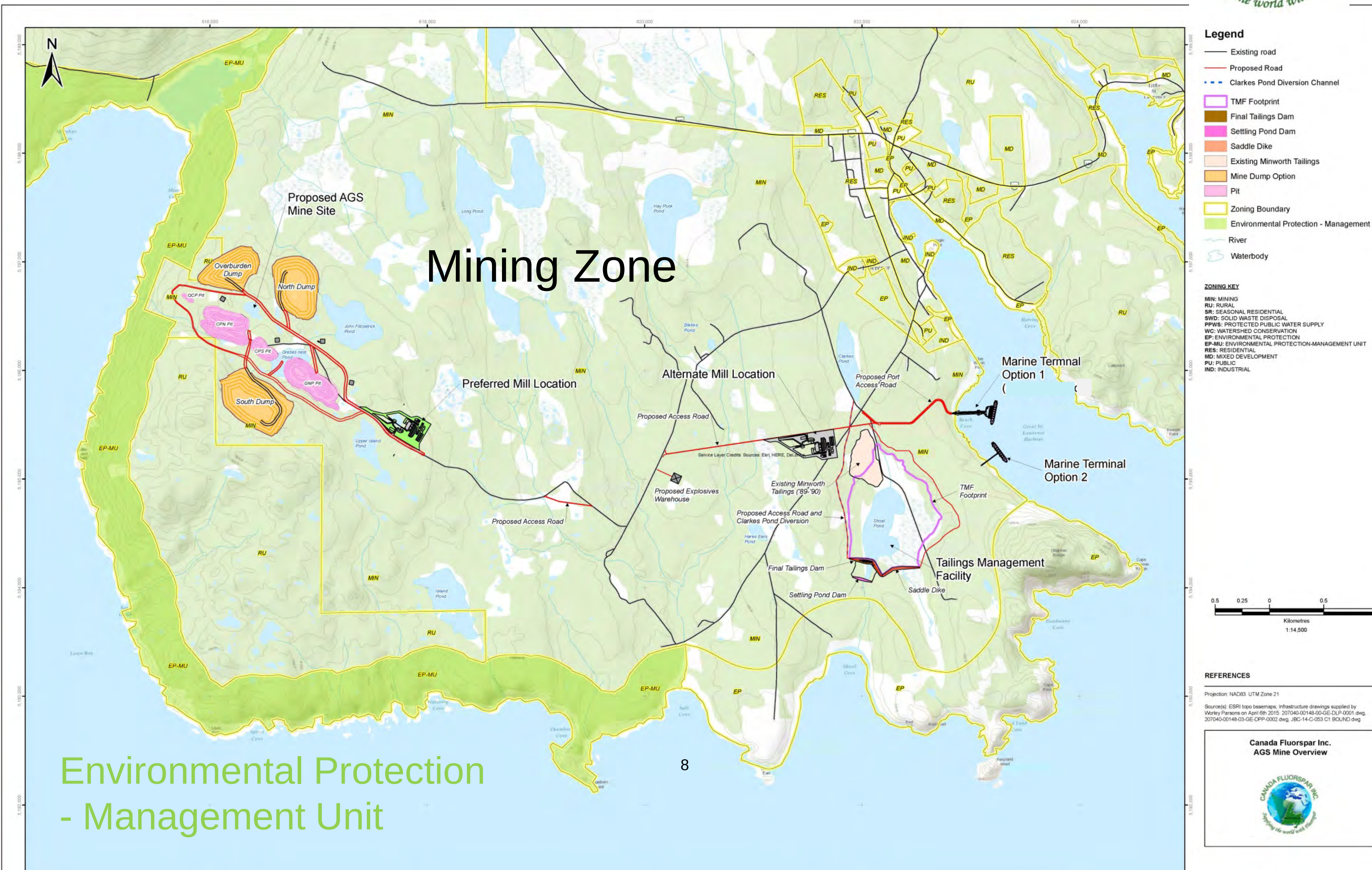
AGS Project Overview

- Scope of the AGS Project:
  - Construction, operation, rehabilitation and closure of the following components:
    - Surface and underground mining of AGS Vein
    - New Mill facility
    - Tailings Management Facility within an area historically used for tailings
    - Marine Terminal at Blue Beach Cove
    - Ancillary infrastructure to support mine and mill: roads, buildings, power lines, etc.
  - Production capacity: 180,000 to 200,000 tonnes per year acid grade concentrate
  - Construction Period: 2 years
  - AGS Mine Life: about 10 years

AGS Project Overview

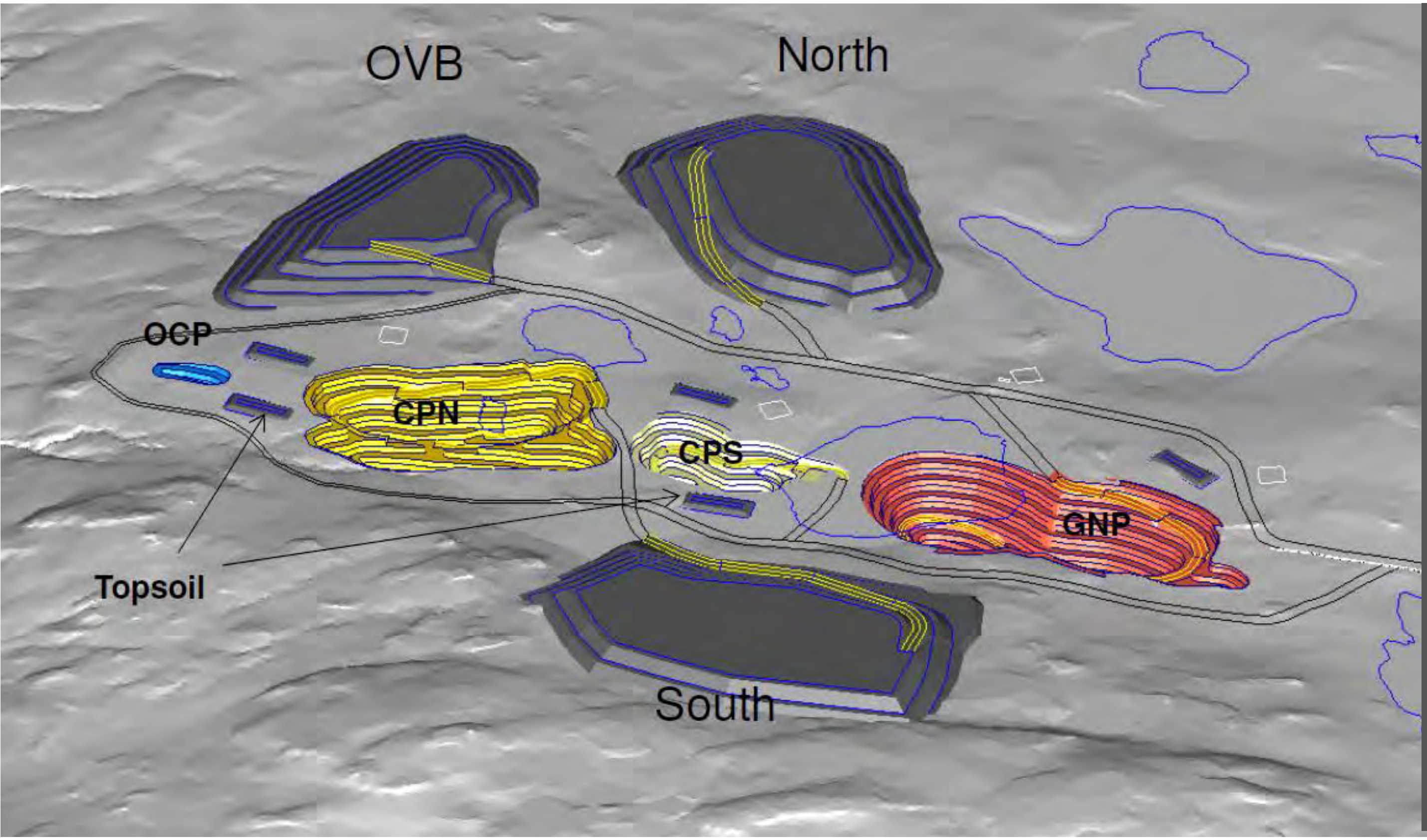


Municipal Zoning



Mining Method

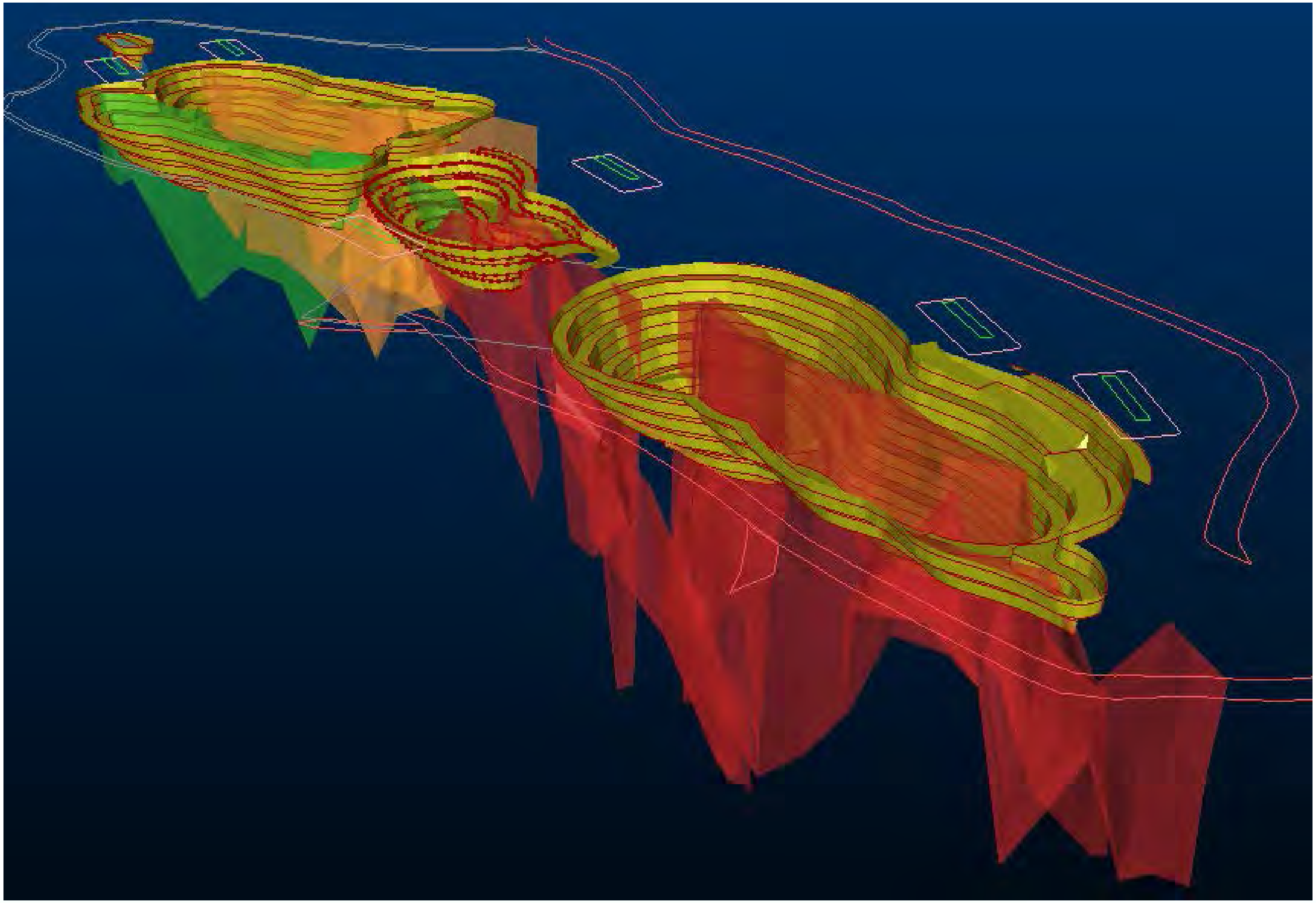
- Proposed Mine:
  - Surface and underground mining of AGS vein



Four single pits to be developed:
1. Open Cut Pit
2. Center Pit North
3. Center Pit South
4. Grebes Nest Pit

Three waste rock disposal areas:
1. Overburden Dump
2. North Dump
3. South Dump

AGS Mine



Mining Equipment – Open Pit

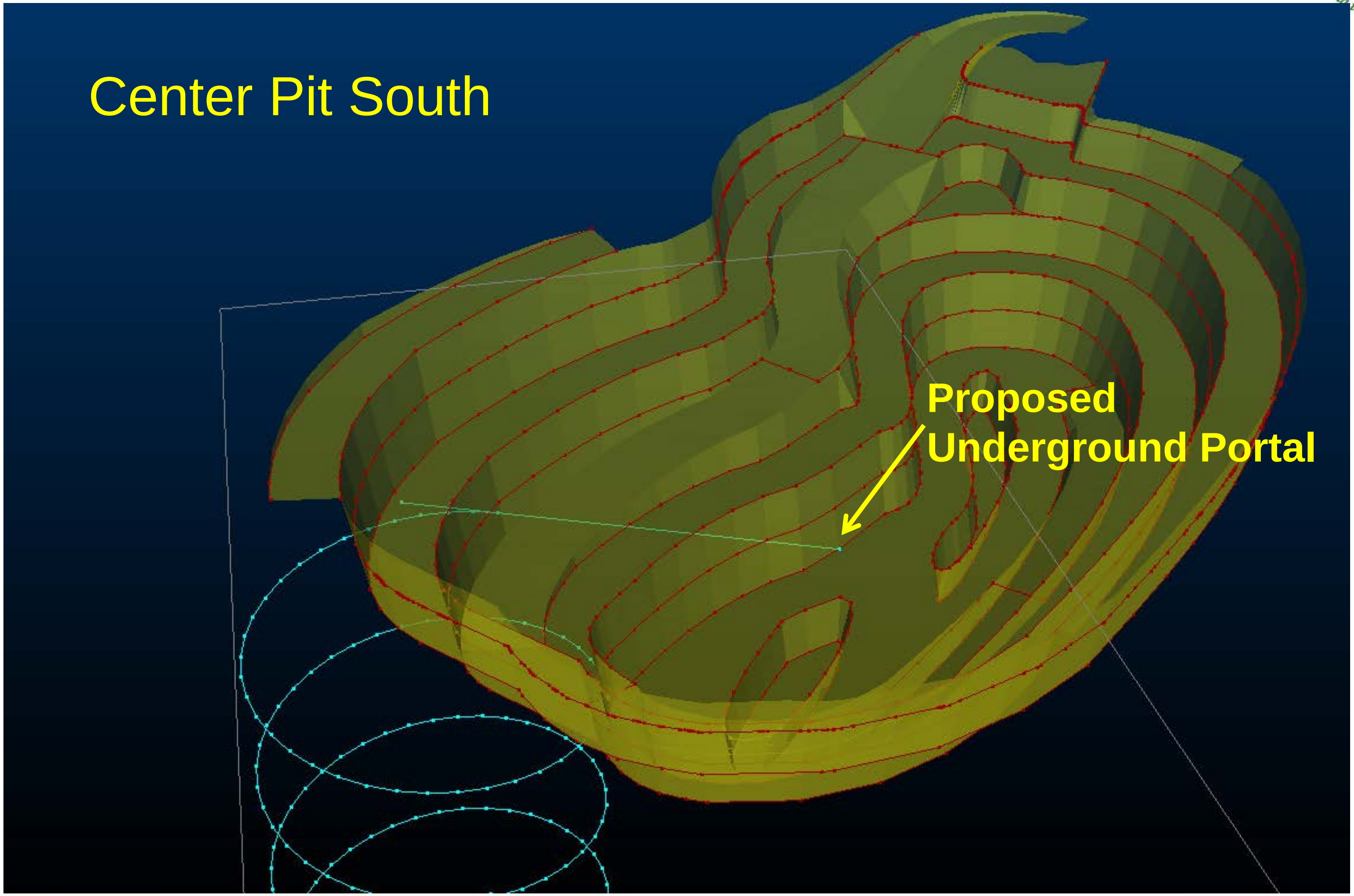
Ore Truck

Ore Excavator

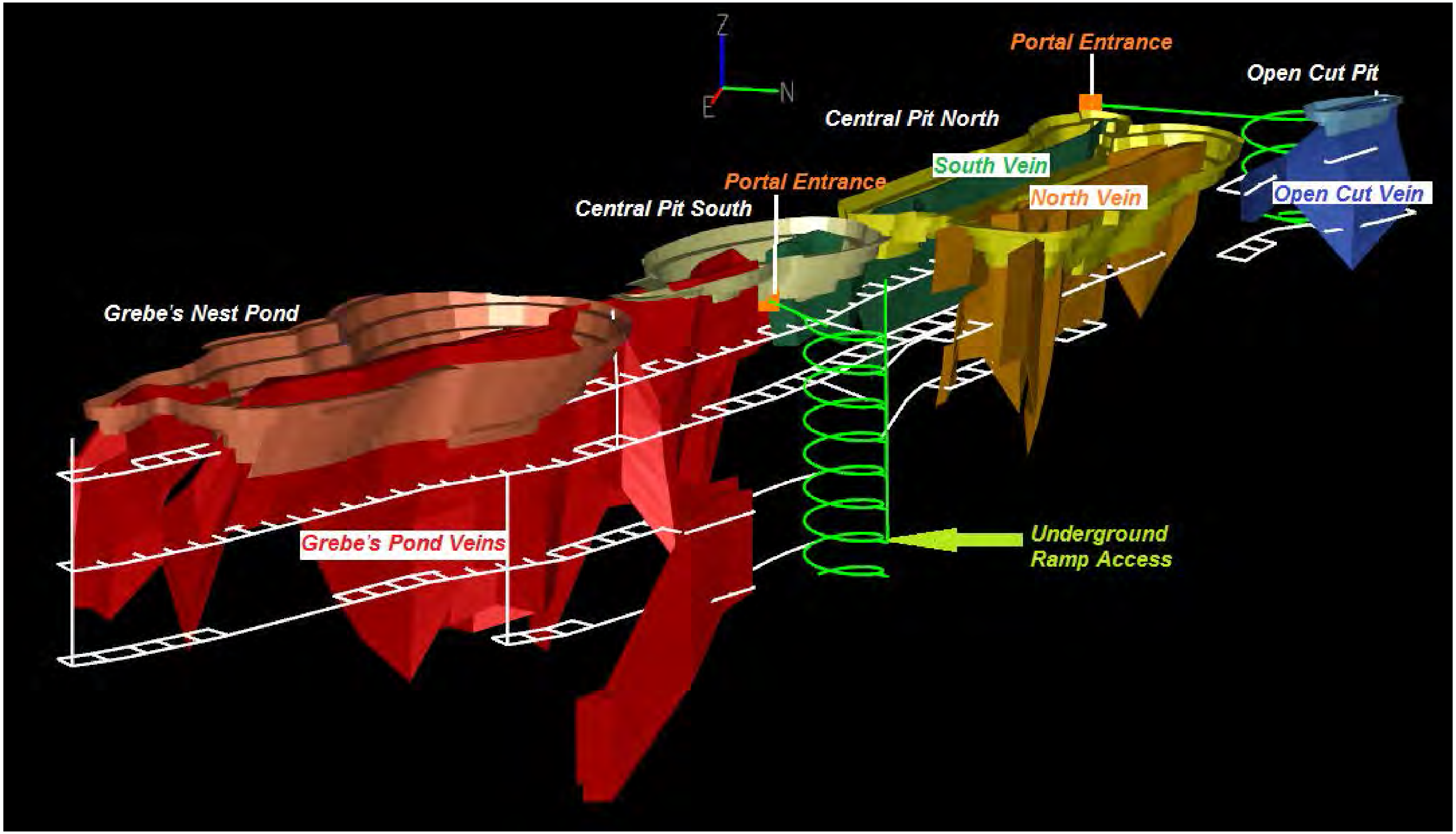
Ore and Overburden Truck

Waste Shovel

Underground Mine



Underground Mine



Mining Equipment - Underground

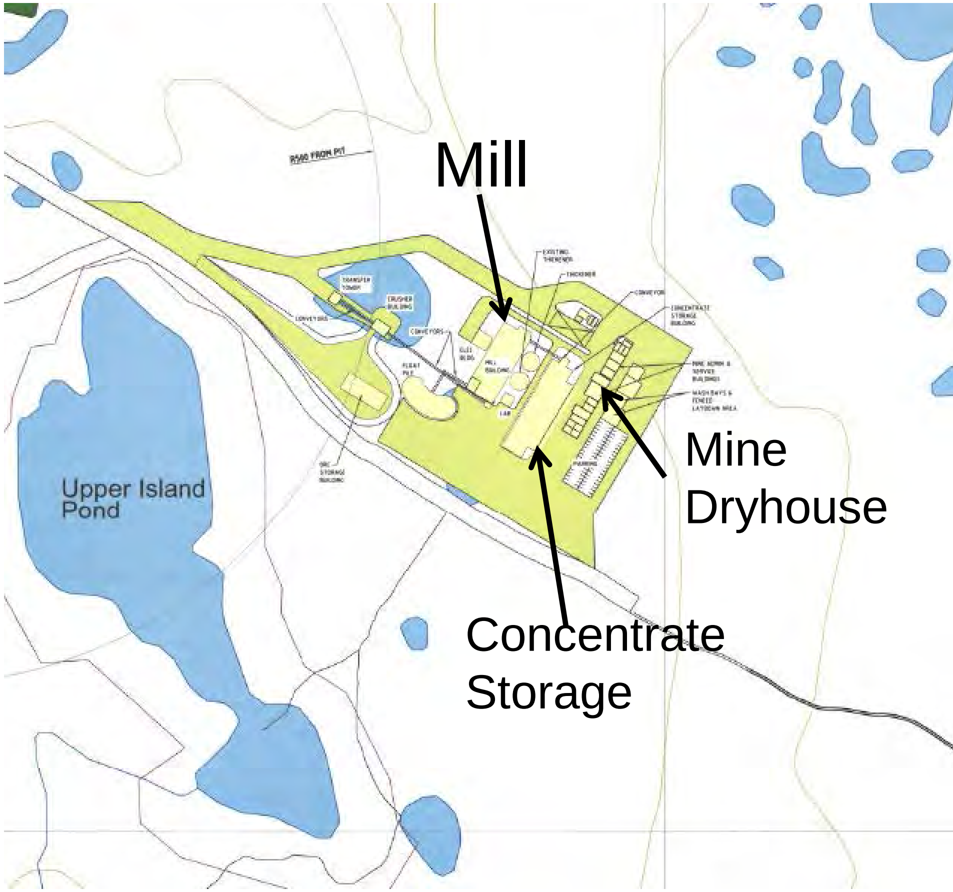
Underground Scoop Tram

Underground Truck

Narrow Vein Underground Scoop Tram

Mill Site

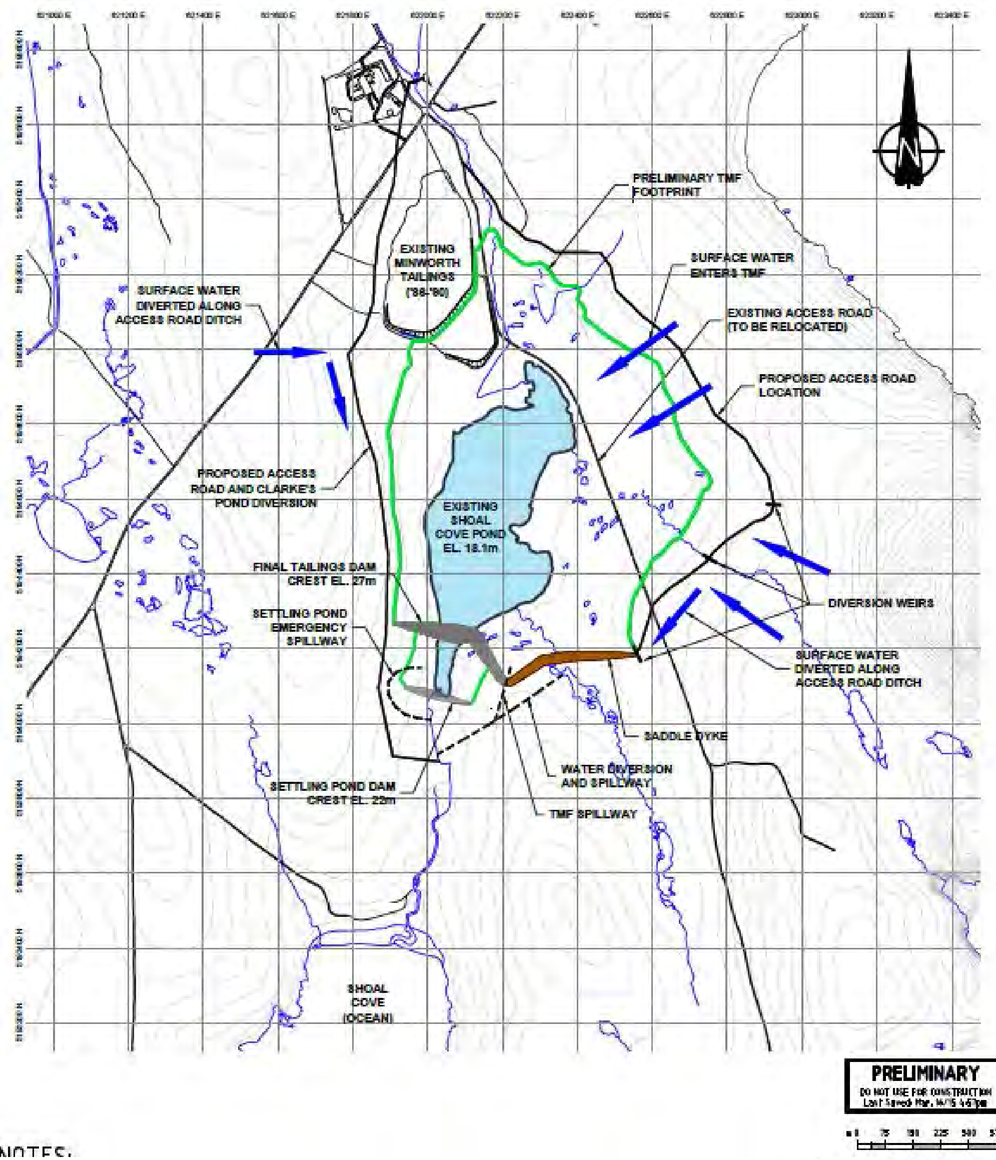
- Buildings at Mill Site:
  - Mill Building
  - Crusher Building
  - Ore storage Building
  - Transfer Tower
  - Electrical Building
  - Concentrate Storage Building
  - Admin. & Engineering Building
  - Storage Buildings
  - Security Building
  - Flocculent Treatment Building
  - Laboratory Building
  - Dryhouse
  - Maintenance Buildings



Ore Processing

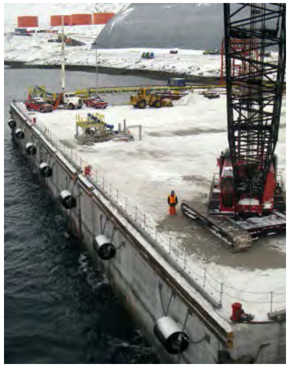
Tailings Management Facility (TMF)

- Proposed AGS TMF:
  - Engineered TMF structure
  - Tailings Capacity: 2.8 million tonnes flotation tailings (2 million cubic meters) over life of mine
  - Designed for 1:100 yr 24-hour rainfall event
  - Water quality monitoring and treatment station
  - Clarke's Pond cutoff wall and diversion channel



Marine Terminal Facility

- Proposed Terminal Facility:
  - Considering 2 options
    - North Option (1):
      - Concrete Caissons
      - Mobile Shiploader
    - South Option (2):
      - Open pile conveyor with mooring dolphins
      - Quadrant Loader
  - Terminal included in Town's land use plan

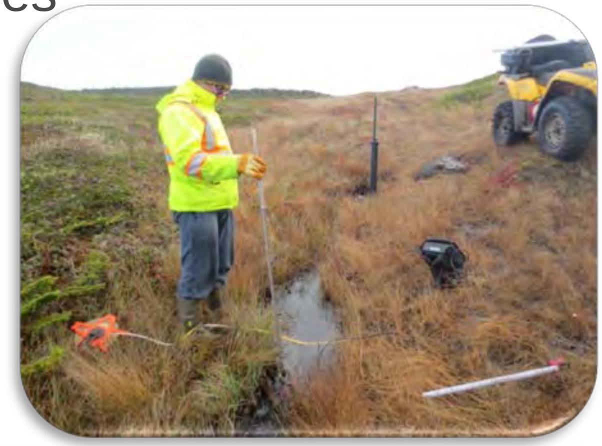


Permitting Process

- Rigorous permitting process required prior to start of construction
- Completion of environmental assessment
- Construction permits required from:
  - Federal Government
    - Fisheries and Oceans Canada
    - Transport Canada
  - Provincial Government
    - Department of Environment and Conservation
    - Department of Natural Resources
    - Service NL
  - Municipality
    - Development Permit
- Other permits will be acquired prior to start of operations

Environmental Studies

- Hydrogeology
  - Groundwater study program started
  - Further testing in 2015
- Fisheries Study
  - Survey of fish habitat and fish population in project footprint completed
- Geochemistry
  - Field tests initiated to study waste rock samples
- Water Quality
  - Quarterly water quality sampling ongoing
- Historic Resources
  - Analysis of historic resources completed
  - No historic resources found on Project site



Environmental Management

- Safety and environmental stewardship are priorities for CFI
- Several environmental management plans will be developed prior to start of construction
  - Objectives of environmental management plans:
    - Document roles and responsibilities of team and contractors
    - Provide methods to monitor compliance
    - Identifies mitigation measures
  - Examples of Environmental Management Plans:
    - Environmental Protection Plan
    - Waste Management Plan
    - Environmental Effects Monitoring Plan
    - Water Management Plan
    - Rehabilitation and Closure Plan

- Plans will be updated during the various Project phases

Community

Employment

- AGS Construction (2 years): 350-375 workers
- AGS Operations (10 years): 150-175 workers
  - Prioritize local employment and procurement
  - Maintain strong employment standards
    - Gender equity
    - Workforce diversity
  - Emphasis on health and safety of workers

Cynthia Farrell Photo

Company donated science kits to St. Lawrence Academy and Lawn's Holy Name of Mary Academy

Community Investments

- Tax Agreement with Town of St. Lawrence
- Training Partnership with Keyin College
- Support various local community initiatives and events

Next Steps

- Upcoming AGS Project Milestones
  - April 2015: Pre-Feasibility Study
  - May 2015: Submit EA Registration to NL Government
  - Public review period and Minister decision after submission
- Continuous engagement with community members and other stakeholders throughout the EA process
- Construction cannot proceed until EA is completed and permits acquired

Your input is important and will be incorporated into Project planning and design

Questions?

Visit us at the various Project stations to discuss with our experts.

If you would like additional information after this meeting, please contact CFI (NL): (709) 873-3331

Consultation Materials

Exit Surveys

Canada Fluorspar Inc.
AGS Project Open House
St. Lawrence, Newfoundland
April 16, 2015

EXIT SURVEY

We appreciate your interest in this Public Information Session for the AGS Project in St. Lawrence. Please take a few minutes to complete this survey by either placing a check mark in the appropriate box or by providing a written response. Your feedback is important to us.

1. How did you learn about this Open House (please check all that apply)?

- ❑ Newspaper
- ❑ Letter
- ❑ Notice Posted in Community
- ❑ Friend
- ❑ Other: ______________________________

2. Which community do you reside in? ______________________________

3. Was the information in the presentation useful?

- ❑ Very useful, a lot of new information
- ❑ Somewhat useful, some new information
- ❑ Neutral, no new information
- ❑ Not very useful, need more information

4. If you asked a question, were the answers provided by CFI and/or Golder representatives useful?

- ❑ Very useful, a lot of new information
- ❑ Somewhat useful, some new information
- ❑ Neutral, no new information
- ❑ Not very useful, need more information

5. What was your main reason for attending this Open House?

____

6. Are there any water bodies you use for fishing near the Project area?

- ❑ Yes
- ❑ No

If you answered yes, please provide the names and/or location of water bodies you use for fishing:

____

____

7. Are there any water bodies you use for recreational activities, other than fishing, near the Project area?

- ❑ Yes
- ❑ No

If you answered yes, please provide the names and/or location of water bodies you use for recreational activities, other than fishing:

____

____

Canada Fluorspar Inc.
AGS Project Open House
St. Lawrence, Newfoundland
April 16, 2015

8. **Please rate your value of Grebes Nest Pond on a scale of 1 to 5 (1** = "I place very little value on Grebes Nest Pond and rarely use the area around the pond" and **5**= "I place a high level of value on Grebes Nest Pond and use the area around the pond frequently**"). Circle one number below:**

1 2 3 4 5

9. **What types of activities (if any) do you practice in the area around Grebes Nest Pond?**

- ❑ Walking/Hiking
- ❑ Cross-Country Skiing
- ❑ Fishing
- ❑ Other

Please explain: ____

____

10. **Please provide any additional comments related to Grebes Nest Pond:**

____

____

11. **Please provide any additional questions or comments related to the Project:**

____

____

____

____

____

OPTIONAL: Please provide your contact information below if you would like to receive Project update information. Note that the answers to your questions will remain confidential.

Name: ____

Address: ____

Phone: ______________________________ Email: ____

Thank you for taking the time to fill out this comment form.

For more information please contact us at 709-873-3331

APPENDIX D

Baseline Water Quality Report

May 20, 2015

AGS PROJECT PRELIMINARY WATER QUALITY BASELINE

Canada Fluorspar Inc. AGS Project Preliminary Water Quality Baseline Report

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REPORT

Report Number: 1407707 (DOC#0013 - Rev 1)

Distribution:

Canada Fluorspar Inc. - PDF
Golder Associates Ltd. - PDF

Golder Associates

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1.0 INTRODUCTION

This report presents the results of a preliminary water quality sampling and testing program to establish background levels of various parameters in surface water around the AGS Mine Project (the Project) site. These results will support the permitting for the Project, a proposed fluorite mine located on the Burin Peninsula, Newfoundland. The Project area situated entirely within the municipal boundaries of the Town of St Lawrence and located to the west of the community (Figure 1).

1.1 Scope of Work

CFI retained Golder Associates Ltd. (Golder) to carry out a baseline water quality study. The scope of work is summarized as:

- Sampling and testing of surface water to establish a predevelopment water quality baseline throughout the Project area;
- Compiling of past investigations' water quality results; and
- Comparison of the laboratory results with the Canadian Water Quality Guidelines for the Protection of Aquatic Life (CCME 2007) and Newfoundland and Labrador Regulation 65/03 for Environmental Control Water and Sewage Regulations (ECWSR) (2003).

1.2 Project Description Overview

St. Lawrence has a long mining history. The area's mineral potential was recognized in the 1840's, when a reference to fluorspar was recorded by Joseph Jukes, a renowned British geologist, who noted a small vein containing "flurate of lime". In 1928, the Black Duck vein was rediscovered and the first producing fluorspar mine was established in 1933 by the St. Lawrence Corporation and Newfoundland Fluorspar Ltd. These two operators were eventually acquired by Alcan: Newfoundland Fluorspar Ltd in 1940; and St. Lawrence Corporation in 1965. The mine was operated under the name "Alcan, Newfluor Works". Because of depressed global fluorspar prices, low production costs of fluorspar in Mexico, and labour problems in St Lawrence, Alcan closed the St. Lawrence operation in 1978 (CFI 2009).

After an eight year hiatus, mining resumed under a new operator, St. Lawrence Fluorspar Limited, a subsidiary of Minworth Ltd based in the United Kingdom. However, this operation was short-lived: project underfunding forced it into receivership in 1991. With this, almost 60 years of nearly continuous mining came to a close in St Lawrence (CFI 2009).

The Proposed Project is located southwest from the Town of St. Lawrence (Figure 1). Recent exploration work carried out by CFI revealed that the AGS deposit is more favourable for development due to accessibility of the AGS Vein for open pit mining. Based on this information, CFI decided to proceed with the development of the AGS Vein instead of proceeding with the reactivation of the previously approved Tarefare and Blue Beach North underground mines.

2.0 STUDY AREA

The study area for the water quality program was selected based on preliminary desktop reviews and an understanding of the Project at the time of the sampling program. The study area is defined as the main watersheds where mining and associated activities (e.g., milling and tailings storage) will occur. The water quality baseline study area was developed in conjunction with the hydrology, hydrogeology and aquatic ecology disciplines. For the purpose of the water quality baseline study, five watersheds have been identified in the study area (Figure 2) and include; Shoal Cove, Salt Cove, Grebes Nest, Upper Island Pond and Northwest Pond.

The existing mill site and the former tailings facility are located in the Shoal Cove watershed, which is approximately 3.9 km^2 in size. The catchment encompasses two ponds (Shoal Cove Pond [15.7 hectares (ha)] and Clarkes Pond [10.0 ha]) as well as the brook itself (ADI Nolan Davis 1990). During previous mining activities, Shoal Cove Pond was used for tailings deposition.

The valleys located near the centre of the study area form the Salt Cove watershed, where the previously mined Tarefare and Director Veins are located. The size of the topographic catchment of Salt Cove to the sea is approximately 24.7 km^2. The Salt Cove Brook watershed covers Salt Cove from its mouth at Salt Cove, northward to the outlet of Haypook Pond. The outflow of Haypook Pond currently flows through a man-made diversion channel constructed in the 1950s to redirect water from the Director Mine area. The Salt Cove watershed also encompasses two larger ponds outside the Project area; Haypook and Long Pond.

In the vicinity of the AGS Vein, there are four watersheds (Figure 2). The largest is the Grebes Nest watershed (approximately 5.5 km^2), followed by the Upper Island watershed (approximately 2.5 km^2), and two small watersheds to the northwest (approximately 0.6 km^2 each); Northwest Pond watershed and Mine Cover watershed.

3.0 METHODS

The water quality baseline study included a water quality sampling program conducted in 2014 and compilation of previous water quality results from the study area. The 2014 program and compilation of previous results are discussed in detail in the following sections.

3.1 2014 Sampling Program

The 2014 sampling program was carried out to continue and expand the data collection of the existing water quality conditions in the study area. The following sections describe the locations of the sampling stations and timing of sample collection for surface water as well as the criteria, parameters, sampling methods used during the sampling program.

3.1.1 Location and Timing of Sampling

Surface water quality sampling was completed from November 3 to 4, 2014 to provide a baseline of the existing surface water quality that could be compared against future potential adverse effects on surface water as a result of the proposed mining operations for the Project.

The field investigation program consisted of baseline surface water sampling from eight (8) streams and four (4) ponds (WQ STA-1 to WQ STA-9, WS-2, WS-5, and WS-10). Samples were collected from five separate watersheds – Grebes Nest (WQ STA 2 to WQ STA 4 and WQ STA 6), Upper Island Pond (WQ STA 1 and WQ STA 7), Mine Cove (WQ STA 8 and WQ STA 9) Shoal Cove (WS-2, WS-5) and Salt Cove (WS-10). One sample location (WQ STA 5) was from a reference area outside the five watersheds. Sampling locations are shown on Figure 2.

Sampling was conducted in accordance with standard practices as outlined in the Protocols Manual for Water Quality Sampling in Canada (CCME, 2011) to obtain a representative sample and to avoid cross contamination between monitoring locations, and one blind duplicate sample was taken for Quality Assurance/Quality Control (QA/QC) purposes. Chemical analysis was carried out by Maxxam Analytics Inc. (Maxxam).

Sample location coordinates were obtained using a hand-held Garmin Geographical Positioning System (GPS) Device Model No 60Sx. The average accuracy of this device is within 3 metres (m) (Garmin 2014). Sample location coordinates are provided in the Table 3-1.

Table 3-1: Water Quality Sampling Locations

Station ID	Location	Watershed	Northing	Easting
WQ STA 1	Upper Island Pond	Upper Island	5,195,500	617,488
WQ STA 2	Grebes Nest Pond outlet	Grebes Nest	5,196,191	616,862
WQ STA 3	John Fitzpatrick Pond outlet	Grebes Nest	5,196,679	617,043
WQ STA 4	Downstream from John Fitzpatrick Pond	Grebes Nest	5,197,032	616,903
WQ STA 5	Reference area	Reference Area	5,199,379	616,772
WQ STA 6	Downstream of John Fitzpatrick Pond	Grebes Nest	5,198,773	616,342
WQ STA 7	Downstream of Upper Island Pond	Upper Island Pond	5,195,035	617,429
WQ STA 8	Unnamed Pond	Mine Cove	5,196615	616,310
WQ STA 9	Downstream of Unnamed Pond	Mine Cove	5,196,637	616,281
WS – 10	Salt Cove Brook	Salt Cove	5,193512	620,347
WS – 2	Clarkes Pond outlet	Shoal Cove	5,195673	621,983
WS – 5	Shoal Cove Pond outlet	Shoal Cove	5,194,407	622,011

3.1.2 Parameters

Water quality analysis covered a range of parameters selected to be generally consistent with the government criteria. The following sections summarize and describe the criteria that were used as part of the data analysis, as well as the specific parameters that were analyzed for to establish baseline surface water quality.

3.1.2.1 Applicable Criteria

The results of the baseline water quality program were compared to the following criteria:

- Newfoundland and Labrador ECWSR (2003); and
- Canadian Council of Ministers of the Environment (CCME) water quality guidelines for the protection of aquatic life (CCME 2007).

The criteria for several metals are presented as a range of values dependent on other water quality parameters such as hardness or pH. In these cases, the parameter-dependent criteria were calculated based on the result for each water quality sample.

3.1.2.2 Analytes

Analytes were chosen to be consistent with the applicable criteria. Baseline water quality samples were submitted for the following analyses:

- **Field parameters** – temperature, pH, conductivity, dissolved oxygen;
- **General parameters** - pH, alkalinity, acidity, conductivity, total dissolved solids (TDS), total suspended solids (TSS), turbidity, true colour, biological oxygen demand (BOD), chemical oxygen demand (COD), total organic carbon (TOC), dissolved organic carbon (DOC), total inorganic carbon (TIC), dissolved inorganic carbon (DIC);
- **Major ions** – calcium, chloride, fluoride, bromide, magnesium, potassium, sodium, silica, sulphate, carbonate (CO_3^-), bicarbonate (CO_3^{2-}). Hardness was calculated based on major ions;
- **Nutrients** – nitrate (NO_3-N), nitrite (NO_2-N), total ammonia (NH_3-N) and total phosphorus;
- **Metals** – total aluminum, antimony, arsenic, boron, barium, beryllium, bismuth, cadmium, chromium, cobalt, copper, iron, lead, lithium, manganese, molybdenum, nickel, selenium, silicon, silver, strontium, tellurium, thallium, tin, titanium, tungsten, uranium, vanadium, zinc and zirconium; and,
- **Mercury** – trace concentrations of mercury.

3.1.3 Sampling Methods

The sampling method used to collect the water samples was the grab sample method, which means the sample was taken during a single sampling event. Where possible the sample containers were filled directly from the surface water source. For sample containers that contained preservatives (pre-charged), samples were collected using another bottle and transferred by pouring into the pre-charged bottles. These water quality samples were not field filtered and therefore provide total concentrations of each analyte. At the time of sampling, field measurements of pH, temperature, and conductivity were collected with a pH/temperature meter and a conductivity/temperature meter.

The following sample collection protocols for general parameters:

- **Calibration** – field parameters were measured with a pH/temperature meter and a conductivity/temperature meter calibrated by the supplier and in the field with calibration solutions provided by the supplier. Calibration for pH (at least two points: 4 and 7), electrical conductivity and redox potential was carried out daily before sampling began and documented in the field notes. Dissolved oxygen was calibrated by the lab prior to equipment release.
- **Sampling Equipment and Handling** – Sterile gloves were worn during sample collection. Sample bottles were provided by the contract analytical laboratory. Sample bottles were generally pre-charged with the appropriate preservatives at the analytical laboratory. Samples were stored in a cooler with ice packs and maintained in a cool state until shipped to the laboratory.
- **Documentation** – Field staff labelled samples with unique sample numbers. Field observations (e.g., weather, surrounding vegetation, substrate, clarity, colour, odour, etc.), as well as the sample collection procedures, techniques and sampling crew were documented. Photographs were taken at each location.
- **River and Stream Equipment and Handling** – water samples were collected facing upstream of the flow and as far from the bank as safely possible, carefully wading out to avoid disturbing the bottom sediment. Sample bottles were immerged below the water surface and facing upstream to avoid introducing any disturbed bottom sediment into the sample. The cap was removed under water and the bottle was let to fill with the current. The bottle was recapped before lifting it out of the water. Bottles pre-charged with preservatives were filled by pouring off the contents of the General Parameters bottle.
- **Field Parameter Measurements** – Measurements of pH, temperature and electrical conductivity were collected in the field at the time of sampling, where practical.

3.1.3.1 Quality Assurance / Quality Control

A QA/QC duplicate sample was collected during the sample campaign from WS4. No statistical difference was noted between the two samples. The QA/QC procedures were in addition to the internal QA/QC requirements and programs of the analytical laboratory.

3.2 Previous Investigations Data Compilation

As part of the surface water quality baseline, previous investigations' water quality results for the Project were compiled for comparison. Previous investigations for the Project included historical results from the Shoal Cove and Salt Cove watersheds between 1984 and 1985 (historical), operations results from the Shoal Cove watershed between 1987 and 1990 (operations) and baseline results from the Shoal Cove and Salt Cove watersheds in 2009 (recent baseline).

The previous water quality results have been tabulated and are discussed in the results section.

4.0 WATER QUALITY RESULTS

Water quality results are summarized below and presented in Table 4-1 to Table 4-4. The 2014 Certificate of Analysis reports can be found in Appendix A. The results are presented for the AGS watershed, historical baseline for Shoal Cove and Salt Cove watersheds, operations for Shoal Cove watershed and recent baseline for the Shoal Cove and Salt Cove watershed. The TMA watershed results include both previous investigation results (AMEC 2009) and results from this investigation.

4.1 AGS Watersheds

The 2014 water quality results for the AGS Project watersheds are presented in Table 4-1. The water quality results are compared to CCME and ECWSR guidelines. Parameters that exceeded guidelines are summarized as follows:

- Surface water sample pH values ranged from (5.0 – 6.2) and were below CCME guideline (6.5 – 9.0) for all nine samples.
- Fluoride concentrations ranged from <0.10 mg/L to 0.24 mg/L and were greater than CCME guideline (0.12 mg/L) in five samples.
- Total phosphorus concentrations were greater than CCME guideline (0.0005 mg/L) at six locations and ranged from <0.020 mg/L to 0.031 mg/L. Note that the detection limit for total phosphorus was greater than the guideline.
- All surface water samples exceeded the CCME guideline (0.005 mg/L) for aluminium. The results for aluminum ranged from 0.13 mg/L to 0.61 mg/L for samples collected.
- Iron concentrations ranged from 0.14 mg/L to 0.66 mg/L and exceeded CCME guideline (0.3 mg/L) in five surface water samples.
- Lead concentrations were greater than CCME guidelines (variable) in one sample and ranged from 0.00025 mg/L to 0.0014 mg/L.

4.2 Historical – Shoal Cove and Salt Cove Watersheds

The historical water quality data (Table 4-2) were collected in 1984 and 1985 and consisted of 15 samples collected from seven stations and Clarkes Pond. The results are summarized as follows:

- pH values ranged from 6.2 – 8.5 and were below CCME guideline (6.5 – 9.0) in five samples.
- Fluoride concentrations were only analysed in Clarkes Pond (4.5 mg/L) and exceeded CCME guideline (0.12 mg/L).
- Total phosphorus concentrations were only analysed in Clarkes Pond (0.041 mg/L) and exceed CCME guideline (0.0005 mg/L).
- Aluminum concentrations ranged from <0.025 mg/L to 0.19 mg/L and were greater than CCME guidelines (variable) in six samples. All concentrations that exceeded were from the 1985 sampling program.

- Cadmium concentrations were less than detection (<0.01 mg/L) except in Clarkes Pond (0.0004 mg/L). Concentrations were above CCME guideline (0.00009 mg/L) in Clarkes Pond.
- Copper concentrations ranged from <0.01 mg/L to 0.02 mg/Land were greater than CCME guidelines (variable) in five samples.
- Iron concentrations ranged from 0.12 mg/L to 0.78 mg/L and were greater than CCME guideline (0.3 mg/L) in five samples.
- Lead concentrations ranged from 0.002 mg/L to 0.03 mg/L and were greater than CCME guidelines (variable) in four samples.

4.3 Operations – Shoal Cove Watershed

Operations surface water quality data (Table 4-3) were collected between 1987 and 1990 at select locations between Clarkes Pond inlet and Shoal Cove Pond outlet. The results are summarized as follows:

- pH values were within CCME guidelines (6.5 – 9.0) throughout operations at locations analysed with the exception of one sample from the tailings pond inlet. Values ranged from 6.9 – 9.1.
- Fluoride concentrations ranged from 0.95mg/L to 52 mg/L throughout operations and were greater than CCME guideline (0.12 mg/L) at all locations.
- TDS concentrations ranged from 65 mg/L to 3,605 mg/L throughout operations and were greater than ECWSR guidelines (1,000 mg/L) at the tailings pond outlet, decant final holding dam and Shoal Cove Pond inlet in at least one sample.
- TSS concentrations ranged from 0.36 mg/L to 529 mg/L and were greater than ECWSR guidelines (30 mg/L) at the Clarkes Pond inlet, Clarkes Pond outlet, decant final holding dam, Shoal Cove Pond inlet and Shoal Cove Pond outlet in at least one sample.
- Iron concentrations ranged from 0.004 mg/L to 277 mg/L and were greater than CCME (0.3 mg/L) and ECWSR (10 mg/L) guidelines in at least one sample at all locations.
- Lead concentrations ranged from 0.02 mg/L to 3.0 mg/L and were greater than CCME (variable) and ECWSR (0.2 mg/L) guideline in at least one sample at all locations.
- Zinc concentrations ranged from 0.004 mg/L to 140 mg/L and were greater than CCME (0.03 mg/L) and ECWSR (0.5 mg/L) guideline in at least one sample at all locations.

4.4 Recent Baseline – Shoal Cove and Salt Cove Watersheds

Recent baseline water quality data (Table 4-4) were collected from fifteen stations in 2009 and from three select stations in 2014. The results are summarized as follows:

- pH values ranged from 5.9 – 7.3 and were below CCME guideline (6.5 – 9.0) at three locations (WS1, WS7 and WS13).
- Fluoride concentrations ranged from 0.11 mg/L to 2.6 mg/L and were above CCME guideline (0.12 mg/L) at twelve sample locations.

- Total phosphorus concentrations were only analysed in 2014 and ranged from <0.02 mg/L to 0.029 mg/L. Concentrations were above ECWSR guideline (0.0005 mg/L) at WS10. However, the detection limit was also above ECWSR guidelines.
- Aluminum concentrations ranged from 0.03 mg/L to 0.58 mg/L and were greater than CCME guidelines (variable) at eleven sample locations.
- Cadmium concentrations ranged from 0.000021 mg/L to 0.00016 mg/L and were greater than CCME guideline (0.00009 mg/L) at seven sample locations.
- Iron concentrations ranged from 0.053 mg/L to 0.62 mg/L and were greater than CCME guideline (0.3 mg/L) at three sample locations.
- Lead concentrations ranged from <0.001 mg/L to 0.006 mg/L and were greater than CCME guidelines (variable) at six sample locations.

5.0 SUMMARY AND CONCLUSIONS

A baseline water quality program was conducted for the AGS Project to establish existing concentrations of various parameters in surface water within five watersheds across the Project site. Water quality analysis has been conducted in five watersheds between 1984 and 2014. This includes historical and recent baseline results from the Shoal Cove and Salt Cove watersheds in 1984 to 1985, 2009 and 2014, operations results in the Shoal Cove watershed from 1986 to 1990 and baseline results from the AGS watersheds in 2014. Water quality results were compiled and compared to the Newfoundland and Labrador ECWSR and the CCME water quality guidelines for the protection of aquatic life (CCME 2007) to identify any potential parameters of concern.

The water quality results from all six watersheds (Shoal Cove, Salt Cove, Grebes Nest, Upper Island Pond, Northwest Pond and Mine Cove) show select parameters including; aluminum, cadmium, fluoride, iron, lead, phosphorus and to a lesser extent, copper and zinc have concentrations that are greater than the CCME and/or ECWSR guidelines.

6.0 RECOMMENDATIONS

Additional baseline water quality sampling is recommended during 2015. The surface water quality baseline program should focus on the collection of surface water samples and in situ measurements of temperature, depth, pH, dissolved oxygen, and conductivity (measured using a multi-parameter meter) at the inflow and outflow to select water bodies and along select watercourses.

Sampling stations should be consistent with the stations sampled during the 2014 program. Sampling frequency is proposed in Table 6-1 to collect samples in the wet (May), dry (July/August) and transitional seasons (October and February). The purpose of sampling over multiple seasons in a year is to gain a better understanding of the potential baseline range in concentrations of parameters prior to the Project development.

Table 6-1: Water Quality Sampling Schedule

Station ID	Location	Water Sampling Schedule
WQ STA 1	Upper Island Pond	May, July/Aug, Oct, Feb
WQ STA 2	Grebes Nest Pond outlet	May, July/Aug, Oct, Feb
WQ STA 3	John Fitzpatrick Pond outlet	May, July/Aug, Oct, Feb
WQ STA 4	Downstream from John Fitzpatrick Pond	May, July/Aug, Oct, Feb
WQ STA 5	Reference area	May, July/Aug, Oct, Feb
WQ STA 6	Downstream of John Fitzpatrick Pond	May, July/Aug, Oct, Feb
WQ STA 7	Downstream of Upper Island Pond	May, July/Aug, Oct, Feb
WQ STA 8	Unnamed Pond	May, July/Aug, Oct, Feb
WQ STA 9	Downstream of Unnamed Pond	May, July/Aug, Oct, Feb
WS – 10	Salt Cove Brook	May, July/Aug, Oct, Feb
WS – 2	Clarkes Pond outlet	May, July/Aug, Oct, Feb
WS – 5	Shoal Cove Pond outlet	May, July/Aug, Oct, Feb

7.0 REFERENCES

AMEC, 2009. Water Quality and Fish Habitat Program in St. Lawerence: Proposed Re-Activation of Fluorspar Mine. Report Submitted to SNC-Lavalin, October 2009.

CCME (Canadian Council of Ministers of the Environment), 2007. Canadian Water Quality Guidelines for the Protection of Aquatic Life. Winnipeg.

CCME (Canadian Council of Ministers of the Environment), 2011. Protocols Manual for Water Quality Sampling in Canada. Winnipeg.

Newfoundland and Labrador Water Resource Act, 2003. Environmental Control Water and Sewage Regulations. Newfoundland and Labrador Regulation 65/03.

TABLES

Table 4-1
Surface Water Quality Analysis - AGS Watershed
Canada Fluorspar Inc.

Parameters	Unit	CCME Freshwater Quality Longterm Guideline [1]	Newfoundland and Labrador Regulation 65/03, Schedule A [2]	WQ STA-1	WQ STA-2	WQ STA-3	WQ STA-4	WQ STA-5	WQ STA-6	WQ STA-7	WQ STA-8	WQ STA-9	Statistics			
				4-Nov-14	3-Nov-14	4-Nov-14	4-Nov-14	4-Nov-14	4-Nov-14	4-Nov-14	4-Nov-14	4-Nov-14	Count	Minimum	Maximum	Average
General Chemistry																
Ammonia	mg/L	-	2	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	9	0.025	0.025	0.025
Bicarbonate	mg/L	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	9	0.5	0.5	0.5
Biochemical Oxygen Demand	mg/L	-	20	-	-	-	-	-	-	-	-	-	0	-	-	-
Chemical Oxygen Demand	mg/L	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Bromide	mg/L	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	9	0.5	0.5	0.5
Carbonate	mg/L	-	-	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	9	0.5	0.5	0.5
Chloride	mg/L	120	-	13	13	13	14	10	9.7	14	13	13	9	9.7	14	13
Colour	TCU	-	-	120	69	31	34	65	69	89	73	67	9	31	120	69
Conductivity	µS/cm	-	-	56	54	52	52	39	40	54	53	54	9	39	56	50
Dissolved Organic Carbon	mg/L	-	-	12	7.2	4.1	4.3	6.7	6.6	9.6	7.0	7.5	9	4.1	12	7.2
Fluoride	mg/L	0.12	-	**0.22**	**0.24**	**0.16**	**0.16**	<0.10	<0.10	**0.21**	<0.10	<0.1	9	0.05	0.24	0.13
Hardness as CaCO3	mg/L	-	-	7.8	7.7	6.6	6.7	6.3	6.5	7.8	4.6	4.5	9	4.5	7.8	6.5
Nitrate as N	mg/L	13	10	<0.050	0.058	<0.05	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	9	0.025	0.058	0.029
Nitrite as N	mg/L	0.06	-	<0.010	<0.01	<0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	9	0.005	0.005	0.005
Nitrate + Nitrite	mg/L	-	-	<0.050	0.058	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	9	0.025	0.058	0.029
Ortho-phosphate	mg/L	-	-	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	9	0.005	0.005	0.005
pH	-	6.5 - 9.0	-	**5.9**	**6.2**	**5.7**	**5.7**	**6.0**	**6.0**	**5.9**	**5.0**	**5.2**	9	5.0	6.2	5.5
Reactive Silica	mg/L	-	-	2.8	2.2	0.84	0.9	1.9	1.9	2.3	0.6	0.67	9	0.6	2.8	1.6
Sulphate	mg/L	-	-	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	9	1.0	1.0	1.0
Sulphide	mg/L	-	0.5	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	<0.020	9	0.01	0.01	0.01
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Total Alkalinity ($CaCO_3$)	mg/L	-	-	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	9	2.5	2.5	2.5
Total Dissolved Solids (Theo) [8]	mg/L	-	1000	-	-	-	-	-	-	-	-	-	0	-	-	-
Total Dissolved Solids (Calculated) [9]	mg/L	-	1000	28	27	25	26	21	21	29	23	24	9	21	29	25
Total Dissolved Solids (Measured)	mg/L	-	1000	63	49	38	38	46	51	61	37	36	9	36	63	47
Total Organic Carbon	mg/L	-	-	11	6.9	4.1	4.1	6.9	6.9	9.3	6.6	7.5	9	4.1	11	7.0
Total Phosphorus	mg/L	-	0.0005	0.027	<0.020	<0.020	0.03	0.025	0.025	0.031	0.03	<0.020	9	0.01	0.031	0.022
Total Suspended Solids	mg/L	-	30	1.6	1.4	1.0	<1.0	1.4	1.4	1.2	<1.0	<1.0	9	0.5	1.6	1.1
Turbidity	NTU	-	-	2.9	1.0	0.92	0.63	0.83	1.0	2.6	0.64	0.6	9	0.6	2.9	1.2
Cations																
Calcium	mg/L	-	-	1.4	1.4	1.1	1.1	1.5	1.5	1.4	0.38	0.38	9	0.38	1.5	1.1
Magnesium	mg/L	-	-	1.0	1.0	0.96	0.98	0.64	0.68	1.0	0.89	0.86	9	0.64	1.0	0.89
Potassium	mg/L	-	-	0.49	0.4	0.3	0.29	0.32	0.3	0.4	0.25	0.27	9	0.25	0.49	0.34
Sodium	mg/L	-	-	8.3	8.3	7.9	7.8	5.9	6.1	8.2	8.2	8.3	9	5.9	8.3	7.7
Ion Balance																
Cation Sum	meq	-	-	0.55	0.54	0.49	0.49	0.41	0.42	0.54	0.47	0.47	9	0.41	0.55	0.49
Anion Sum	meq	-	-	0.39	0.38	0.38	0.41	0.29	0.27	0.42	0.36	0.36	9	0.27	0.42	0.36
Ion Balance	%	-	-	17	17	13	8.9	17	22	13	13	13	9	8.9	22	15
Total Metals																
Aluminum	mg/L	Variable [3]	-	**0.61**	**0.33**	**0.17**	**0.18**	**0.13**	**0.13**	**0.46**	**0.29**	**0.28**	9	0.13	0.61	0.29
Antimony	mg/L	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	9	0.0005	0.0005	0.0005
Arsenic	mg/L	0.005	0.5	0.0012	<0.001	<0.001	<0.001	<0.001	<0.001	0.0011	<0.001	<0.001	9	0.0005	0.0012	0.00064
Boron	mg/L	1.5	5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	9	0.025	0.025	0.025
Barium	mg/L	-	5	0.0083	0.0037	0.0032	0.0031	0.014	0.013	0.0085	0.0031	0.0026	9	0.0026	0.014	0.0066
Beryllium	mg/L	-	-	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	9	0.0005	0.0005	0.0005
Bismuth	mg/L	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	9	0.001	0.001	0.001
Cadmium	mg/L	0.00009	0.05	0.000037	0.00003	0.000017	0.000022	0.000021	0.000025	0.000029	0.000044	0.00004	9	0.000017	0.000044	0.000029
Calcium	mg/L	-	-	1.4	1.4	1.1	1.1	1.5	1.5	1.4	0.38	0.38	9	0.38	1.5	1.1
Chromium	mg/L	-	0.05 [7]	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	9	0.0005	0.0005	0.0005
Cobalt	mg/L	-	-	0.00054	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	<0.0004	9	0.0002	0.00054	0.00024
Copper	mg/L	Variable [4]	0.3	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	9	0.001	0.001	0.001
Iron	mg/L	0.3	10	**0.66**	**0.44**	0.14	0.14	**0.53**	**0.53**	**0.52**	0.15	0.2	9	0.14	0.66	0.37
Lead	mg/L	Variable [5]	0.2	**0.0014**	0.00088	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	0.00092	0.00096	0.00068	9	0.00025	0.0014	0.00065
Lithium	mg/L	-	-	0.0027	0.0021	<0.002	<0.002	<0.002	<0.002	0.0022	<0.002	<0.002	9	0.001	0.0027	0.0014
Magnesium	mg/L	-	-	1.0	1.0	0.96	0.98	0.64	0.68	1.0	0.89	0.86	9	0.64	1.0	0.89
Manganese	mg/L	-	-	0.022	0.019	0.0061	0.0069	0.025	0.024	0.011	0.034	0.035	9	0.0061	0.035	0.02
Mercury	mg/L	0.000026	0.005	<0.000013	<0.000013	<0.000013	<0.000013	<0.000013	<0.000013	<0.000013	<0.000013	<0.000013	9	0.0000065	0.0000065	0.0000065
Molybdenum	mg/L	0.073	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	9	0.001	0.001	0.001
Nickel	mg/L	Variable [6]	0.5	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	9	0.001	0.001	0.001
Phosphorus	mg/L	-	0.0005	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	9	0.05	0.05	0.05
Potassium	mg/L	-	-	0.49	0.4	0.3	0.29	0.32	0.3	0.4	0.25	0.27	9	0.25	0.49	0.34
Selenium	mg/L	0.001	0.01	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	9	0.0005	0.0005	0.0005
Silicon	mg/L	-	-	1.5	1.1	<0.5	<0.5	0.83	0.88	1.2	<0.5	<0.5	9	0.25	1.5	0.72
Silver	mg/L	0.0001	0.05	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	9	0.00005	0.00005	0.00005
Sodium	mg/L	-	-	8.3	8.3	7.9	7.8	5.9	6.1	8.2	8.2	8.3	9	5.9	8.3	7.7
Strontium	mg/L	-	-	0.01	0.0096	0.0083	0.0084	0.011	0.012	0.0098	0.0057	0.0053	9	0.0053	0.012	0.0089
Sulphur	mg/L	-	-	<5	<5	<5	<5	<5	<5	<5	<5	<5	9	2.5	2.5	2.5
Tellurium	mg/L	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	9	0.001	0.001	0.001
Thallium	mg/L	0.0008		<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	<0.00010	9	0.00005	0.00005	0.00005
Tin	mg/L	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	9	0.001	0.001	0.001
Titanium	mg/L	-	-	0.0072	0.0028	<0.002	<0.002	0.0025	<0.002	0.0037	0.0029	0.0025	9	0.001	0.0072	0.0027
Uranium	mg/L	0.015		<0.00010	<0.00010	<0.00010	<0.00010	0.00019	0.00021	<0.00010	<0.00010	<0.00010	9	0.00005	0.00021	0.000083
Vanadium	mg/L	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	9	0.001	0.001	0.001
Zirconium	mg/L	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	9	0.001	0.001	0.001
Zinc	mg/L	0.03	0.5	0.0089	0.0063	<0.005	<0.005	0.0025	<0.005	0.005	0.0089	0.0077	9	0.0025	0.0089	0.0052

Notes:

-	Not analyzed
nd	Result not detected
1.0	Result exceeds CCME Freshwater Quality Longterm Guideline
1.0 (underlined)	Results exceeds Newfoundland and Labrador Regulation 65/03, Schedule A
1.0 (shaded)	Non-detect result exceeds one or both guidelines presented.

1. Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life.

2. Newfoundland and Labrador Regulation 65/03. 2003. Environmental Control Water and Sewage Regulations, Water Resources Act (O.C. 2003-231).

3. If pH < 6.5, guideline is 5 µg/L. If pH > 6.5, guideline is 100 µg/L.

4 If water hardness (as CaCO3) is 0 to < 82 mg/L, guideline is 2 µg/L.
At hardness ≥ 82 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $0.2 * e^{\{0.8545[\ln(hardness)] - 1.465\}}$
At hardness > 180 mg/L, guideline is 4 µg/L.

5. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 1 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{1.273[\ln(hardness)] - 4.705\}}$
At hardness > 180 mg/L, guideline is 7 µg/L.

6. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 25 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{0.76[\ln(hardness)] + 1.06\}}$
At hardness > 180 mg/L, guideline is 150 µg/L.

7. Guideline is for hexavalent chromium. Guideline for trivalent chromium is 1000 µg/L.

8. Total Dissolved Solids (Theo) from APHA 2510 B.

9. Total Dissolved Solids (Calc) based on Standard Methods, Method 1030E-Checking Correctness of Analyses, and is calculated as follows: Total Dissolved Solids (mg/L) = Ca + Mg + Na + K + Cl + SO_4 + F + SiO_2 + [(NO_2+NO_3) * 4.43] + (PO_4 * 3.06) + (Total Alkalinity as $CaCO_3$ * 0.6) + (NH_4 * 1.21) + Fe + Mn

Table 4-2
Surface Water Quality Analysis - Historical Shoal Cove and Salt Cove Watersheds
Canada Fluorspar Inc.

Parameters	Unit	CCME Freshwater Quality Longterm Guideline [1]	Newfoundland and Labrador Regulation 65/03, Schedule A [2]	1	1	2	2	3	3	4	4	5	5	6	6	7	7	Clarke's Pond	Statistics			
				1-Jul-84	1-Jun-85	1-Jul-84	1-Jun-85	1-Jul-84	1-Jun-85	1-Jul-84	1-Jun-85	1-Jul-84	1-Jun-85	1-Jul-84	1-Jun-85	1-Jul-84	1-Jun-85	1-Oct-84	Count	Minimum	Maximum	Average
General Chemistry																						
Ammonia	mg/L	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.013	1	0.013	0.013	0.013
Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Biochemical Oxygen Demand	mg/L	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Chemical Oxygen Demand	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	31	1	31	31	31
Bromide	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Chloride	mg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	10	1	10	10	10
Colour	TCU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60	1	60	60	60
Conductivity	µS/cm	-	-	106	172	90	88	126	100	37	278	46	59	69	62	38	44	95	15	37	278	94
Dissolved Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Fluoride	mg/L	0.12	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	**4.5**	1	4.5	4.5	4.5
Hardness as CaCO3	mg/L	-	-	32	38	25	24	39	28	7.0	106	6.0	8.0	13	14	6.0	8.0	19	15	6.0	106	25
Nitrate as N	mg/L	13	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Nitrite as N	mg/L	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Nitrate + Nitrite	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.02	1	0.02	0.02	0.02
Ortho-phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
pH	-	6.5 - 9.0	-	7.7	8.5	7.5	7.1	7.6	7.3	6.7	7.5	**6.4**	**6.3**	6.8	**6.4**	6.5	**6.2**	**6.4**	15	6.2	8.5	6.7
Reactive Silica	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Sulphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Sulphide	mg/L	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.62	1	0.62	0.62	0.62
Total Alkalinity ($CaCO_3$)	mg/L	-	-	35	39	26	25	45	31	5.4	103	4.8	13	15	16	7.0	13	18	15	4.8	103	27
Total Dissolved Solids (Theo) [8]	mg/L	-	1000	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	<1	-	14	0.5	0.5	0.5
Total Dissolved Solids (Calculated) [9]	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Total Dissolved Solids (Measured)	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Total Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Total Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0.041	1	0.041	0.041	0.041
Total Suspended Solids	mg/L	-	30	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Turbidity	NTU	-	-	0.5	0.8	0.5	0.5	0.7	0.5	0.7	1.8	0.3	0.4	1.4	0.5	0.8	0.6	0.29	15	0.29	1.8	0.69
Cations																						
Calcium	mg/L	-	-	11	9.2	8.3	7.5	14	8.6	1.6	4.0	1.4	1.8	3.2	2.3	1.5	1.5	5.7	15	1.4	14	5.4
Magnesium	mg/L	-	-	1.2	1.9	1.1	1.2	1.3	1.1	0.63	1.5	0.78	0.92	1.2	1.1	0.62	0.66	1.3	15	0.62	1.9	1.1
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Ion Balance																						
Cation Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Anion Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Ion Balance	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Total Metals																						
Aluminum	mg/L	Variable [3]	-	0.06	**0.16**	<0.025	**0.19**	<0.025	**0.16**	<0.025	0.1	<0.025	**0.17**	<0.025	**0.14**	<0.025	**0.17**	-	14	0.013	0.19	0.088
Antimony	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Arsenic	mg/L	0.005	0.5	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	<0.05	-	14	0.025	0.025	0.025
Boron	mg/L	1.5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Barium	mg/L	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Cadmium	mg/L	0.00009	0.05	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	**0.0004**	15	0.0004	0.005	0.0047
Calcium	mg/L	-	-	11	9.2	8.3	7.5	14	8.6	1.6	4.0	1.4	1.8	3.2	2.3	1.5	1.5	5.7	15	1.4	14	5.4
Chromium	mg/L	-	0.05 [7]	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	0.02	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	14	0.005	0.02	0.0071
Cobalt	mg/L	-	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	<0.01	-	-	7	0.005	0.005	0.005
Copper	mg/L	Variable [4]	0.3	<0.01	<0.01	<0.01	**0.01**	<0.01	<0.01	<0.01	**0.02**	<0.01	<0.01	<0.01	**0.01**	<0.01	**0.02**	**0.01**	15	0.005	0.02	0.008
Iron	mg/L	0.3	10	0.18	0.18	0.18	0.13	0.21	0.17	**0.43**	**0.49**	0.14	0.12	**0.78**	**0.64**	**0.46**	0.3	0.19	15	0.12	0.78	0.31
Lead	mg/L	Variable [5]	0.2	<0.02	<0.02	<0.02	**0.03**	<0.02	<0.02	<0.02	<0.02	<0.02	**0.02**	<0.02	<0.02	<0.02	**0.02**	**0.002**	15	0.002	0.03	0.012
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Magnesium	mg/L	-	-	1.2	1.9	1.1	1.2	1.3	1.1	0.63	1.5	0.78	0.92	1.2	1.1	0.62	0.66	1.3	15	0.62	1.9	1.1
Manganese	mg/L	-	-	0.14	0.06	0.09	0.04	0.21	0.12	0.02	1.5	<0.01	0.02	0.03	0.03	0.02	0.02	0.04	15	0.005	1.5	0.16
Mercury	mg/L	0.000026	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Molybdenum	mg/L	0.073	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Nickel	mg/L	Variable [6]	0.5	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	-	14	0.005	0.005	0.005
Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Selenium	mg/L	0.001	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Silver	mg/L	0.0001	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Sulphur	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Tellurium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Thallium	mg/L	0.0008		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Uranium	mg/L	0.015		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Zirconium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	0	-	-	-
Zinc	mg/L	0.03	0.5	0.01	0.01	0.01	<0.01	<0.01	<0.01	<0.01	**0.04**	<0.01	<0.01	<0.01	<0.01	<0.01	<0.01	0.01	15	0.005	0.04	0.0087

Notes:

-	Not analyzed
nd	Result not detected
1.0	Result exceeds CCME Freshwater Quality Longterm Guideline
<u>1.0</u>	Results exceeds Newfoundland and Labrador Regulation 65/03, Schedule A
1.0	Non-detect result exceeds one or both guidelines presented.

1. Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life.

2. Newfoundland and Labrador Regulation 65/03. 2003. Environmental Control Water and Sewage Regulations, Water Resources Act (O.C. 2003-231).

3. If pH < 6.5, guideline is 0.005 mg/L. If pH > 6.5, guideline is 0.1 mg/L.

4 If water hardness (as CaCO3) is 0 to < 82 mg/L, guideline is 0.002 mg/L.
At hardness ≥ 82 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (mg/L) = $(0.2 * e^{\{0.8545[\ln(hardness)] - 1.465\}})/1000$
At hardness > 180 mg/L, guideline is 0.004 mg/L.

5. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 0.001 mg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (mg/L) = $(e^{\{1.273[\ln(hardness)] - 4.705\}})/1000$
At hardness > 180 mg/L, guideline is 0.007 mg/L.

6. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 0.025 mg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (mg/L) = $(e^{\{0.76[\ln(hardness)] + 1.06\}})/1000$
At hardness > 180 mg/L, guideline is 0.15 mg/L.

7. Guideline is for hexavalent chromium. Guideline for trivalent chromium is 1 mg/L.

8. Total Dissolved Solids (Theo) from APHA 2510 B.

9. Total Dissolved Solids (Calc) based on Standard Methods, Method 1030E-Checking Correctness of Analyses, and is calculated as follows: Total Dissolved Solids (mg/L) = $Ca + Mg + Na + K + Cl + SO_4 + F + SiO_2 + [(NO_2+NO_3) * 4.43] + (PO_4 * 3.06) +$ (Total Alkalinity as $CaCO_3 * 0.6) + (NH_4 * 1.21) + Fe + Mn$

Parameters	Unit	CCME Freshwater Quality Longterm Guideline [1]	Newfoundland and Labrador Regulation 65/03, Schedule A [2]	Clarke's Pond Inlet 1-Nov-86	Clarke's Pond Inlet 1-Dec-86	Clarke's Pond Inlet 1-Jan-87	Clarke's Pond Inlet 1-Feb-87	Clarke's Pond Inlet 1-Mar-87	Clarke's Pond Inlet 1-Apr-87	Clarke's Pond Inlet 1-May-87	Clarke's Pond Inlet 1-Jun-87	Clarke's Pond Inlet 1-Jul-87	Clarke's Pond Inlet 1-Aug-87	Clarke's Pond Inlet 1-Sep-87	Clarke's Pond Inlet 1-Mar-89	Clarke's Pond Inlet 1-Apr-89	Clarke's Pond Inlet 1-May-89	Clarke's Pond Inlet 1-Jun-89	Clarke's Pond Inlet 1-Jul-89	Clarke's Pond Inlet 1-Aug-89	Clarke's Pond Inlet 1-Sep-89	Clarke's Pond Inlet 1-Oct-89	Clarke's Pond Inlet 1-Nov-89	Clarke's Pond Inlet 1-Dec-89	Clarke's Pond Inlet 1-Jan-90
General Chemistry																									
Ammonia	mg/L	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand	mg/L	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chemical Oxygen Demand	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromide	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Colour	TCU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity	µS/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	0.12	-	-	-	-	-	-	-	-	-	-	-	-	**1.4**	**1.2**	**2.7**	**2.8**	**3.0**	**2.9**	**2.3**	**2.6**	**1.8**	**1.8**	**1.5**
Hardness as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	mg/L	13	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	mg/L	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate + Nitrite	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ortho-phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	-	6.5 - 9.0	-	7.8	7.9	8.1	8.2	8.1	7.9	8.3	7.9	8.0	8.2	7.9	8.1	8.0	8.2	8.2	8.2	8.3	8.2	8.2	8.3	9.0	8.4
Reactive Silica	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphide	mg/L	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Alkalinity ($CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (Theo) [8]	mg/L	-	1000	152	169	204	170	127	165	130	186	188	197	442	170	138	162	168	182	173	187	176	185	207	167
Total Dissolved Solids (Calculated) [9]	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (Measured)	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	-	30	<u>55</u>	<u>138</u>	<u>91</u>	<u>85</u>	<u>61</u>	8.0	<u>35</u>	<u>64</u>	<u>50</u>	<u>32</u>	<u>145</u>	<u>82</u>	<u>55</u>	<u>30</u>	30	<u>93</u>	<u>47</u>	<u>44</u>	<u>123</u>	<u>173</u>	<u>422</u>	<u>244</u>
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cations																									
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ion Balance																									
Cation Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anion Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ion Balance	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																									
Aluminum	mg/L	Variable [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.00009	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	0.05 [7]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	Variable [4]	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	0.3	10	-	-	-	-	-	-	-	-	-	-	-	-	**1.6**	**0.83**	**0.35**	**2.2**	**0.75**	**1.1**	**0.88**	**4.7**	-	-
Lead	mg/L	Variable [5]	0.2	-	-	-	-	-	-	-	-	-	-	-	-	**<u>0.33</u>**	**0.1**	**0.16**	**<u>1.1</u>**	**<u>0.21</u>**	**0.2**	**<u>0.85</u>**	**<u>2.4</u>**	-	-
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	0.000026	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.073	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	Variable [6]	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.001	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tellurium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0008		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	0.015		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zirconium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	0.03	0.5	-	-	-	-	-	-	-	-	-	-	-	-	**0.3**	**0.16**	**0.18**	**<u>1.5</u>**	**0.27**	**0.32**	**<u>1.1</u>**	**0.45**	-	-

Notes:

-	Not analyzed
nd	Result not detected
1.0	Result exceeds CCME Freshwater Quality Longterm Guideline
<u>1.0</u>	Results exceeds Newfoundland and Labrador Regulation 65/03, Schedule A
1.0	Non-detect result exceeds one or both guidelines presented.

1. Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life.

2. Newfoundland and Labrador Regulation 65/03. 2003. Environmental Control Water and Sewage Regulations, Water Resources Act (O.C. 2003-231).

3. If pH < 6.5, guideline is 5 µg/L. If pH > 6.5, guideline is 100 µg/L.

4 If water hardness (as CaCO3) is 0 to < 82 mg/L, guideline is 2 µg/L.
At hardness ≥ 82 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = 0.2 * $e^{\{0.8545[ln(hardness)] - 1.465\}}$
At hardness > 180 mg/L, guideline is 4 µg/L.

5. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 1 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{1.273[ln(hardness)] - 4.705\}}$
At hardness > 180 mg/L, guideline is 7 µg/L.

6. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 25 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{0.76[ln(hardness)] + 1.06\}}$
At hardness > 180 mg/L, guideline is 150 µg/L.

7. Guideline is for hexavalent chromium. Guideline for trivalent chromium is 1000 µg/L.

8. Total Dissolved Solids (Theo) from APHA 2510 B.

9. Total Dissolved Solids (Calc) based on Standard Methods, Method 1030E-Checking Correctness of Analyses, and is calculated as follows: Total Dissolved Solids (mg/L) = Ca + Mg + Na + K + Cl + SO_4 + F + SiO_2 + [(NO_2+NO_3) * 4.43] + (PO_4 * 3.06) + (Total Alkalinity as $CaCO_3$ * 0.6) + (NH_4 * 1.21) + Fe + Mn

Table 4-3
Surface Water Quality Analysis - Operations Shoal Cove Watershed
Canada Fluorspar Inc.

Parameters	Unit	CCME Freshwater Quality Longterm Guideline [1]	Newfoundland and Labrador Regulation 65/03, Schedule A [2]	Clarke's Pond Inlet	Clarke's Pond Inlet	Clarke's Pond Inlet	Clarke's Pond Inlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet	Clarke's Pond Outlet
				1-May-90	1-Jun-90	1-Jul-90	1-Aug-90	1-Apr-87	1-May-87	1-Jun-87	1-Jul-87	1-Aug-87	1-Sep-87	1-Feb-89	1-Mar-89	1-Apr-89	1-May-89	1-Jun-89	1-Jul-89	1-Aug-89	1-Sep-89	1-Oct-89	1-Nov-89	1-Dec-89	1-Jan-90
General Chemistry																									
Ammonia	mg/L	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand	mg/L	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chemical Oxygen Demand	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromide	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Colour	TCU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity	µS/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	0.12	-	**1.5**	**1.6**	**1.3**	**1.2**	-	-	-	-	-	-	**1.2**	**1.1**	**1.2**	**2.6**	**2.5**	**2.9**	**2.3**	**2.2**	**2.2**	**3.7**	**1.5**	**1.2**
Hardness as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	mg/L	13	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	mg/L	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate + Nitrite	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ortho-phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	-	6.5 - 9.0	-	8.2	8.1	8.1	7.9	7.9	8.1	8.2	8.0	8.2	8.1	7.8	7.9	7.8	8.3	8.3	8.5	8.4	8.3	8.2	8.3	8.4	8.2
Reactive Silica	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphide	mg/L	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Alkalinity ($CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (Theo) [8]	mg/L	-	1000	196	213	204	271	165	141	130	123	217	125	142	146	65	143	147	169	162	155	165	174	204	175
Total Dissolved Solids (Calculated) [9]	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (Measured)	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	-	30	36	50	44	38	8.0	1.4	0.36	1.2	10	10	12	9.7	54	5.7	4.0	5.8	4.0	7.6	10	17	9.4	11
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cations																									
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ion Balance																									
Cation Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anion Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ion Balance	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																									
Aluminum	mg/L	Variable [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.00009	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	0.05 [7]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	Variable [4]	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	0.3	10	**0.51**	**0.8**	**1.3**	**0.94**	-	-	-	-	-	-	0.04	-	**1.3**	176	0.23	**0.9**	**0.58**	**1.6**	**1.7**	**2.3**	-	-
Lead	mg/L	Variable [5]	0.2	**0.13**	**0.26**	**0.29**	**0.24**	-	-	-	-	-	-	**0.02**	-	**0.18**	0.46	**0.05**	**0.08**	0.22	**0.13**	0.25	0.34	-	-
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	0.000026	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.073	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	Variable [6]	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.001	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tellurium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0008		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	0.015		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zirconium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	0.03	0.5	**0.04**	**0.22**	**0.06**	**0.16**	-	-	-	-	-	-	**0.04**	-	**0.11**	140	**0.04**	**0.22**	**0.14**	**0.08**	**0.42**	**0.08**	-	-

Notes:

-	Not analyzed
nd	Result not detected
1.0	Result exceeds CCME Freshwater Quality Longterm Guideline
1.0	Results exceeds Newfoundland and Labrador Regulation 65/03, Schedule A
1.0	Non-detect result exceeds one or both guidelines presented.

1. Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life.

2. Newfoundland and Labrador Regulation 65/03. 2003. Environmental Control Water and Sewage Regulations, Water Resources Act (O.C. 2003-231).

3. If pH < 6.5, guideline is 5 µg/L. If pH > 6.5, guideline is 100 µg/L.

4 If water hardness (as CaCO3) is 0 to < 82 mg/L, guideline is 2 µg/L.
At hardness ≥ 82 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $0.2 * e^{\{0.8545[\ln(hardness)] - 1.465\}}$
At hardness > 180 mg/L, guideline is 4 µg/L.

5. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 1 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{1.273[\ln(hardness)] - 4.705\}}$
At hardness > 180 mg/L, guideline is 7 µg/L.

6. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 25 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{0.76[\ln(hardness)] + 1.06\}}$
At hardness > 180 mg/L, guideline is 150 µg/L.

7. Guideline is for hexavalent chromium. Guideline for trivalent chromium is 1000 µg/L.

8. Total Dissolved Solids (Theo) from APHA 2510 B.

9. Total Dissolved Solids (Calc) based on Standard Methods, Method 1030E-Checking Correctness of Analyses, and is calculated as follows: Total Dissolved Solids (mg/L) = $Ca + Mg + Na + K + Cl + SO_4 + F + SiO_2 + [(NO_2+NO_3) * 4.43] + (PO_4 * 3.06) + (\text{Total Alkalinity as } CaCO_3 * 0.6) + (NH_4 * 1.21) + Fe + Mn$

Table 4-3
Surface Water Quality Analysis - Operations Shoal Cove Watershed
Canada Fluorspar Inc.

Parameters	Unit	CCME Freshwater Quality Longterm Guideline [1]	Newfoundland and Labrador Regulation 65/03, Schedule A [2]	Clarke's Pond Outlet 1-May-90	Clarke's Pond Outlet 1-Jun-90	Clarke's Pond Outlet 1-Jul-90	Clarke's Pond Outlet 1-Aug-90	Tailings Pond Inlet 1-Feb-89	Tailings Pond Inlet 1-Mar-89	Tailings Pond Inlet 1-Apr-89	Tailings Pond Inlet 1-May-89	Tailings Pond Inlet 1-Jun-89	Tailings Pond Inlet 1-Jul-89	Tailings Pond Inlet 1-Aug-89	Tailings Pond Inlet 1-Sep-89	Tailings Pond Inlet 1-Oct-89	Tailings Pond Inlet 1-Nov-89	Tailings Pond Inlet 1-Dec-89	Tailings Pond Inlet 1-Jan-90	Tailings Pond Inlet 1-May-90	Tailings Pond Inlet 1-Jun-90	Tailings Pond Inlet 1-Jul-90	Tailings Pond Inlet 1-Aug-90	Decant Final Holding Dam 1-Feb-88	Decant Final Holding Dam 1-Dec-88
General Chemistry																									
Ammonia	mg/L	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand	mg/L	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chemical Oxygen Demand	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromide	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Colour	TCU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity	µS/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	0.12	-	**0.95**	**1.2**	**1.1**	**1.1**	**3.4**	**3.3**	**3.3**	**35**	**52**	**6.2**	**6.1**	**5.4**	**8.8**	**3.4**	**2.9**	**3.0**	**2.6**	**3.7**	**6.3**	**6.5**	**3.1**	**2.7**
Hardness as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	mg/L	13	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	mg/L	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate + Nitrite	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ortho-phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	-	6.5 - 9.0	-	8.3	8.3	8.3	8.5	8.0	7.8	7.7	8.6	**9.1**	8.0	7.9	7.7	8.0	8.5	8.2	7.8	8.3	8.3	8.2	8.4	7.9	7.9
Reactive Silica	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphide	mg/L	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Alkalinity ($CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (Theo) [8]	mg/L	-	1000	143	185	233	215	852	896	1268	1246	1948	1269	1320	3605	1934	1814	778	694	756	962	1139	1422	582	578
Total Dissolved Solids (Calculated) [9]	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (Measured)	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	-	30	38	4.7	10	3.4	-	12	11	7.3	8.2	12	13	13	13	12	9.2	7.9	8.5	7.7	7.1	8.9	62	52
Turbidity	NTU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cations																									
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ion Balance																									
Cation Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anion Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ion Balance	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																									
Aluminum	mg/L	Variable [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.00009	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	0.05 [7]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	Variable [4]	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	0.3	10	**0.35**	**3.9**	**1.1**	**0.81**	0.004	-	**1012**	**1871**	**1427**	**1622**	1865	1032	1459	2968	-	-	2245	940	663	1113	0.05	0.06
Lead	mg/L	Variable [5]	0.2	**0.02**	0.38	**0.11**	**0.11**	**0.03**	-	88	79	200	297	**185**	**133**	**209**	**777**	-	-	**251**	**291**	**108**	**136**	**0.05**	**0.03**
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	0.000026	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.073	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	Variable [6]	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.001	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tellurium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0008		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	0.015		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zirconium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	0.03	0.5	0.004	**0.18**	0.004	**1.2**	**0.05**	-	**51**	**53**	**98**	**197**	57	163	243	346	-	-	901	141	172	185	**0.09**	**0.05**

Notes:

-	Not analyzed
nd	Result not detected
1.0	Result exceeds CCME Freshwater Quality Longterm Guideline
1.0	Results exceeds Newfoundland and Labrador Regulation 65/03, Schedule A
1.0	Non-detect result exceeds one or both guidelines presented.

1. Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life.

2. Newfoundland and Labrador Regulation 65/03. 2003. Environmental Control Water and Sewage Regulations, Water Resources Act (O.C. 2003-231).

3. If pH < 6.5, guideline is 5 µg/L. If pH > 6.5, guideline is 100 µg/L.

4 If water hardness (as CaCO3) is 0 to < 82 mg/L, guideline is 2 µg/L.
At hardness ≥ 82 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = 0.2 * $e^{\{0.8545[\ln(hardness)] - 1.465\}}$
At hardness > 180 mg/L, guideline is 4 µg/L.

5. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 1 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{1.273[\ln(hardness)] - 4.705\}}$
At hardness > 180 mg/L, guideline is 7 µg/L.

6. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 25 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{0.76[\ln(hardness)] + 1.06\}}$
At hardness > 180 mg/L, guideline is 150 µg/L.

7. Guideline is for hexavalent chromium. Guideline for trivalent chromium is 1000 µg/L.

8. Total Dissolved Solids (Theo) from APHA 2510 B.

9. Total Dissolved Solids (Calc) based on Standard Methods, Method 1030E-Checking Correctness of Analyses, and is calculated as follows: Total Dissolved Solids (mg/L) = Ca + Mg + Na + K + Cl + SO_4 + F + SiO_2 + [(NO_2+NO_3) * 4.43] + (PO_4 * 3.06) + (Total Alkalinity as $CaCO_3$ * 0.6) + (NH_4 * 1.21) + Fe + Mn

Table 4-3
Surface Water Quality Analysis - Operations Shoal Cove Watershed
Canada Fluorspar Inc.

Parameters	Unit	CCME Freshwater Quality Longterm Guideline [1]	Newfoundland and Labrador Regulation 65/03, Schedule A [2]	Decant Final Holding Dam 1-Feb-89	Decant Final Holding Dam 1-Mar-89	Decant Final Holding Dam 1-Apr-89	Decant Final Holding Dam 1-May-89	Decant Final Holding Dam 1-Jun-89	Decant Final Holding Dam 1-Jul-89	Decant Final Holding Dam 1-Aug-89	Decant Final Holding Dam 1-Sep-89	Decant Final Holding Dam 1-Oct-89	Decant Final Holding Dam 1-Nov-89	Decant Final Holding Dam 1-Dec-89	Decant Final Holding Dam 1-Jan-90	Decant Final Holding Dam 1-May-90	Decant Final Holding Dam 1-Jun-90	Decant Final Holding Dam 1-Jul-90	Decant Final Holding Dam 1-Aug-90	Shoal Cove Pond Inlet 1-Feb-89	Shoal Cove Pond Inlet 1-Mar-89	Shoal Cove Pond Inlet 1-Apr-89	Shoal Cove Pond Inlet 1-May-89	Shoal Cove Pond Inlet 1-Jun-89	Shoal Cove Pond Inlet 1-Jul-89
General Chemistry																									
Ammonia	mg/L	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand	mg/L	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chemical Oxygen Demand	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromide	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Colour	TCU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity	µS/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	0.12	-	**2.3**	**3.3**	**2.9**	**8.7**	**8.9**	**8.6**	**6.6**	**6.1**	**9.2**	**6.0**	**6.9**	**3.4**	**3.2**	**5.0**	**4.4**	**4.8**	**2.1**	**3.0**	**2.4**	**7.8**	**9.6**	**8.1**
Hardness as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	mg/L	13	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	mg/L	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate + Nitrite	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ortho-phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	-	6.5 - 9.0	-	7.6	7.9	7.8	7.8	7.9	7.9	8.0	8.0	8.1	8.2	8.5	8.3	8.0	7.8	7.8	8.0	7.7	7.8	7.6	7.8	7.8	7.9
Reactive Silica	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphide	mg/L	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Alkalinity ($CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (Theo) [8]	mg/L	-	1000	505	613	480	714	924	731	675	570	704	674	538	441	490	725	613	1017	435	459	373	603	859	699
Total Dissolved Solids (Calculated) [9]	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (Measured)	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	-	30	204	333	98	87	477	278	482	230	380	404	160	110	430	529	168	294	338	319	67	64	443	244
Turbidity	NTU	-	-	-	-	-	1509	10289	4485	12350	>1000	>1000	>1000	>1000	>1000	>1000	>1000	>1000	>1000	-	-	-	1364	8577	4005
Cations																									
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ion Balance																									
Cation Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anion Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ion Balance	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																									
Aluminum	mg/L	Variable [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.00009	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	0.05 [7]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	Variable [4]	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	0.3	10	0.07	-	**1.8**	**10**	28	**6.1**	**8.8**	**7.0**	**6.3**	16	-	-	43	23	**3.7**	95	0.19	-	**1.6**	**8.6**	82	**6.0**
Lead	mg/L	Variable [5]	0.2	**0.03**	-	**0.21**	**1.0**	**3.3**	**1.2**	**2.5**	**0.56**	**0.78**	**2.0**	-	-	**2.0**	**3.2**	**0.73**	**1.1**	**0.04**	-	**0.11**	**0.61**	1.4	1.3
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	0.000026	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.073	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	Variable [6]	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.001	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tellurium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0008		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	0.015		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zirconium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	0.03	0.5	**0.08**	-	**0.15**	**0.45**	3.4	1.1	1.4	1.4	1.5	0.65	-	-	7.0	2.5	**0.1**	**0.4**	**0.09**	-	**0.11**	127	6.3	1.1

Notes:

-	Not analyzed
nd	Result not detected
1.0	Result exceeds CCME Freshwater Quality Longterm Guideline
1.0	Results exceeds Newfoundland and Labrador Regulation 65/03, Schedule A
1.0	Non-detect result exceeds one or both guidelines presented.

1. Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life.

2. Newfoundland and Labrador Regulation 65/03. 2003. Environmental Control Water and Sewage Regulations, Water Resources Act (O.C. 2003-231).

3. If pH < 6.5, guideline is 5 µg/L. If pH > 6.5, guideline is 100 µg/L.

4 If water hardness (as CaCO3) is 0 to < 82 mg/L, guideline is 2 µg/L.
At hardness ≥ 82 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = 0.2 * $e^{\{0.8545[\ln(hardness)] - 1.465\}}$
At hardness > 180 mg/L, guideline is 4 µg/L.

5. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 1 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{1.273[\ln(hardness)] - 4.705\}}$
At hardness > 180 mg/L, guideline is 7 µg/L.

6. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 25 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{0.76[\ln(hardness)] + 1.06\}}$
At hardness > 180 mg/L, guideline is 150 µg/L.

7. Guideline is for hexavalent chromium. Guideline for trivalent chromium is 1000 µg/L.

8. Total Dissolved Solids (Theo) from APHA 2510 B.

9. Total Dissolved Solids (Calc) based on Standard Methods, Method 1030E-Checking Correctness of Analyses, and is calculated as follows: Total Dissolved Solids (mg/L) = Ca + Mg + Na + K + Cl + SO_4 + F + SiO_2 + [(NO_2+NO_3) * 4.43] + (PO_4 * 3.06) + (Total Alkalinity as $CaCO_3$ * 0.6) + (NH_4 * 1.21) + Fe + Mn

Table 4-3
Surface Water Quality Analysis - Operations Shoal Cove Watershed
Canada Fluorspar Inc.

Parameters	Unit	CCME Freshwater Quality Longterm Guideline [1]	Newfoundland and Labrador Regulation 65/03, Schedule A [2]	Shoal Cove Pond Inlet 1-Aug-89	Shoal Cove Pond Inlet 1-Sep-89	Shoal Cove Pond Inlet 1-Oct-89	Shoal Cove Pond Inlet 1-Nov-89	Shoal Cove Pond Inlet 1-Dec-89	Shoal Cove Pond Inlet 1-Jan-90	Shoal Cove Pond Inlet 1-May-90	Shoal Cove Pond Inlet 1-Jun-90	Shoal Cove Pond Inlet 1-Jul-90	Shoal Cove Pond Inlet 1-Aug-90	Shoal Cove Pond Outlet 1-Feb-89	Shoal Cove Pond Outlet 1-Mar-89	Shoal Cove Pond Outlet 1-Apr-89	Shoal Cove Pond Outlet 1-May-89	Shoal Cove Pond Outlet 1-Jun-89	Shoal Cove Pond Outlet 1-Jul-89	Shoal Cove Pond Outlet 1-Aug-89	Shoal Cove Pond Outlet 1-Sep-89	Shoal Cove Pond Outlet 1-Oct-89	Shoal Cove Pond Outlet 1-Nov-89	Shoal Cove Pond Outlet 1-Dec-89	Shoal Cove Pond Outlet 1-Jan-90
General Chemistry																									
Ammonia	mg/L	-	2	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bicarbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Biochemical Oxygen Demand	mg/L	-	20	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chemical Oxygen Demand	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromide	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Carbonate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chloride	mg/L	120	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Colour	TCU	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Conductivity	µS/cm	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Dissolved Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Fluoride	mg/L	0.12	-	**6.2**	**5.8**	**9.0**	**4.5**	**4.9**	**3.2**	**3.0**	**4.3**	**3.5**	**4.5**	**1.1**	**1.2**	**1.1**	**3.3**	**5.0**	**5.1**	**4.3**	**3.8**	**4.1**	**2.3**	**2.2**	**1.4**
Hardness as CaCO3	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate as N	mg/L	13	10	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrite as N	mg/L	0.06	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nitrate + Nitrite	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ortho-phosphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
pH	-	6.5 - 9.0	-	8.0	8.0	8.0	8.1	8.4	8.1	7.9	7.9	7.7	8.0	7.4	7.6	6.9	7.9	7.9	8.1	8.2	8.0	8.0	8.1	8.9	7.8
Reactive Silica	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphate	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphide	mg/L	-	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Alkalinity ($CaCO_3$)	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (Theo) [8]	mg/L	-	1000	603	545	666	630	491	408	437	620	508	1115	130	152	124	193	250	326	319	211	244	242	213	189
Total Dissolved Solids (Calculated) [9]	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Dissolved Solids (Measured)	mg/L	-	1000	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Organic Carbon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Suspended Solids	mg/L	-	30	404	203	320	377	131	115	380	428	124	286	-	7.4	10	4.5	28	23	43	11	36	33	4.5	6.0
Turbidity	NTU	-	-	10140	>1000	>1000	>1000	>1000	>1000	>1000	>1000	>1000	>1000	-	-	-	-	-	-	-	-	-	-	-	-
Cations																									
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ion Balance																									
Cation Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Anion Sum	meq	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Ion Balance	%	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Metals																									
Aluminum	mg/L	Variable [3]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Antimony	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Arsenic	mg/L	0.005	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Boron	mg/L	1.5	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Barium	mg/L	-	5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cadmium	mg/L	0.00009	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Calcium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Chromium	mg/L	-	0.05 [7]	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Cobalt	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Copper	mg/L	Variable [4]	0.3	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Iron	mg/L	0.3	10	**8.5**	**7.7**	**5.0**	14	-	-	26	26	**3.0**	277	0.008	-	**0.97**	**7.0**	0.3	**1.4**	**1.8**	**1.3**	**1.4**	**1.3**	-	-
Lead	mg/L	Variable [5]	0.2	1.7	0.48	0.73	3.2	-	-	1.9	2.2	0.6	1.0	**0.02**	-	**0.05**	1.4	**0.07**	**0.09**	**0.57**	**0.11**	**0.29**	**0.42**	-	-
Lithium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Manganese	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Mercury	mg/L	0.000026	0.005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Molybdenum	mg/L	0.073	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Nickel	mg/L	Variable [6]	0.5	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Phosphorus	mg/L	-	0.0005	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Potassium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Selenium	mg/L	0.001	0.01	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silicon	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Silver	mg/L	0.0001	0.05	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sodium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Strontium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Sulphur	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tellurium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Thallium	mg/L	0.0008		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Uranium	mg/L	0.015		-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zirconium	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Zinc	mg/L	0.03	0.5	0.92	0.58	1.1	0.75	-	-	1.9	0.96	**0.4**	**0.37**	**0.04**	-	**0.07**	**0.25**	**0.04**	0.69	**0.29**	**0.06**	**0.49**	**0.07**	-	-

Notes:

-	Not analyzed
nd	Result not detected
1.0	Result exceeds CCME Freshwater Quality Longterm Guideline
1.0	Results exceeds Newfoundland and Labrador Regulation 65/03, Schedule A
1.0	Non-detect result exceeds one or both guidelines presented.

1. Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life.

2. Newfoundland and Labrador Regulation 65/03. 2003. Environmental Control Water and Sewage Regulations, Water Resources Act (O.C. 2003-231).

3. If pH < 6.5, guideline is 5 µg/L. If pH > 6.5, guideline is 100 µg/L.
4 If water hardness (as CaCO3) is 0 to < 82 mg/L, guideline is 2 µg/L.
At hardness ≥ 82 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = 0.2 * $e^{(0.8545[\ln(hardness)] - 1.465)}$
At hardness > 180 mg/L, guideline is 4 µg/L.
5. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 1 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) =$e^{(1.273[\ln(hardness)] - 4.705)}$
At hardness > 180 mg/L, guideline is 7 µg/L.
6. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 25 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) =$e^{(0.76[\ln(hardness)] + 1.06)}$
At hardness > 180 mg/L, guideline is 150 µg/L.
7. Guideline is for hexavalent chromium. Guideline for trivalent chromium is 1000 µg/L.
8. Total Dissolved Solids (Theo) from APHA 2510 B.
9. Total Dissolved Solids (Calc) based on Standard Methods, Method 1030E-Checking Correctness of Analyses, and is calculated as follows: Total Dissolved Solids (mg/L) = Ca + Mg + Na + K + Cl + SO_4 + F + SiO_2 + [(NO_2+NO_3) * 4.43] + (PO_4 * 3.06) + (Total Alkalinity as $CaCO_3$ * 0.6) + (NH_4 * 1.21) + Fe + Mn

Parameters	Unit	CCME Freshwater Quality Longterm Guideline [1]	Newfoundland and Labrador Regulation 65/03, Schedule A [2]	Shoal Cove Pond Outlet	Shoal Cove Pond Outlet	Shoal Cove Pond Outlet	Shoal Cove Pond Outlet	Statistics			
				1-May-90	1-Jun-90	1-Jul-90	1-Aug-90	Count	Minimum	Maximum	Average
General Chemistry											
Ammonia	mg/L	-	2	-	-	-	-	0	-	-	-
Bicarbonate	mg/L	-	-	-	-	-	-	0	-	-	-
Biochemical Oxygen Demand	mg/L	-	20	-	-	-	-	0	-	-	-
Chemical Oxygen Demand	mg/L	-	-	-	-	-	-	0	-	-	-
Bromide	mg/L	-	-	-	-	-	-	0	-	-	-
Carbonate	mg/L	-	-	-	-	-	-	0	-	-	-
Chloride	mg/L	120	-	-	-	-	-	0	-	-	-
Colour	TCU	-	-	-	-	-	-	0	-	-	-
Conductivity	µS/cm	-	-	-	-	-	-	0	-	-	-
Dissolved Organic Carbon	mg/L	-	-	-	-	-	-	0	-	-	-
Fluoride	mg/L	0.12	-	**1.2**	**1.9**	**1.7**	**1.9**	97	0.95	52	4.4
Hardness as CaCO3	mg/L	-	-	-	-	-	-	0	-	-	-
Nitrate as N	mg/L	13	10	-	-	-	-	0	-	-	-
Nitrite as N	mg/L	0.06	-	-	-	-	-	0	-	-	-
Nitrate + Nitrite	mg/L	-	-	-	-	-	-	0	-	-	-
Ortho-phosphate	mg/L	-	-	-	-	-	-	0	-	-	-
pH	-	6.5 - 9.0	-	8.0	7.9	8.0	8.2	114	6.9	9.1	8.0
Reactive Silica	mg/L	-	-	-	-	-	-	0	-	-	-
Sulphate	mg/L	-	-	-	-	-	-	0	-	-	-
Sulphide	mg/L	-	0.5	-	-	-	-	0	-	-	-
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-	-	0	-	-	-
Total Alkalinity ($CaCO_3$)	mg/L	-	-	-	-	-	-	0	-	-	-
Total Dissolved Solids (Theo) [8]	mg/L	-	1000	179	203	311	320	114	65	3605	482
Total Dissolved Solids (Calculated) [9]	mg/L	-	1000	-	-	-	-	0	-	-	-
Total Dissolved Solids (Measured)	mg/L	-	1000	-	-	-	-	0	-	-	-
Total Organic Carbon	mg/L	-	-	-	-	-	-	0	-	-	-
Total Phosphorus	mg/L	-	0.0005	-	-	-	-	0	-	-	-
Total Suspended Solids	mg/L	-	30	25	35	23	5.6	112	0.36	529	107
Turbidity	NTU	-	-	-	-	-	-	26	1000	12350	2720
Cations											
Calcium	mg/L	-	-	-	-	-	-	0	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	0	-	-	-
Potassium	mg/L	-	-	-	-	-	-	0	-	-	-
Sodium	mg/L	-	-	-	-	-	-	0	-	-	-
Ion Balance											
Cation Sum	meq	-	-	-	-	-	-	0	-	-	-
Anion Sum	meq	-	-	-	-	-	-	0	-	-	-
Ion Balance	%	-	-	-	-	-	-	0	-	-	-
Total Metals											
Aluminum	mg/L	Variable [3]	-	-	-	-	-	0	-	-	-
Antimony	mg/L	-	-	-	-	-	-	0	-	-	-
Arsenic	mg/L	0.005	0.5	-	-	-	-	0	-	-	-
Boron	mg/L	1.5	5	-	-	-	-	0	-	-	-
Barium	mg/L	-	5	-	-	-	-	0	-	-	-
Beryllium	mg/L	-	-	-	-	-	-	0	-	-	-
Bismuth	mg/L	-	-	-	-	-	-	0	-	-	-
Cadmium	mg/L	0.00009	0.05	-	-	-	-	0	-	-	-
Calcium	mg/L	-	-	-	-	-	-	0	-	-	-
Chromium	mg/L	-	0.05 [7]	-	-	-	-	0	-	-	-
Cobalt	mg/L	-	-	-	-	-	-	0	-	-	-
Copper	mg/L	Variable [4]	0.3	-	-	-	-	0	-	-	-
Iron	mg/L	0.3	10	**0.58**	**1.9**	**1.5**	**1.4**	79	0.004	2968	243
Lead	mg/L	Variable [5]	0.2	**0.07**	**0.19**	**0.23**	**0.13**	79	0.02	777	35
Lithium	mg/L	-	-	-	-	-	-	0	-	-	-
Magnesium	mg/L	-	-	-	-	-	-	0	-	-	-
Manganese	mg/L	-	-	-	-	-	-	0	-	-	-
Mercury	mg/L	0.000026	0.005	-	-	-	-	0	-	-	-
Molybdenum	mg/L	0.073	-	-	-	-	-	0	-	-	-
Nickel	mg/L	Variable [6]	0.5	-	-	-	-	0	-	-	-
Phosphorus	mg/L	-	0.0005	-	-	-	-	0	-	-	-
Potassium	mg/L	-	-	-	-	-	-	0	-	-	-
Selenium	mg/L	0.001	0.01	-	-	-	-	0	-	-	-
Silicon	mg/L	-	-	-	-	-	-	0	-	-	-
Silver	mg/L	0.0001	0.05	-	-	-	-	0	-	-	-
Sodium	mg/L	-	-	-	-	-	-	0	-	-	-
Strontium	mg/L	-	-	-	-	-	-	0	-	-	-
Sulphur	mg/L	-	-	-	-	-	-	0	-	-	-
Tellurium	mg/L	-	-	-	-	-	-	0	-	-	-
Thallium	mg/L	0.0008		-	-	-	-	0	-	-	-
Tin	mg/L	-	-	-	-	-	-	0	-	-	-
Titanium	mg/L	-	-	-	-	-	-	0	-	-	-
Uranium	mg/L	0.015		-	-	-	-	0	-	-	-
Vanadium	mg/L	-	-	-	-	-	-	0	-	-	-
Zirconium	mg/L	-	-	-	-	-	-	0	-	-	-
Zinc	mg/L	0.03	0.5	**0.34**	**0.04**	**0.37**	**0.09**	79	0.004	901	37

Notes:

-	Not analyzed
nd	Result not detected
1.0	Result exceeds CCME Freshwater Quality Longterm Guideline
1.0	Results exceeds Newfoundland and Labrador Regulation 65/03, Schedule A
1.0	Non-detect result exceeds one or both guidelines presented.

1. Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life.

2. Newfoundland and Labrador Regulation 65/03. 2003. Environmental Control Water and Sewage Regulations, Water Resources Act (O.C. 2003-231).

3. If pH < 6.5, guideline is 5 µg/L. If pH > 6.5, guideline is 100 µg/L.

4 If water hardness (as CaCO3) is 0 to < 82 mg/L, guideline is 2 µg/L.
At hardness ≥ 82 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $0.2 * e^{\{0.8545[ln(hardness)] - 1.465\}}$
At hardness > 180 mg/L, guideline is 4 µg/L.

5. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 1 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) =$e^{\{1.273[ln(hardness)] - 4.705\}}$
At hardness > 180 mg/L, guideline is 7 µg/L.

6. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 25 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) =$e^{\{0.76[ln(hardness)] + 1.06\}}$
At hardness > 180 mg/L, guideline is 150 µg/L.

7. Guideline is for hexavalent chromium. Guideline for trivalent chromium is 1000 µg/L.

8. Total Dissolved Solids (Theo) from APHA 2510 B.

9. Total Dissolved Solids (Calc) based on Standard Methods, Method 1030E-Checking Correctness of Analyses, and is calculated as follows: Total Dissolved Solids (mg/L) = Ca + Mg + Na + K + Cl + SO_4 + F + SiO_2 + [(NO_2+NO_3) * 4.43] + (PO_4 * 3.06) + (Total Alkalinity as $CaCO_3$ * 0.6) + (NH_4 * 1.21) + Fe + Mn

Table 4-4
Surface Water Quality Analysis - Recent Baseline Shoal Cove and Salt Cove Watersheds
Canada Fluorspar Inc.

Parameters	Unit	CCME Freshwater Quality Longterm Guideline [1]	Newfoundland and Labrador Regulation 65/03, Schedule A [2]	Canal Dam MS1 WS1	WS1	WS2	WS-2	WS3	WS4	MG1 (Field Duplicate of WS4)	WS5	WS-5	WS6	WS7	WS8	WS9	WS10	WS-10	WS11	WS12	WS13	WS14	WS15
				1-Apr-97	2-Apr-09	2-Apr-09	3-Nov-14	2-Apr-09	3-Apr-09	3-Apr-09	2-Apr-09	3-Nov-14	2-Apr-09	2-Apr-09	3-Apr-09	2-Apr-09	2-Apr-09	3-Nov-14	3-Apr-09	3-Apr-09	3-Apr-09	2-Apr-09	2-Apr-09
General Chemistry																							
Ammonia	mg/L	-	2	nd	<0.01	<0.01	<0.050	<0.01	<0.01	<0.01	<0.01	<0.050	0.011	<0.01	<0.01	<0.01	0.012	<0.050	<0.01	<0.01	<0.01	<0.01	0.035
Bicarbonate	mg/L	-	-	nd	39	29	24	30	34	37	21	22	21	<6	<6	17	17	5.7	<6	<6	<6	7.6	36
Biochemical Oxygen Demand	mg/L	-	20	-	2.0	3.0	-	3.0	3.0	4.0	4.0	-	3.0	4.0	3.0	3.0	3.0	-	4.0	4.0	3.0	4.0	3.0
Chemical Oxygen Demand	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bromide	mg/L	-	-	-	-	-	<1.0	-	-	-	-	<1.0	-	-	-	-	-	<1.0	-	-	-	-	-
Carbonate	mg/L	-	-	nd	<3	<3	<1.0	<3	<3	<3	<3	<1.0	<3	<3	<3	<3	<3	<1.0	<3	<3	<3	<3	<3
Chloride	mg/L	120	-	7.0	12	14	15	15	17	17	17	19	18	9.2	12	12	15	12	14	12	12	30	26
Colour	TCU	-	-	39	19	19	90	20	14	7.0	19	100	14	18	<5	14	17	140	31	29	19	14	10
Conductivity	µS/cm	-	-	-	112	104	99	108	129	131	102	110	108	38	55	82	88	55	63	59	55	127	152
Dissolved Organic Carbon	mg/L	-	-	3.2	-	-	8.9	-	-	-	-	9.7	-	-	-	-	-	11	-	-	-	-	-
Fluoride	mg/L	0.12	-	**0.22**	**1.2**	**1.3**	**1.6**	**1.4**	**2.3**	**2.6**	**1.3**	**1.5**	**1.4**	0.11	**0.13**	**0.8**	**0.83**	**0.41**	**0.25**	**0.29**	0.12	**1.1**	**1.6**
Hardness as CaCO3	mg/L	-	-	3.0	38	30	34	31	37	37	25	31	27	4.3	6.2	20	21	11	8.4	8.4	6.0	17	35
Nitrate as N	mg/L	13	10	nd	0.14	0.09	0.082	0.25	0.48	0.73	0.1	0.087	0.097	<0.05	<0.05	0.091	0.11	0.067	0.071	<0.05	<0.05	0.17	0.061
Nitrite as N	mg/L	0.06	-	nd	<0.015	<0.015	<0.010	<0.015	<0.015	<0.015	<0.015	<0.010	<0.015	<0.015	<0.015	<0.015	<0.015	0.005	<0.015	<0.015	<0.015	<0.015	<0.015
Nitrate + Nitrite	mg/L	-	-	nd	-	-	0.082	-	-	-	-	0.087	-	-	-	-	-	0.067	-	-	-	-	-
Ortho-phosphate	mg/L	-	-	nd	<0.1	<0.1	<0.010	<0.1	<0.1	<0.1	<0.1	<0.010	<0.1	<0.1	<0.1	<0.1	<0.1	<0.010	<0.1	<0.1	<0.1	<0.1	<0.1
pH	-	6.5 - 9.0	-	**5.9**	7.2	7.1	7.3	7.3	6.7	6.7	7.3	7.3	7.3	**6.0**	6.6	7.1	7.1	6.5	6.6	6.6	**6.3**	6.7	7.1
Reactive Silica	mg/L	-	-	0.9	3.9	2.9	3.9	3.1	4.3	4.3	3.2	3.8	3.5	1.2	1.6	2.7	3.2	2.5	3.5	3.1	3.0	4.8	5.7
Sulphate	mg/L	-	-	nd	2.4	2.5	<2.0	2.7	3.6	3.7	2.9	<2.0	3.0	1.7	2.3	2.6	2.8	<2.0	2.6	2.5	2.5	5.2	3.5
Sulphide	mg/L	-	0.5	-	-	-	<0.020	-	-	-	-	<0.020	-	-	-	-	-	<0.020	-	-	-	-	-
Total Kjeldahl Nitrogen	mg/L	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Total Alkalinity ($CaCO_3$)	mg/L	-	-	nd	32	23	24	24	28	30	17	22	18	<5	<5	14	14	5.7	<5	<5	<5	6.2	30
Total Dissolved Solids (Theo) [8]	mg/L	-	1000	14	73	68	-	70	84	85	66	-	70	25	36	53	57	-	41	38	36	82	99
Total Dissolved Solids (Calculated) [9]	mg/L	-	1000	-	-	-	58	-	-	-	-	63	-	-	-	-	-	31	-	-	-	-	-
Total Dissolved Solids (Measured)	mg/L	-	1000	-	-	-	52	-	-	-	-	85	-	-	-	-	-	48	-	-	-	-	-
Total Organic Carbon	mg/L	-	-	-	2.5	2.5	9.1	2.5	2.3	2.3	2.6	10	2.6	2.7	2.9	2.6	2.6	11	3.6	3.6	3.9	2.3	2.2
Total Phosphorus	mg/L	-	0.0005	nd	-	-	<0.020	-	-	-	-	<0.020	-	-	-	-	-	0.029	-	-	-	-	-
Total Suspended Solids	mg/L	-	30	-	<2	<2	1.6	<2	<2	<2	2.0	3.6	3.0	<2	<2	<2	<2	3.6	<2	<2	<2	<2	<2
Turbidity	NTU	-	-	0.5	1.4	1.9	1.3	1.3	2.9	3.0	3.5	2.5	3.6	1.3	1.6	1.0	1.5	1.5	1.4	1.5	0.9	1.1	1.2
Cations																							
Calcium	mg/L	-	-	0.7	14	10	12	11	13	13	8.4	9.9	9.0	0.89	1.1	6.7	6.7	2.9	1.8	2.0	1.1	3.7	12
Magnesium	mg/L	-	-	0.3	0.77	0.85	1.0	0.88	1.2	1.2	1.0	1.4	1.1	0.5	0.82	0.73	0.98	0.89	0.95	0.84	0.8	1.8	1.5
Potassium	mg/L	-	-	nd	0.39	0.4	0.47	0.42	0.78	0.78	0.56	0.7	0.56	0.31	0.32	0.42	0.44	0.39	0.46	0.46	0.44	0.8	0.66
Sodium	mg/L	-	-	3.7	7.0	8.1	8.9	8.4	10	10	9.9	12	10	5.6	7.4	7.4	8.7	7.4	8.7	7.9	7.9	17	15
Ion Balance																							
Cation Sum	meq	-	-	-	1.1	0.95	1.1	0.99	1.2	1.2	0.95	1.2	1.0	0.34	0.45	0.73	0.8	0.57	0.56	0.52	0.48	1.1	1.4
Anion Sum	meq	-	-	-	1.0	0.92	1.0	0.97	1.2	1.2	0.89	1.1	0.93	0.32	0.46	0.69	0.76	0.49	0.54	0.5	0.44	1.1	1.4
Ion Balance	%	-	-	-	1.8	1.5	3.9	0.87	1.8	-0.48	3.3	5.4	3.7	3.4	-0.45	2.9	2.9	7.6	1.7	2.4	4.0	1.2	-1.1
Total Metals																							
Aluminum	mg/L	Variable [3]	-	**0.08**	**0.11**	**0.14**	**0.31**	**0.16**	**0.58**	**0.57**	**0.21**	**0.43**	**0.32**	**0.038**	0.076	**0.12**	**0.15**	**0.29**	0.093	0.076	**0.077**	**0.2**	0.03
Antimony	mg/L	-	-	nd	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Arsenic	mg/L	0.005	0.5	nd	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Boron	mg/L	1.5	5	nd	-	-	<0.05	-	-	-	-	<0.05	-	-	-	-	-	<0.05	-	-	-	-	-
Barium	mg/L	-	5	nd	0.087	0.09	0.097	0.091	0.13	0.13	0.084	0.11	0.087	0.007	0.014	0.042	0.036	0.019	0.011	0.0085	0.0066	0.005	0.045
Beryllium	mg/L	-	-	nd	0.0003	0.0002	<0.001	0.0002	0.0003	0.0003	0.0001	<0.001	0.0002	<0.0002	<0.1	0.0002	0.0002	<0.001	<0.0001	<0.0001	<0.0001	0.0001	<0.0002
Bismuth	mg/L	-	-	-	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.002	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Cadmium	mg/L	0.00009	0.05	nd	**0.00013**	0.000063	0.000043	**0.000092**	**0.00016**	**0.00015**	**0.00013**	0.000052	**0.00013**	0.000048	0.000027	**0.000097**	0.000079	0.000047	0.000068	0.000063	0.000021	0.000047	**0.000091**
Calcium	mg/L	-	-	0.7	14	10	12	11	13	13	8.4	9.9	9.0	0.89	1.1	6.7	6.7	2.9	1.8	2.0	1.1	3.7	12
Chromium	mg/L	-	0.05 [7]	0.003	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Cobalt	mg/L	-	-	nd	<0.001	<0.001	<0.0004	<0.001	<0.001	<0.001	<0.001	<0.0004	<0.001	<0.001	<0.001	<0.001	<0.001	<0.0004	<0.001	<0.001	<0.001	<0.001	<0.001
Copper	mg/L	Variable [4]	0.3	nd	0.001	<0.001	<0.002	<0.001	0.002	0.002	0.001	**0.0026**	0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001
Iron	mg/L	0.3	10	0.11	0.13	0.09	0.3	0.1	0.053	0.058	0.16	**0.44**	0.28	0.16	0.15	0.18	0.2	**0.62**	**0.33**	0.27	0.19	0.059	0.092
Lead	mg/L	Variable [5]	0.2	**0.006**	**0.002**	0.001	**0.0027**	0.001	**0.002**	**0.002**	**0.004**	**0.0055**	**0.006**	<0.001	<0.001	<0.001	0.001	**0.0013**	<0.001	<0.001	<0.001	<0.001	<0.001
Lithium	mg/L	-	-	-	-	-	<0.002	-	-	-	-	0.0021	-	-	-	-	-	<0.002	-	-	-	-	-
Magnesium	mg/L	-	-	0.3	0.77	0.85	1.0	0.88	1.2	1.2	1.0	1.4	1.1	0.5	0.82	0.73	0.98	0.89	0.95	0.84	0.8	1.8	1.5
Manganese	mg/L	-	-	0.044	0.036	0.024	0.018	0.032	0.014	0.013	0.12	0.064	0.17	0.058	0.009	0.17	0.12	0.075	0.022	0.016	0.013	0.016	0.72
Mercury	mg/L	0.000026	0.005	nd	<0.00002	0.00002	<0.000013	<0.00002	0.00002	0.00002	<0.00002	<0.000013	<0.00002	<0.00002	<0.00002	<0.00002	<0.00002	<0.000013	<0.00002	<0.00002	0.00002	<0.00002	<0.00002
Molybdenum	mg/L	0.073	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Nickel	mg/L	Variable [6]	0.5	nd	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001	<0.002	<0.001	<0.001	<0.001	<0.001	<0.001
Phosphorus	mg/L	-	0.0005	-	0.002	<0.002	<0.1	<0.002	0.002	0.003	<0.002	<0.1	0.005	<0.002	<0.002	<0.002	0.003	<0.1	0.004	0.002	0.004	0.003	0.004
Potassium	mg/L	-	-	nd	0.39	0.4	0.47	0.42	0.78	0.78	0.56	0.7	0.56	0.31	0.32	0.42	0.44	0.39	0.46	0.46	0.44	0.8	0.66
Selenium	mg/L	0.001	0.01	nd	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001	<0.001
Silicon	mg/L	-	-	-	-	-	1.9	-	-	-	-	2.0	-	-	-	-	-	1.2	-	-	-	-	-
Silver	mg/L	0.0001	0.05	nd	<0.0001	<0.0001	<0.00010	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001	<0.00010	<0.0001	<0.0001	<0.0001	<0.0001	<0.0001
Sodium	mg/L	-	-	3.7	7.0	8.1	8.9	8.4	10	10	9.9	12	10	5.6	7.4	7.4	8.7	7.4	8.7	7.9	7.9	17	15
Strontium	mg/L	-	-	-	-	-	0.021	-	-	-	-	0.025	-	-	-	-	-	0.014	-	-	-	-	-
Sulphur	mg/L	-	-	-	-	-	<5	-	-	-	-	<5	-	-	-	-	-	<5	-	-	-	-	-
Tellurium	mg/L	-	-	-	-	-	<0.002	-	-	-	-	<0.002	-	-	-	-	-	<0.002	-	-	-	-	-
Thallium	mg/L	0.0008		-	-	-	<0.00010	-	-	-	-	<0.00010	-	-	-	-	-	<0.00010	-	-	-	-	-
Tin	mg/L	-	-	-	-	-	<0.002	-	-	-	-	<0.002	-	-	-	-	-	<0.002	-	-	-	-	-
Titanium	mg/L	-	-	-	-	-	0.0056	-	-	-	-	0.006	-	-	-	-	-	0.0039	-	-	-	-	-
Uranium	mg/L	0.015		-	-	-	0.00058	-	-	-	-	0.00074	-	-	-	-	-	0.00046	-	-	-	-	-
Vanadium	mg/L	-	-	-	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002	<0.002
Zirconium	mg/L	-	-	-	-	-	<0.002	-	-	-	-	<0.002	-	-	-	-	-	<0.002	-	-	-	-	-
Zinc	mg/L	0.03	0.5	nd	0.014	0.007	0.0054	0.007	0.028	0.027	0.009	0.0095	0.014	0.004	0.005	0.007	0.007	0.006	0.003	0.003	0.003	0.005	0.002

Notes:

-	Not analyzed
nd	Result not detected
1.0	Result exceeds CCME Freshwater Quality Longterm Guideline
1.0 (underlined)	Results exceeds Newfoundland and Labrador Regulation 65/03, Schedule A
1.0 (shaded)	Non-detect result exceeds one or both guidelines presented.

1. Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life.

2. Newfoundland and Labrador Regulation 65/03. 2003. Environmental Control Water and Sewage Regulations, Water Resources Act (O.C. 2003-231).

3. If pH < 6.5, guideline is 5 µg/L. If pH > 6.5, guideline is 100 µg/L.

4 If water hardness (as CaCO3) is 0 to < 82 mg/L, guideline is 2 µg/L.
At hardness ≥ 82 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $0.2 * e^{\{0.8545[\ln(hardness)] - 1.465\}}$
At hardness > 180 mg/L, guideline is 4 µg/L.

5. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 1 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{1.273[\ln(hardness)] - 4.705\}}$
At hardness > 180 mg/L, guideline is 7 µg/L.

6. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 25 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $e^{\{0.76[\ln(hardness)] + 1.06\}}$
At hardness > 180 mg/L, guideline is 150 µg/L.

7. Guideline is for hexavalent chromium. Guideline for trivalent chromium is 1000 µg/L.

8. Total Dissolved Solids (Theo) from APHA 2510 B.

9. Total Dissolved Solids (Calc) based on Standard Methods, Method 1030E-Checking Correctness of Analyses, and is calculated as follows: Total Dissolved Solids (mg/L) = Ca + Mg + Na + K + Cl + SO_4 + F + SiO_2 + [(NO_2+NO_3) * 4.43] + (PO_4 * 3.06) + (Total Alkalinity as $CaCO_3$ * 0.6) + (NH_4 * 1.21) + Fe + Mn

Parameters	Unit	CCME Freshwater Quality Longterm Guideline [1]	Newfoundland and Labrador Regulation 65/03, Schedule A [2]	Statistics			
				Count	Minimum	Maximum	Average
General Chemistry							
Ammonia	mg/L	-	2	19	0.005	0.035	0.01
Bicarbonate	mg/L	-	-	19	3.0	39	19
Biochemical Oxygen Demand	mg/L	-	20	16	2.0	4.0	3.3
Chemical Oxygen Demand	mg/L	-	-	0	-	-	-
Bromide	mg/L	-	-	3	0.5	0.5	0.5
Carbonate	mg/L	-	-	19	0.5	1.5	1.3
Chloride	mg/L	120	-	20	7.0	30	15
Colour	TCU	-	-	20	2.5	140	32
Conductivity	µS/cm	-	-	19	38	152	94
Dissolved Organic Carbon	mg/L	-	-	4	3.2	11	8.2
Fluoride	mg/L	0.12	-	20	0.11	2.6	1.02
Hardness as CaCO3	mg/L	-	-	20	3.0	38	21
Nitrate as N	mg/L	13	10	19	0.025	0.73	0.14
Nitrite as N	mg/L	0.06	-	19	0.005	0.0075	0.0071
Nitrate + Nitrite	mg/L	-	-	3	0.067	0.087	0.079
Ortho-phosphate	mg/L	-	-	19	0.005	0.05	0.043
pH	-	6.5 - 9.0	-	20	5.9	7.3	6.6
Reactive Silica	mg/L	-	-	20	0.9	5.7	3.2
Sulphate	mg/L	-	-	19	1.0	5.2	2.6
Sulphide	mg/L	-	0.5	3	0.01	0.01	0.01
Total Kjeldahl Nitrogen	mg/L	-	-	0	-	-	-
Total Alkalinity ($CaCO_3$)	mg/L	-	-	19	2.5	32	16
Total Dissolved Solids (Theo) [8]	mg/L	-	1000	17	14	99	59
Total Dissolved Solids (Calculated) [9]	mg/L	-	1000	3	31	63	51
Total Dissolved Solids (Measured)	mg/L	-	1000	3	48	85	62
Total Organic Carbon	mg/L	-	-	19	2.2	11	3.9
Total Phosphorus	mg/L	-	0.0005	3	0.01	0.029	0.016
Total Suspended Solids	mg/L	-	30	19	1.0	3.6	1.5
Turbidity	NTU	-	-	20	0.5	3.6	1.7
Cations							
Calcium	mg/L	-	-	20	0.7	14	7.0
Magnesium	mg/L	-	-	20	0.3	1.8	0.97
Potassium	mg/L	-	-	19	0.31	0.8	0.51
Sodium	mg/L	-	-	20	3.7	17	9.1
Ion Balance							
Cation Sum	meq	-	-	19	0.34	1.4	0.87
Anion Sum	meq	-	-	19	0.32	1.4	0.83
Ion Balance	%	-	-	19	-1.1	7.6	2.4
Total Metals							
Aluminum	mg/L	Variable [3]	-	20	0.03	0.58	0.2
Antimony	mg/L	-	-	19	0.0005	0.0005	0.0005
Arsenic	mg/L	0.005	0.5	19	0.0005	0.0005	0.0005
Boron	mg/L	1.5	5	3	0.025	0.025	0.025
Barium	mg/L	-	5	19	0.005	0.13	0.058
Beryllium	mg/L	-	-	19	0.00005	0.05	0.0028
Bismuth	mg/L	-	-	19	0.00025	0.001	0.00037
Cadmium	mg/L	0.00009	0.05	19	0.000021	0.00016	0.00008
Calcium	mg/L	-	-	20	0.7	14	7.0
Chromium	mg/L	-	0.05 [7]	20	0.0005	0.003	0.00063
Cobalt	mg/L	-	-	19	0.0002	0.0005	0.00045
Copper	mg/L	Variable [4]	0.3	19	0.0005	0.0026	0.00095
Iron	mg/L	0.3	10	20	0.053	0.62	0.2
Lead	mg/L	Variable [5]	0.2	20	0.0005	0.006	0.0019
Lithium	mg/L	-	-	3	0.001	0.0021	0.0014
Magnesium	mg/L	-	-	20	0.3	1.8	0.97
Manganese	mg/L	-	-	20	0.009	0.72	0.087
Mercury	mg/L	0.000026	0.005	19	0.0000065	0.00002	0.000012
Molybdenum	mg/L	0.073	-	19	0.001	0.001	0.001
Nickel	mg/L	Variable [6]	0.5	19	0.0005	0.001	0.00058
Phosphorus	mg/L	-	0.0005	19	0.001	0.05	0.0099
Potassium	mg/L	-	-	19	0.31	0.8	0.51
Selenium	mg/L	0.001	0.01	19	0.0005	0.0005	0.0005
Silicon	mg/L	-	-	3	1.2	2.0	1.7
Silver	mg/L	0.0001	0.05	19	0.00005	0.00005	0.00005
Sodium	mg/L	-	-	20	3.7	17	9.1
Strontium	mg/L	-	-	3	0.014	0.025	0.02
Sulphur	mg/L	-	-	3	2.5	2.5	2.5
Tellurium	mg/L	-	-	3	0.001	0.001	0.001
Thallium	mg/L	0.0008		3	0.00005	0.00005	0.00005
Tin	mg/L	-	-	3	0.001	0.001	0.001
Titanium	mg/L	-	-	3	0.0039	0.006	0.0052
Uranium	mg/L	0.015		3	0.00046	0.00074	0.00059
Vanadium	mg/L	-	-	19	0.001	0.001	0.001
Zirconium	mg/L	-	-	3	0.001	0.001	0.001
Zinc	mg/L	0.03	0.5	19	0.002	0.028	0.0087

Notes:

-	Not analyzed
nd	Result not detected
1.0	Result exceeds CCME Freshwater Quality Longterm Guideline
<u>1.0</u>	Results exceeds Newfoundland and Labrador Regulation 65/03, Schedule A
1.0	Non-detect result exceeds one or both guidelines presented.

1. Canadian Council of Ministers of the Environment. 1999. Canadian water quality guidelines for the protection of aquatic life.

2. Newfoundland and Labrador Regulation 65/03. 2003. Environmental Control Water and Sewage Regulations, Water Resources Act (O.C. 2003-231).

3. If pH < 6.5, guideline is 5 µg/L. If pH > 6.5, guideline is 100 µg/L.

4 If water hardness (as CaCO3) is 0 to < 82 mg/L, guideline is 2 µg/L.
At hardness ≥ 82 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) = $0.2 * e^{\{0.8545[\ln(hardness)] - 1.465\}}$
At hardness > 180 mg/L, guideline is 4 µg/L.

5. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 1 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) =$e^{\{1.273[\ln(hardness)] - 4.705\}}$
At hardness > 180 mg/L, guideline is 7 µg/L.

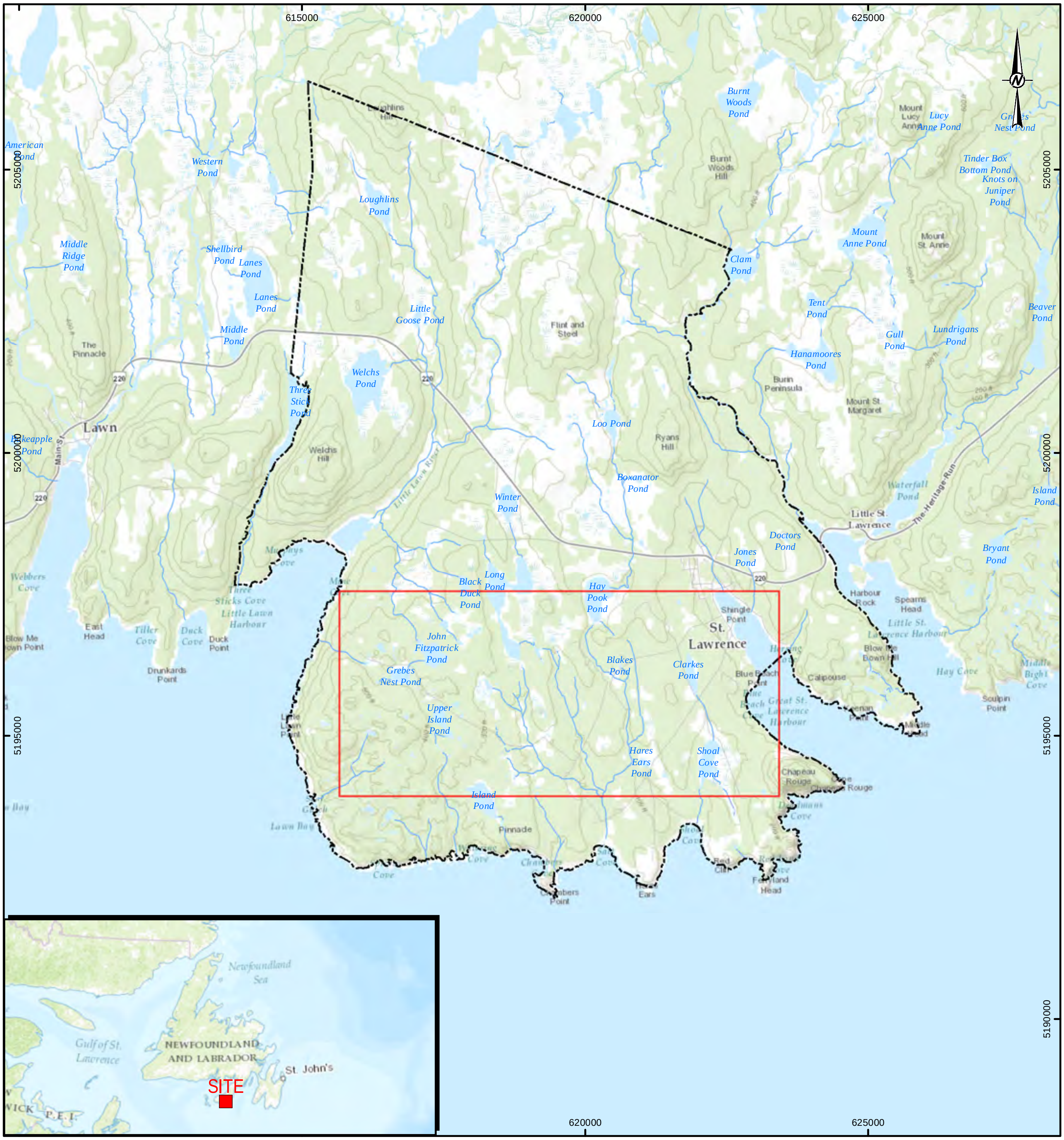
6. If water hardness (as CaCO3) is 0 to ≤ 60 mg/L, guideline is 25 µg/L.
At hardness > 60 to ≤ 180 mg/L, guideline is calculated as follows: Guideline (µg/L) =$e^{\{0.76[\ln(hardness)] + 1.06\}}$
At hardness > 180 mg/L, guideline is 150 µg/L.

7. Guideline is for hexavalent chromium. Guideline for trivalent chromium is 1000 µg/L.

8. Total Dissolved Solids (Theo) from APHA 2510 B.

9. Total Dissolved Solids (Calc) based on Standard Methods, Method 1030E-Checking Correctness of Analyses, and is calculated as follows: Total Dissolved Solids (mg/L) = Ca + Mg + Na + K + Cl + SO_4 + F + SiO_2 + [(NO_2+NO_3) * 4.43] + (PO_4 * 3.06) + (Total Alkalinity as $CaCO_3$ * 0.6) + (NH_4 * 1.21) + Fe + Mn

FIGURES



LEGEND

- Municipal Boundary
- Project Location

1 0 1 2

Kilometres

1:100,000

CLIENT

CANADA FLUORSPAR INC.

PROJECT

BASELINE WATER QUALITY PROGRAM

TITLE

PROJECT LOCATION AND TOWN OF ST. LAWRENCE MUNICIPAL BOUNDARY

CONSULTANT

Golder Associates

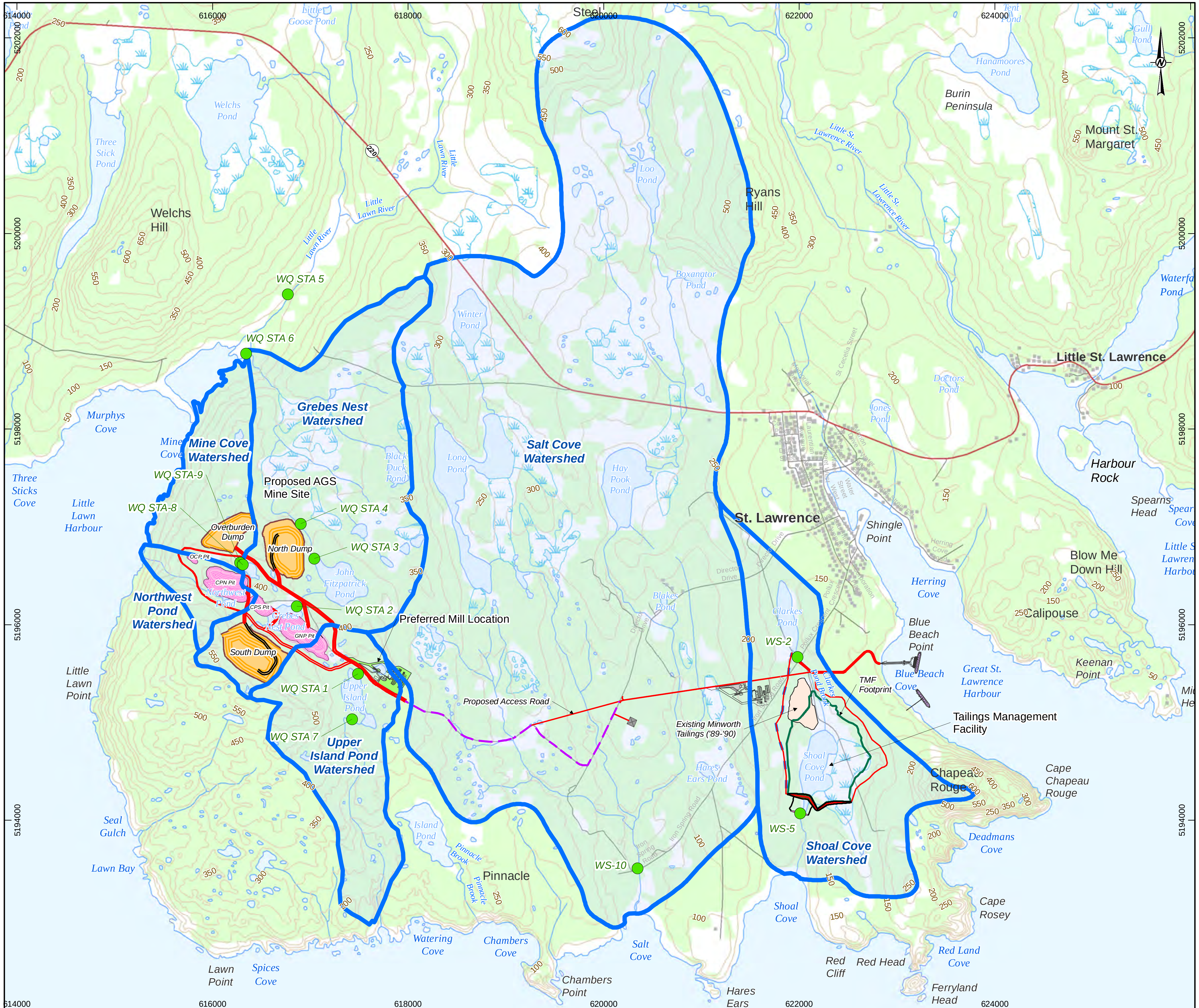
YYYY-MM-DD	2015-04-29
DESIGN	DL
GIS	RS
REVIEW	DFL
APPROVED	

PROJECT	REV	FIGURE
1407707	0	1

REFERENCE

SOURCE(S): DEVELOPMENT REGULATIONS 2011 LAND USE ZONING MAP 1, JAN. 19, 2013, TOWN OF ST. LAWRENCE; WORLD TOPO MAP, ESRI BASEMAPS.
PROJECTION: NAD 1983 UTM ZONE 21N

H:\Projects\Canada Fluorspar\St-Lawrence_NL_Mines\PROJECTS\Baseline Water Quality Program\MXD\Fig_1 Project Watersheds and Water Quality Project Site Location.mxd



LEGEND

PROJECT COMPONENTS

- Clarkes Pond Diversion Channel
- Proposed Road
- Proposed Upgraded Road
- TMF Footprint
- Final Tailings Dam
- Settling Pond Dam
- Saddle Dike
- Existing Minworth Tailings
- Mine Dump Option
- Pit

WATER QUALITY COMPONENTS

- Surface Water Sampling Site
- Watershed Area

TOPOGRAPHY

- Building
- Highway
- Existing Road
- Contour Line (interval: 50 ft)
- Watercourse
- Waterbody
- Wetland

0 1 2

Kilometres

1:40,000

REFERENCE

SOURCE(S): CANVEC & CANVEC+, 1: 50 000 SCALE, NRCAN.

DATUM: NAD 83. PROJECTION: UTM ZONE 21.

CLIENT

CANADA FLUORSPAR INC.

PROJECT

BASELINE WATER QUALITY PROGRAM

TITLE

PROJECT WATERSHEDS AND WATER QUALITY SAMPLING

CONSULTANT

Golder Associates

YYYY-MM-DD	2015-05-19
DESIGN	DL
GIS	RS
REVIEW	DFL
APPROVED	

PROJECT No. 14-07707

Rev. 0

FIGURE 2

Report Signature Page

GOLDER ASSOCIATES LTD.

Dan LaPorte (M.Sc., P.Geo.)
Hydrogeochemist

David Brown (M.Sc., P.Geo.)
Principal

DFL/sp

\\golder.gds\gal\montreal\actif\2014\1250\1407707 canada fluorspar-ea-ags mine st-lawrence\3 phase 4-component studies\water quality\report\1. text\1407707_doc0013_rev 1_water quality baseline report_20may2015.docx

APPENDIX A

Laboratory Certificates

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3664	YI3665		YI3666	YI3666		YI3667	YI3668	YI3669			YI3670	YI3670		YI3671		YI3672			YI3673	YI3673		YI3674		YI3675	YI3676		
Sampling Date				2014/11/03 13:35	2014/11/03 14:00		2014/11/03 14:55	2014/11/03 14:55		2014/11/03 16:00	2014/11/04 08:45	2014/11/04 09:05			2014/11/04 10:10	2014/11/04 10:10		2014/11/04 10:20		2014/11/04 11:15			2014/11/04 11:50	2014/11/04 11:50		2014/11/04 12:15		2014/11/04 14:50	2014/11/04 15:15		
COC Number				B 128762	B 128762		B 128762	B 128762		B 128762	B 128762	B 128762			B 128762	B 128762		B 128762		B 128762			B 128762	B 128762		B 128763		B 128763	B 128763		
	Units	Criteria A	AO	WS-2	WS-5	QC Batch	WS-10	WS-10 Lab-Dup	QC Batch	WQ STA-2	WQ STA-9	WQ STA-8	RDL	QC Batch	WQ STA-3	WQ STA-3 Lab-Dup	QC Batch	WQ STA-4	QC Batch	MW14-04A	RDL	QC Batch	WQ STN-1	WQ STN-1 Lab-Dup	QC Batch	WQ STN-7	QC Batch	WQ STN-6	WQ STN-5	RDL	QC Batch
Calculated Parameters																															
Anion Sum	me/L	-	-	1.00	1.06	3813787	0.490		3813787	0.380	0.360	0.360	N/A	3813787	0.380		3813787	0.410	3813787	2.74	N/A	3813787	0.390		3813787	0.420	3813787	0.270	0.290	N/A	3813787
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	24	22	3813784	5.7		3813784	<1.0	<1.0	<1.0	1.0	3813784	<1.0		3813784	<1.0	3813784	93	1.0	3813784	<1.0		3813784	<1.0	3813784	<1.0	<1.0	1.0	3813784
Calculated TDS	mg/L	-	500	58	63	3813791	31		3813791	27	24	23	1.0	3813791	25		3813791	26	3813791	150	1.0	3813791	28		3813791	29	3813791	21	21	1.0	3813791
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	<1.0	3813784	<1.0		3813784	<1.0	<1.0	<1.0	1.0	3813784	<1.0		3813784	<1.0	3813784	<1.0	1.0	3813784	<1.0		3813784	<1.0	3813784	<1.0	<1.0	1.0	3813784
Cation Sum	me/L	-	-	1.08	1.18	3813787	0.570		3813787	0.540	0.470	0.470	N/A	3813787	0.490		3813787	0.490	3813787	2.54	N/A	3813787	0.550		3813787	0.540	3813787	0.420	0.410	N/A	3813787
Hardness (CaCO3)	mg/L	-	-	34	31	3813785	11		3813785	7.7	4.5	4.6	1.0	3813785	6.6		3813785	6.7	3813785	92	1.0	3813785	7.8		3813785	7.8	3813785	6.5	6.3	1.0	3813785
Ion Balance (% Difference)	%	-	-	3.85	5.36	3813786	7.55		3813786	17.4	13.3	13.3	N/A	3813786	12.6		3813786	8.89	3813786	3.79	N/A	3813786	17.0		3813786	12.5	3813786	21.7	17.1	N/A	3813786
Langelier Index (@ 20C)	N/A	-	-	-1.57	-1.73	3813789	-3.60		3813789	NC	NC	NC		3813789	NC		3813789	NC	3813789	-0.327		3813789	NC		3813789	NC	3813789	NC	NC		3813789
Langelier Index (@ 4C)	N/A	-	-	-1.82	-1.98	3813790	-3.85		3813790	NC	NC	NC		3813790	NC		3813790	NC	3813790	-0.577		3813790	NC		3813790	NC	3813790	NC	NC		3813790
Nitrate (N)	mg/L	10	-	0.082	0.087	3813329	0.067		3813329	0.058	<0.050	<0.050	0.050	3813329	<0.050		3813329	<0.050	3813788	<0.050	0.050	3813788	<0.050		3813788	<0.050	3813788	<0.050	<0.050	0.050	3813788
Saturation pH (@ 20C)	N/A	-	-	8.86	9.00	3813789	10.1		3813789	NC	NC	NC		3813789	NC		3813789	NC	3813789	7.90		3813789	NC		3813789	NC	3813789	NC	NC		3813789
Saturation pH (@ 4C)	N/A	-	-	9.11	9.26	3813790	10.3		3813790	NC	NC	NC		3813790	NC		3813790	NC	3813790	8.15		3813790	NC		3813790	NC	3813790	NC	NC		3813790
Inorganics																															
Total Alkalinity (Total as CaCO3)	mg/L	-	-	24	22	3823280	5.7	5.3	3823280	<5.0	<5.0	<5.0	5.0	3823280	<5.0		3823280	<5.0	3823280	93	5.0	3823280	<5.0		3823280	<5.0	3823280	<5.0	<5.0	5.0	3823280
Dissolved Chloride (Cl)	mg/L	-	250	15	19	3823281	12	12	3823281	13	13	13	1.0	3823281	13		3823281	14	3823281	16	1.0	3823281	13		3823281	14	3823281	9.7	10	1.0	3823281
Colour	TCU	-	15	90	100	3823284	140	140	3823284	69	67	73	25	3823284	31		3823284	34	3823284	10	5.0	3823284	120		3823284	89	3823284	69	65	25	3823284
Nitrate + Nitrite	mg/L	-	-	0.082	0.087	3823286	0.067	0.067	3823286	0.058	<0.050	<0.050	0.050	3823286	<0.050		3823286	<0.050	3823286	<0.050	0.050	3823286	<0.050		3823286	<0.050	3823286	<0.050	<0.050	0.050	3823286
Nitrite (N)	mg/L	1	-	<0.010	<0.010	3823287	<0.010	<0.010	3823287	<0.010	<0.010	<0.010	0.010	3823287	<0.010		3823287	<0.010	3823287	<0.010	0.010	3823287	<0.010		3823287	<0.010	3823287	<0.010	<0.010	0.010	3823287
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	<0.050	<0.050	3823460	<0.050		3823460	<0.050	<0.050	<0.050	0.050	3823467	<0.050		3821900	<0.050	3821900	0.075	0.050	3823467	<0.050	0.052	3821900	<0.050	3823467	<0.050	<0.050	0.050	3823467
Total Organic Carbon (C)	mg/L	-	-	9.1	10	3821731	11		3821731	6.9	7.5	6.6	0.50	3821731	4.1	4.0	3821731	4.1	3821731	4.2	0.50	3821731	11		3821731	9.3	3821731	6.9	6.9	0.50	3821731
Orthophosphate (P)	mg/L	-	-	<0.010	<0.010	3823285	<0.010	<0.010	3823285	<0.010	<0.010	<0.010	0.010	3823285	<0.010		3823285	<0.010	3823285	<0.010	0.010	3823285	<0.010		3823285	<0.010	3823285	<0.010	<0.010	0.010	3823285
pH	pH	-	6.5 : 8.5	7.29	7.28	3823264	6.50		3823264	6.15	5.16	4.98	N/A	3823423	5.65		3823423	5.65	3823423	7.57	N/A	3823423	5.88		3823423	5.92	3823423	6.02	6.03	N/A	3823423
Reactive Silica (SiO2)	mg/L	-	-	3.9	3.8	3823283	2.5	2.6	3823283	2.2	0.67	0.60	0.50	3823283	0.84		3823283	0.90	3823283	7.6	0.50	3823283	2.8		3823283	2.3	3823283	1.9	1.9	0.50	3823283
Dissolved Sulphate (SO4)	mg/L	-	500	<2.0	<2.0	3823282	<2.0	<2.0	3823282	<2.0	<2.0	<2.0	2.0	3823282	<2.0		3823282	<2.0	3823282	16	2.0	3823282	<2.0		3823282	<2.0	3823282	<2.0	<2.0	2.0	3823282
Turbidity	NTU	0.3	-	**1.3**	**2.5**	3825930	**1.5**		3825931	**1.0**	**0.60**	**0.64**	0.10	3825931	**0.92**	**0.95**	3825931	**0.63**	3825931	**6.0**	0.10	3825931	**2.9**		3825931	**2.6**	3825931	**1.0**	**0.83**	0.10	3825931
Conductivity	uS/cm	-	-	99	110	3823265	55		3823265	54	54	53	1.0	3823429	52		3823429	52	3823429	250	1.0	3823429	56		3823429	54	3823429	40	39	1.0	3823429
Metals																															
Total Aluminum (Al)	ug/L	-	100	310	430	3815304	290		3815304	330	280	290	5.0	3815304	170		3815304	180	3815304	170	5.0	3815304	610		3815304	460	3815304	130	130	5.0	3817191
Total Antimony (Sb)	ug/L	6	-	<1.0	<1.0	3815304	<1.0		3815304	<1.0	<1.0	<1.0	1.0	3815304	<1.0		3815304	<1.0	3815304	<1.0	1.0	3815304	<1.0		3815304	<1.0	3815304	<1.0	<1.0	1.0	3817191
Total Arsenic (As)	ug/L	10	-	<1.0	<1.0	3815304	<1.0		3815304	<1.0	<1.0	<1.0	1.0	3815304	<1.0		3815304	<1.0	3815304	<1.0	1.0	3815304	1.2		3815304	1.1	3815304	<1.0	<1.0	1.0	3817191
Total Barium (Ba)	ug/L	1000	-	97	110	3815304	19		3815304	3.7	2.6	3.1	1.0	3815304	3.2		3815304	3.1	3815304	97	1.0	3815304	8.3		3815304	8.5	3815304	13	14	1.0	3817191
Total Beryllium (Be)	ug/L	-	-	<1.0	<1.0	3815304	<1.0		3815304	<1.0	<1.0	<1.0	1.0	3815304	<1.0		3815304	<1.0	3815304	<1.0	1.0	3815304	<1.0		3815304	<1.0	3815304	<1.0	<1.0	1.0	3817191
Total Bismuth (Bi)	ug/L	-	-	<2.0	<2.0	3815304	<2.0		3815304	<2.0	<2.0	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	<2.0	2.0	3817191
Total Boron (B)	ug/L	5000	-	<50	<50	3815304	<50		3815304	<50	<50	<50	50	3815304	<50		3815304	<50	3815304	<50	50	3815304	<50		3815304	<50	3815304	<50	<50	50	3817191
Total Cadmium (Cd)	ug/L	5	-	0.043	0.052	3815304	0.047		3815304	0.030	0.040	0.044	0.010	3815304	0.017		3815304	0.022	3815304	0.25	0.010	3815304	0.037		3815304	0.029	3815304	0.025	0.021	0.010	3817191
Total Calcium (Ca)	ug/L	-	-	12000	9900	3815304	2900		3815304	1400	380	380	100	3815304	1100		3815304	1100	3815304	32000	100	3815304	1400		3815304	1400	3815304	1500	1500	100	3817191
Total Chromium (Cr)	ug/L	50	-	<1.0	<1.0	3815304	<1.0		3815304	<1.0	<1.0	<1.0	1.0	3815304	<1.0		3815304	<1.0	3815304	2.7	1.0	3815304	<1.0		3815304	<1.0	3815304	<1.0	<1.0	1.0	3817191
Total Cobalt (Co)	ug/L	-	-	<0.40	<0.40	3815304	<0.40		3815304	<0.40	<0.40	<0.40	0.40	3815304	<0.40		3815304	<0.40	3815304	0.75	0.40	3815304	0.54		3815304	<0.40	3815304	<0.40	<0.40	0.40	3817191
Total Copper (Cu)	ug/L	-	1000	<2.0	2.6	3815304	<2.0		3815304	<2.0	<2.0	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	7.8	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	<2.0	2.0	3817191
Total Iron (Fe)	ug/L	-	300	300	440	3815304	620		3815304	440	200	150	50	3815304	140		3815304	140	3815304	340	50	3815304	660		3815304	520	3815304	530	530	50	3817191
Total Lead (Pb)	ug/L	10	-	2.7	5.5	3815304	1.3		3815304	0.88	0.68	0.96	0.50	3815304	<0.50		3815304	<0.50	3815304	2.9	0.50	3815304	1.4		3815304	0.92	3815304	<0.50	<0.50	0.50	3817191
Total Lithium (Li)	ug/L	-	-	<2.0	2.1	3815304	<2.0		3815304	2.1	<2.0	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	17	2.0	3815304	2.7		3815304	2.2	3815304	<2.0	<2.0	2.0	3817191
Total Magnesium (Mg)	ug/L	-	-	1000	1400	3815304	890		3815304	1000	860	890	100	3815304	960		3815304	980	3815304	2600	100	3815304	1000		3815304	1000	3815304	680	640	100	3817191
Total Manganese (Mn)	ug/L	-	50	18	64	3815304	75		3815304	19	35	34	2.0	3815304	6.1		3815304	6.9	3815304	170	2.0	3815304	22		3815304	11	3815304	24	25	2.0	3817191
Total Molybdenum (Mo)	ug/L	-	-	<2.0	<2.0	3815304	<2.0		3815304	<2.0	<2.0	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	13	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	<2.0	2.0	3817191
Total Nickel (Ni)	ug/L	-	-	<2.0	<2.0	3815304	<2.0		3815304	<2.0	<2.0	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	3.9	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	<2.0	2.0	3817191
Total Phosphorus (P)	ug/L	-	-	<100	<100	3815304	<100		3815304	<100	<100	<100	100	3815304	<100		3815304	<100	3815304	<100	100	3815304	<100		3815304	<100	3815304	<100	<100	100	3817191
Total Potassium (K)	ug/L	-	-	470	700	3815304	390		3815304	400	270	250	100	3815304	300		3815304	290	3815304	1300	100	3815304	490		3815304	400	3815304	300	320	100	3817191
Total Selenium (Se)	ug/L	50	-	<1.0	<1.0	3815304	<1.0		3815304	<1.0	<1.0	<1.0	1.0	3815304	<1.0		3815304	<1.0	3815304	<1.0	1.0	3815304	<1.0		3815304	<1.0	3815304	<1.0	<1.0	1.0	3817191
Total Silicon (Si)	ug/L	-	-	1900	2000	3815304	1200		3815304	1100	<500	<500	500	3815304	<500		3815304	<500	3815304	3500	500	3815304	1500		3815304	1200	3815304	880	830	500	3817191
Total Silver (Ag)	ug/L	-	-	<0.10	<0.10	3815304	<0.10		3815304	<0.10	<0.10	<0.10	0.10	3815304	<0.10		3815304	<0.10	3815304	<0.10	0.10	3815304	<0.10		3815304	<0.10	3815304	<0.10	<0.10	0.10	3817191
Total Sodium (Na)	ug/L	-	200000	8900	12000	3815304	7400		3815304	8300	8300	8200	100	3815304	7900		3815304	7800	3815304	15000	100	3815304	8300		3815304	8200	3815304	6100	5900	100	3817191
Total Strontium (Sr)	ug/L	-	-	21	25	3815304	14		3815304	9.6	5.3	5.7	2.0	3815304	8.3		3815304	8.4	3815304	140	2.0	3815304	10		3815304	9.8	3815304	12	11	2.0	3817191
Total Sulphur (S)	ug/L	-	-	<5000	<5000	3815304	<5000		3815304	<5000	<5000	<5000	5000	3815304	<5000		3815304	<5000	3815304	<5000	5000	3815304	<5000		3815304	<5000	3815304	<5000	<5000	5000	3817191
Total Tellurium (Te)	ug/L	-	-	<2.0	<2.0	3815304	<2.0		3815304	<2.0	<2.0	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	<2.0	2.0	3817191
Total Thallium (Tl)	ug/L	-	-	<0.10	<0.10	3815304	<0.10		3815304	<0.10	<0.10	<0.10	0.10	3815304	<0.10		3815304	<0.10	3815304	<0.10	0.10	3815304	<0.10		3815304	<0.10	3815304	<0.10	<0.10	0.10	3817191
Total Tin (Sn)	ug/L	-	-	<2.0	<2.0	3815304	<2.0		3815304	<2.0	<2.0	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	2.7	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	<2.0	2.0	3817191
Total Titanium (Ti)	ug/L	-	-	5.6	6.0	3815304	3.9		3815304	2.8	2.5	2.9	2.0	3815304	<2.0		3815304	<2.0	3815304	6.3	2.0	3815304	7.2		3815304	3.7	3815304	<2.0	2.5	2.0	3817191
Total Uranium (U)	ug/L	20	-	0.58	0.74	3815304	0.46		3815304	<0.10	<0.10	<0.10	0.10	3815304	<0.10		3815304	<0.10	3815304	5.1	0.10	3815304	<0.10		3815304	<0.10	3815304	0.21	0.19	0.10	3817191
Total Vanadium (V)	ug/L	-	-	<2.0	<2.0	3815304	<2.0		3815304	<2.0	<2.0	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	<2.0	2.0	3817191
Total Zirconium (Zr)	ug/L	-	-	<2.0	<2.0	3815304	<2.0		3815304	<2.0	<2.0	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	2.0	3815304	<2.0		3815304	<2.0	3815304	<2.0	<2.0	2.0	3817191
Total Zinc (Zn)	ug/L	-	5000	5.4	9.5	3815304	6.0		3815304	6.3	7.7	8.9	5.0	3815304	<5.0		3815304	<5.0	3815304	800	5.0	3815304	8.9		3815304	5.0	3815304	<5.0	<5.0	5.0	3817191

RDL = Reportable Detection Limit
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EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

RESULTS OF ANALYSES OF

Maxxam ID				YI3664	YI3664		YI3665	YI3666	YI3666	YI3667	YI3668	YI3669	YI3670
Sampling Date				2014/11/03 13:35	/03 13:35		2014/11/03 14:00	2014/11/03 14:55	2014/11/03 14:55	2014/11/03 16:00	2014/11/04 08:45	2014/11/04 09:05	2014/11/04 10:10
COC Number				B 128762	B		B 128762	B 128762	B 128762	B 128762	B 128762	B 128762	B 128762
	Units	**Criteria A**	**AO**	**WS-2**	**WS-2 Lab-Dup**	**RDL**	**WS-5**	**WS-10**	**WS-10 Lab-Dup**	**WQ STA-2**	**WQ STA-9**	**WQ STA-8**	**WQ STA-3**
Field Measurements													
Field pH	pH	-	-	6.00		N/A	6.23	6.11		5.95	3.70	3.94	4.69
Inorganics													
Total Dissolved Solids	mg/L	-	500	52		20	85	48		49	36	37	38
Dissolved Fluoride (F-)	mg/L	**1.5**	-	**1.6**		0.10	1.5	0.41	0.40	0.24	<0.10	<0.10	0.16
Dissolved Organic Carbon (C)	mg/L	-	-	8.9		0.50	9.7	11		7.2	7.5	7.0	4.1
Total Phosphorus	mg/L	-	-	<0.020		0.020	<0.020	0.029		<0.020	<0.020	0.030	<0.020
Total Suspended Solids	mg/L	-	-	1.6		1.0	3.6	3.6		1.4	<1.0	<1.0	1.0
Sulphide	mg/L	-	0.05	<0.020	<0.020	0.020	<0.020	<0.020		<0.020	<0.020	<0.020	<0.020
Bromide (Br-)	mg/L	-	-	<1.0		1.0	<1.0	<1.0		<1.0	<1.0	<1.0	<1.0

Maxxam ID		YI3671			YI3672		YI3673	YI3674	YI3675	YI3675	YI3676		
Sampling Date		2014/11/04 10:20			2014/11/04 11:15		2014/11/04 11:50	2014/11/04 12:15	2014/11/04 14:50	2014/11/04 14:50	2014/11/04 15:15		
COC Number		B 128762			B 128762		B 128762	B 128763	B 128763	B 128763	B 128763		
	QC Batch	**WQ STA-4**	**RDL**	**QC Batch**	**MW14-04A**	**RDL**	**WQ STN-1**	**WQ STN-7**	**WQ STN-6**	**WQ STN-6 Lab-Dup**	**WQ STN-5**	**RDL**	**QC Batch**
Field Measurements													
Field pH	ONSITE	4.76	N/A	ONSITE	6.22	N/A	5.92	5.94	5.68		5.53	N/A	ONSITE
Inorganics													
Total Dissolved Solids	3821546	38	10	3821546	170	20	63	61	51		46	20	3823470
Dissolved Fluoride (F-)	3815638	0.16	0.10	3815638	**1.7**	0.10	0.22	0.21	<0.10		<0.10	0.10	3815638
Dissolved Organic Carbon (C)	3821726	4.3	0.50	3825851	3.5	0.50	12	9.6	6.6		6.7	0.50	3825851
Total Phosphorus	3823358	0.030	0.020	3823358	0.028	0.020	0.027	0.031	0.025		0.025	0.020	3823358
Total Suspended Solids	3817326	<1.0	1.0	3817326	7.9	2.0	1.6	1.2	1.4		1.4	1.0	3817326
Sulphide	3816944	<0.020	0.020	3816944	<0.020	0.020	<0.020	<0.020	<0.020		<0.020	0.020	3816944
Bromide (Br-)	3817015	<1.0	1.0	3817015	<1.0	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.0	3817015

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Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YE4528	YE4528	YE4529			YE4530	YE4530			YE4531			YE4532			YI3672		
Sampling Date				2014/10/24 11:30	2014/10/24 11:30	2014/10/24 13:20			2014/10/24 15:00	2014/10/24 15:00			2014/10/25 11:45			2014/10/26 15:10			2014/11/04 11:15		
COC Number				B 128761	B 128761	B 128761			B 128761	B 128761			B 128761			B 128761			B 128762		
	Units	**Criteria A**	**AO**	**MW14-01A**	**MW14-01A Lab-Dup**	**MW14-02A**	**RDL**	**QC Batch**	**MW14-03A**	**MW14-03A Lab-Dup**	**RDL**	**QC Batch**	**PGS-93B**	**RDL**	**QC Batch**	**PGS-124**	**RDL**	**QC Batch**	**MW14-04A**	**RDL**	**QC Batch**
Calculated Parameters																					
Anion Sum	me/L	-	-	1.25		2.08	N/A	3801231	0.720		N/A	3801231	1.93	N/A	3801231	1.26	N/A	3801231	2.74	N/A	3813787
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	36		72	1.0	3801228	11		1.0	3801228	61	1.0	3801228	13	1.0	3801228	93	1.0	3813784
Calculated TDS	mg/L	-	500	74		120	1.0	3801237	70		1.0	3801237	110	1.0	3801237	170	1.0	3801237	150	1.0	3813791
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0		<1.0	1.0	3801228	<1.0		1.0	3801228	<1.0	1.0	3801228	<1.0	1.0	3801228	<1.0	1.0	3813784
Cation Sum	me/L	-	-	1.25		1.96	N/A	3801231	1.49		N/A	3801231	1.90	N/A	3801231	4.47	N/A	3801231	2.54	N/A	3813787
Hardness (CaCO3)	mg/L	-	-	39		64	1.0	3801229	19		1.0	3801229	64	1.0	3801229	80	1.0	3801229	92	1.0	3813785
Ion Balance (% Difference)	%	-	-	0.00		2.97	N/A	3801230	34.8		N/A	3801230	0.780	N/A	3801230	56.0	N/A	3801230	3.79	N/A	3813786
Langelier Index (@ 20C)	N/A	-	-	-1.30		-0.557		3801235	-3.30			3801235	-0.167		3801235	-2.33		3801235	-0.327		3813789
Langelier Index (@ 4C)	N/A	-	-	-1.55		-0.807		3801236	-3.55			3801236	-0.418		3801236	-2.58		3801236	-0.577		3813790
Nitrate (N)	mg/L	10	-	<0.050		<0.050	0.050	3801232	<0.050		0.050	3801232	<0.050	0.050	3801232	0.17	0.050	3801232	<0.050	0.050	3813788
Saturation pH (@ 20C)	N/A	-	-	8.66		8.19		3801235	9.81			3801235	8.19		3801235	9.13		3801235	7.90		3813789
Saturation pH (@ 4C)	N/A	-	-	8.91		8.44		3801236	10.1			3801236	8.44		3801236	9.38		3801236	8.15		3813790
Inorganics																					
Total Alkalinity (Total as CaCO3)	mg/L	-	-	36	36	73	5.0	3803507	11		5.0	3803507	62	5.0	3803507	13	5.0	3803507	93	5.0	3823280
Dissolved Chloride (Cl)	mg/L	-	250	15	14	17	1.0	3803513	17		1.0	3803513	14	1.0	3803513	25	1.0	3803513	16	1.0	3823281
Colour	TCU	-	15	<5.0	<5.0	8.5	5.0	3803517	160		25	3803517	<5.0	5.0	3803517	95	25	3803517	10	5.0	3823284
Nitrate + Nitrite	mg/L	-	-	<0.050	<0.050	<0.050	0.050	3803519	<0.050		0.050	3803519	<0.050	0.050	3803519	0.17	0.050	3803519	<0.050	0.050	3823286
Nitrite (N)	mg/L	1	-	<0.010	<0.010	<0.010	0.010	3803520	<0.010		0.010	3803520	<0.010	0.010	3803520	<0.010	0.010	3803520	<0.010	0.010	3823287
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	0.061		<0.050	0.050	3804761	0.085		0.050	3804761	<0.050	0.050	3804761	0.060	0.050	3809291	0.075	0.050	3823467
Total Organic Carbon (C)	mg/L	-	-	3.5		8.7	0.50	3813443	38 (1)		5.0	3801325	<0.50	0.50	3801325	21 (1)	5.0	3801325	4.2	0.50	3821731
Orthophosphate (P)	mg/L	-	-	<0.010	<0.010	<0.010	0.010	3803518	0.011		0.010	3803518	<0.010	0.010	3803518	<0.010	0.010	3803518	<0.010	0.010	3823285
pH	pH	-	6.5 : 8.5	7.36		7.63	N/A	3810222	6.51	6.51	N/A	3802765	8.02	N/A	3810222	6.80	N/A	3810222	7.57	N/A	3823423
Reactive Silica (SiO2)	mg/L	-	-	6.7	6.7	11	0.50	3803516	9.9		0.50	3803516	9.7	0.50	3803516	19	0.50	3803516	7.6	0.50	3823283
Dissolved Sulphate (SO4)	mg/L	-	500	4.0	3.9	4.6	2.0	3803514	<2.0		2.0	3803514	8.2	2.0	3803514	10	2.0	3803514	16	2.0	3823282
Turbidity	NTU	0.3	-	**27**		**13**	0.10	3810731	**150**		0.50	3810731	**7.6**	0.10	3810731	**660**	5.0	3810731	**6.0**	0.10	3825931
Conductivity	uS/cm	-	-	120		180	1.0	3810230	83	83	1.0	3802766	180	1.0	3810230	130	1.0	3810230	250	1.0	3823429
Metals																					
Total Aluminum (Al)	ug/L	-	100	610		710	5.0	3802699	15000		5.0	3802699	580	5.0	3802699	39000	5.0	3802699	170	5.0	3815304
Total Antimony (Sb)	ug/L	6	-	<1.0		<1.0	1.0	3802699	4.0		1.0	3802699	<1.0	1.0	3802699	<1.0	1.0	3802699	<1.0	1.0	3815304
Total Arsenic (As)	ug/L	10	-	4.8		<1.0	1.0	3802699	**120**		1.0	3802699	**26**	1.0	3802699	**23**	1.0	3802699	<1.0	1.0	3815304
Total Barium (Ba)	ug/L	1000	-	74		42	1.0	3802699	190		1.0	3802699	32	1.0	3802699	740	1.0	3802699	97	1.0	3815304
Total Beryllium (Be)	ug/L	-	-	<1.0		<1.0	1.0	3802699	3.0		1.0	3802699	<1.0	1.0	3802699	3.6	1.0	3802699	<1.0	1.0	3815304
Total Bismuth (Bi)	ug/L	-	-	<2.0		<2.0	2.0	3802699	<2.0		2.0	3802699	<2.0	2.0	3802699	<2.0	2.0	3802699	<2.0	2.0	3815304
Total Boron (B)	ug/L	5000	-	<50		<50	50	3802699	<50		50	3802699	<50	50	3802699	<50	50	3802699	<50	50	3815304
Total Cadmium (Cd)	ug/L	5	-	0.24		0.99	0.010	3802699	3.2		0.010	3802699	0.11	0.010	3802699	2.6	0.010	3802699	0.25	0.010	3815304
Total Calcium (Ca)	ug/L	-	-	13000		21000	100	3802699	3500		100	3802699	24000	100	3802699	13000	100	3802699	32000	100	3815304
Total Chromium (Cr)	ug/L	50	-	<1.0		<1.0	1.0	3802699	12		1.0	3802699	<1.0	1.0	3802699	**56**	1.0	3802699	2.7	1.0	3815304
Total Cobalt (Co)	ug/L	-	-	<0.40		0.98	0.40	3802699	8.6		0.40	3802699	<0.40	0.40	3802699	26	0.40	3802699	0.75	0.40	3815304
Total Copper (Cu)	ug/L	-	1000	5.2		4.4	2.0	3802699	110		2.0	3802699	3.1	2.0	3802699	120	2.0	3802699	7.8	2.0	3815304
Total Iron (Fe)	ug/L	-	300	490		670	50	3802699	15000		50	3802699	640	50	3802699	53000	50	3802699	340	50	3815304
Total Lead (Pb)	ug/L	10	-	7.3		4.4	0.50	3802699	**1000**		0.50	3802699	4.6	0.50	3802699	**250**	0.50	3802699	2.9	0.50	3815304
Total Lithium (Li)	ug/L	-	-	8.3		13	2.0	3802699	30		2.0	3802699	65	2.0	3802699	140	2.0	3802699	17	2.0	3815304
Total Magnesium (Mg)	ug/L	-	-	1500		3100	100	3802699	2400		100	3802699	1000	100	3802699	11000	100	3802699	2600	100	3815304
Total Manganese (Mn)	ug/L	-	50	44		120	2.0	3802699	800		2.0	3802699	19	2.0	3802699	1100	2.0	3802699	170	2.0	3815304
Total Molybdenum (Mo)	ug/L	-	-	2.1		<2.0	2.0	3802699	7.6		2.0	3802699	7.1	2.0	3802699	9.2	2.0	3802699	13	2.0	3815304
Total Nickel (Ni)	ug/L	-	-	<2.0		3.6	2.0	3802699	12		2.0	3802699	<2.0	2.0	3802699	52	2.0	3802699	3.9	2.0	3815304
Total Phosphorus (P)	ug/L	-	-	100		<100	100	3802699	380		100	3802699	100	100	3802699	840	100	3802699	<100	100	3815304
Total Potassium (K)	ug/L	-	-	1400		1400	100	3802699	1800		100	3802699	1200	100	3802699	10000	100	3802699	1300	100	3815304
Total Selenium (Se)	ug/L	50	-	<1.0		<1.0	1.0	3802699	1.0		1.0	3802699	<1.0	1.0	3802699	1.1	1.0	3802699	<1.0	1.0	3815304
Total Silicon (Si)	ug/L	-	-	3400		5500	500	3802699	9900		500	3802699	5000	500	3802699	39000	500	3802699	3500	500	3815304
Total Silver (Ag)	ug/L	-	-	0.10		0.15	0.10	3802699	0.86		0.10	3802699	0.17	0.10	3802699	13	0.10	3802699	<0.10	0.10	3815304
Total Sodium (Na)	ug/L	-	200000	9700		14000	100	3802699	12000		100	3802699	13000	100	3802699	16000	100	3802699	15000	100	3815304
Total Strontium (Sr)	ug/L	-	-	86		87	2.0	3802699	27		2.0	3802699	270	2.0	3802699	52	2.0	3802699	140	2.0	3815304
Total Sulphur (S)	ug/L	-	-	<5000		<5000	5000	3802699	<5000		5000	3802699	<5000	5000	3802699	<5000	5000	3802699	<5000	5000	3815304
Total Tellurium (Te)	ug/L	-	-	<2.0		<2.0	2.0	3802699	<2.0		2.0	3802699	<2.0	2.0	3802699	<2.0	2.0	3802699	<2.0	2.0	3815304
Total Thallium (Tl)	ug/L	-	-	<0.10		<0.10	0.10	3802699	0.24		0.10	3802699	<0.10	0.10	3802699	0.73	0.10	3802699	<0.10	0.10	3815304
Total Tin (Sn)	ug/L	-	-	<2.0		<2.0	2.0	3802699	<2.0		2.0	3802699	<2.0	2.0	3802699	2.3	2.0	3802699	2.7	2.0	3815304
Total Titanium (Ti)	ug/L	-	-	4.1		6.4	2.0	3802699	200		2.0	3802699	6.9	2.0	3802699	550	2.0	3802699	6.3	2.0	3815304

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YE4528	YE4528	YE4529			YE4530	YE4530			YE4531			YE4532			YI3672		
Sampling Date				2014/10/24 11:30	2014/10/24 11:30	2014/10/24 13:20			2014/10/24 15:00	2014/10/24 15:00			2014/10/25 11:45			2014/10/26 15:10			2014/11/04 11:15		
COC Number				B 128761	B 128761	B 128761			B 128761	B 128761			B 128761			B 128761			B 128762		
	Units	**Criteria A**	**AO**	**MW14-01A**	**MW14-01A Lab-Dup**	**MW14-02A**	**RDL**	**QC Batch**	**MW14-03A**	**MW14-03A Lab-Dup**	**RDL**	**QC Batch**	**PGS-93B**	**RDL**	**QC Batch**	**PGS-124**	**RDL**	**QC Batch**	**MW14-04A**	**RDL**	**QC Batch**
Total Uranium (U)	ug/L	**20**	-	0.43		0.54	0.10	3802699	6.1		0.10	3802699	3.6	0.10	3802699	3.5	0.10	3802699	5.1	0.10	3815304
Total Vanadium (V)	ug/L	**-**	-	<2.0		<2.0	2.0	3802699	22		2.0	3802699	<2.0	2.0	3802699	47	2.0	3802699	<2.0	2.0	3815304
Total Zirconium (Zr)	ug/L	**-**	-	<2.0		<2.0	2.0	3802699	3.3		2.0	3802699	<2.0	2.0	3802699	3.6	2.0	3802699	<2.0	2.0	3815304
Total Zinc (Zn)	ug/L	**-**	5000	48		64	5.0	3802699	380		5.0	3802699	25	5.0	3802699	540	5.0	3802699	800	5.0	3815304

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.
(1) Reporting limit was increased due to turbidity.

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

RESULTS OF ANALYSES OF WATER

Maxxam ID				YE4528		YE4529			YE4530		YE4531	YE4531		YE4532			YI3672		
Sampling Date				2014/10/24 11:30		2014/10/24 13:20			2014/10/24 15:00		2014/10/25 11:45	2014/10/25 11:45		2014/10/26 15:10			2014/11/04 11:15		
COC Number				B 128761		B 128761			B 128761		B 128761	B 128761		B 128761			B 128762		
	Units	**Criteria A**	**AO**	**MW14-01A**	**RDL**	**MW14-02A**	**RDL**	**QC Batch**	**MW14-03A**	**RDL**	**PGS-93B**	**PGS-93B Lab-Dup**	**RDL**	**PGS-124**	**RDL**	**QC Batch**	**MW14-04A**	**RDL**	**QC Batch**
Field Measurements																			
Field pH	pH	-	-												N/A		6.22	N/A	ONSITE
Inorganics																			
Total Dissolved Solids	mg/L	-	500	97	20	150	20	3811569	210	40	110		20	140	20	3811569	170	20	3823470
Dissolved Fluoride (F-)	mg/L	**1.5**	-	0.55	0.10	0.80	0.10	3806847	0.28	0.10	**2.6**		0.10	1.3	0.10	3806847	**1.7**	0.10	3815638
Dissolved Organic Carbon (C)	mg/L	-	-	7.8	0.50	11	0.50	3813442	29 (1)	5.0	<0.50		0.50	11	0.50	3801537	3.5	0.50	3825851
Total Phosphorus	mg/L	-	-	0.026	0.020	0.027	0.020	3810800	0.24	0.020	0.028		0.020	0.81	0.10	3810800	0.028	0.020	3823358
Total Suspended Solids	mg/L	-	-	<10	10	<5.0	5.0	3806746	55	5.0	15		2.0	1100	20	3806746	7.9	2.0	3817326
Sulphide	mg/L	-	0.05	<0.020	0.020	<0.020	0.020	3804000	0.025	0.020	<0.020		0.020	<0.020	0.020	3804000	<0.020	0.020	3816944
Bromide (Br-)	mg/L	-	-	<1.0	1.0	<1.0	1.0	3806128	<1.0	1.0	<1.0	<1.0	1.0	<1.0	1.0	3806128	<1.0	1.0	3817015

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
EDL = Estimated Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.
(1) Elevated reporting limit due to sample matrix.

Maxxam
A Bureau Veritas Group Company

Success Through Science®

Your Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Your C.O.C. #: B 128762, B 128763

Attention: Phyllis McCrindle
Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2014/11/24
Report #: R3231712
Version: 2R

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B4K8828
Received: 2014/11/06, 10:07

Sample Matrix: Water
Samples Received: 13

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Carbonate, Bicarbonate and Hydroxide	3	N/A	2014/11/14	N/A	SM 22 4500-CO2 D
Carbonate, Bicarbonate and Hydroxide	10	N/A	2014/11/17	N/A	SM 22 4500-CO2 D
Alkalinity	13	N/A	2014/11/19	ATL SOP 00013	EPA 310.2 R1974 m
Anions (1)	13	N/A	2014/11/10	CAM SOP-00435	SM 22 4110 B m
Chloride	13	N/A	2014/11/18	ATL SOP 00014	SM 22 4500-Cl- E m
Colour	13	N/A	2014/11/17	ATL SOP 00020	SM 22 2120C m
Organic carbon - Diss (DOC) (2)	7	N/A	2014/11/13	ATL SOP 00037	SM 22 5310C m
Organic carbon - Diss (DOC) (2)	6	N/A	2014/11/17	ATL SOP 00037	SM 22 5310C m
Conductance - water	13	N/A	2014/11/14	ATL SOP 00004	SM 22 2510B m
Fluoride	13	N/A	2014/11/07	ATL SOP 00043	SM 22 4500-F- C m
Hardness (calculated as CaCO3)	11	N/A	2014/11/10	ATL SOP 00048	SM 22 2340 B
Hardness (calculated as CaCO3)	2	N/A	2014/11/13	ATL SOP 00048	SM 22 2340 B
Mercury - Total (CVAA,LL)	1	2014/11/10	2014/11/17	ATL SOP 00026	EPA 245.1 R3 m
Mercury - Total (CVAA,LL)	11	2014/11/12	2014/11/13	ATL SOP 00026	EPA 245.1 R3 m
Mercury - Total (CVAA,LL)	1	2014/11/17	2014/11/17	ATL SOP 00026	EPA 245.1 R3 m
Metals Water Total MS (3)	11	2014/11/07	2014/11/08	ATL SOP 00058	EPA 6020A R1 m
Metals Water Total MS (3)	2	2014/11/10	2014/11/12	ATL SOP 00058	EPA 6020A R1 m
Ion Balance (% Difference)	13	N/A	2014/11/19		Auto Calc.
Anion and Cation Sum	3	N/A	2014/11/17		Auto Calc.
Anion and Cation Sum	10	N/A	2014/11/18		Auto Calc.
Nitrogen Ammonia - water	3	N/A	2014/11/14	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen Ammonia - water	10	N/A	2014/11/17	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	13	N/A	2014/11/18	ATL SOP 00016	USGS SOPINCF0452.2 m
Nitrogen - Nitrite	13	N/A	2014/11/17	ATL SOP 00017	SM 22 4500-NO2- B m
Nitrogen - Nitrate (as N)	13	N/A	2014/11/18	ATL SOP 00018	ASTM D3867
pH - On-Site	13	N/A	2014/11/06		
pH (4)	13	N/A	2014/11/14	ATL SOP 00003	SM 22 4500-H+ B m
Phosphorus - ortho	13	N/A	2014/11/17	ATL SOP 00021	EPA 365.2 m
Sat. pH and Langelier Index (@ 20C)	13	N/A	2014/11/19	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C)	13	N/A	2014/11/19	ATL SOP 00049	Auto Calc.
Reactive Silica	13	N/A	2014/11/17	ATL SOP 00022	EPA 366.0 m
Sulphate	13	N/A	2014/11/18	ATL SOP 00023	EPA 375.4 R1978 m
Sulphide (1)	13	N/A	2014/11/09	CAM SOP-00455	SM 22 4500-S G m
Total Dissolved Solids (Filt. Residue)	8	N/A	2014/11/14	ATL SOP 00009	EPA 160.1 m

Your Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Your C.O.C. #: B 128762, B 128763

Attention: Phyllis McCrindle
Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2014/11/24
Report #: R3231712
Version: 2R

CERTIFICATE OF ANALYSIS – REVISED REPORT

-2-

Sample Matrix: Water
Samples Received: 13

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Total Dissolved Solids (Filt. Residue)	5	N/A	2014/11/17	ATL SOP 00009	EPA 160.1 m
Total Dissolved Solids (TDS calc)	13	N/A	2014/11/19		Auto Calc.
Organic carbon - Total (TOC) (2)	13	N/A	2014/11/13	ATL SOP 00037	SM 22 5310C m
Total Phosphorus (Colourimetric) (1)	13	2014/11/14	2014/11/14	CAM SOP-00407	SM 4500 P B F m
Total Suspended Solids	13	N/A	2014/11/12	ATL SOP 00007	EPA 160.2 m
Turbidity	13	N/A	2014/11/17	ATL SOP 00011	EPA 180.1 R2 m

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

* 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) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC.
(3) New RDLs in effect due to release of NS Contaminated Sites Regulations. Reduced RDL based on MDL study performance. Low level analytical run checks being implemented.
(4) The APHA Standard Method require pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.

Encryption Key

Heather Macumber.
Heather Macumber
24 Nov 2014 13:46:43 -04:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Heather Macumber, Project Manager
Email: HMacumber@maxxam.ca
Phone# (902) 420-0203 Ext:226

==
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. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 2

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3664	YI3665		
Sampling Date				2014/11/03 13:35	2014/11/03 14:00		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WS-2**	**WS-5**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	me/L	-	-	1.00	1.06	N/A	3813787
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	24	22	1.0	3813784
Calculated TDS	mg/L	-	500	58	63	1.0	3813791
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	<1.0	1.0	3813784
Cation Sum	me/L	-	-	1.08	1.18	N/A	3813787
Hardness (CaCO3)	mg/L	-	-	34	31	1.0	3813785
Ion Balance (% Difference)	%	-	-	3.85	5.36	N/A	3813786
Langelier Index (@ 20C)	N/A	-	-	-1.57	-1.73		3813789
Langelier Index (@ 4C)	N/A	-	-	-1.82	-1.98		3813790
Nitrate (N)	mg/L	**10**	-	0.082	0.087	0.050	3813329
Saturation pH (@ 20C)	N/A	-	-	8.86	9.00		3813789
Saturation pH (@ 4C)	N/A	-	-	9.11	9.26		3813790
Inorganics							
Total Alkalinity (Total as CaCO3)	mg/L	-	-	24	22	5.0	3823280
Dissolved Chloride (Cl)	mg/L	-	250	15	19	1.0	3823281
Colour	TCU	-	15	90	100	25	3823284
Nitrate + Nitrite	mg/L	-	-	0.082	0.087	0.050	3823286
Nitrite (N)	mg/L	**1**	-	<0.010	<0.010	0.010	3823287
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	<0.050	<0.050	0.050	3823460
Total Organic Carbon (C)	mg/L	-	-	9.1	10	0.50	3821731
Orthophosphate (P)	mg/L	-	-	<0.010	<0.010	0.010	3823285
pH	pH	-	6.5 : 8.5	7.29	7.28	N/A	3823264

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3664	YI3665		
Sampling Date				2014/11/03 13:35	2014/11/03 14:00		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WS-2**	**WS-5**	**RDL**	**QC Batch**
Reactive Silica (SiO2)	mg/L	**-**	-	3.9	3.8	0.50	3823283
Dissolved Sulphate (SO4)	mg/L	**-**	500	<2.0	<2.0	2.0	3823282
Turbidity	NTU	**0.3**	-	**1.3**	**2.5**	0.10	3825930
Conductivity	uS/cm	**-**	-	99	110	1.0	3823265
Metals							
Total Aluminum (Al)	ug/L	**-**	100	310	430	5.0	3815304
Total Antimony (Sb)	ug/L	**6**	-	<1.0	<1.0	1.0	3815304
Total Arsenic (As)	ug/L	**10**	-	<1.0	<1.0	1.0	3815304
Total Barium (Ba)	ug/L	**1000**	-	97	110	1.0	3815304
Total Beryllium (Be)	ug/L	**-**	-	<1.0	<1.0	1.0	3815304
Total Bismuth (Bi)	ug/L	**-**	-	<2.0	<2.0	2.0	3815304
Total Boron (B)	ug/L	**5000**	-	<50	<50	50	3815304
Total Cadmium (Cd)	ug/L	**5**	-	0.043	0.052	0.010	3815304
Total Calcium (Ca)	ug/L	**-**	-	12000	9900	100	3815304
Total Chromium (Cr)	ug/L	**50**	-	<1.0	<1.0	1.0	3815304
Total Cobalt (Co)	ug/L	**-**	-	<0.40	<0.40	0.40	3815304
Total Copper (Cu)	ug/L	**-**	1000	<2.0	2.6	2.0	3815304
Total Iron (Fe)	ug/L	**-**	300	300	440	50	3815304
Total Lead (Pb)	ug/L	**10**	-	2.7	5.5	0.50	3815304
Total Lithium (Li)	ug/L	**-**	-	<2.0	2.1	2.0	3815304
Total Magnesium (Mg)	ug/L	**-**	-	1000	1400	100	3815304
Total Manganese (Mn)	ug/L	**-**	50	18	64	2.0	3815304
Total Molybdenum (Mo)	ug/L	**-**	-	<2.0	<2.0	2.0	3815304

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3664	YI3665		
Sampling Date				2014/11/03 13:35	2014/11/03 14:00		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WS-2**	**WS-5**	**RDL**	**QC Batch**
Total Nickel (Ni)	ug/L	**-**	-	<2.0	<2.0	2.0	3815304
Total Phosphorus (P)	ug/L	**-**	-	<100	<100	100	3815304
Total Potassium (K)	ug/L	**-**	-	470	700	100	3815304
Total Selenium (Se)	ug/L	**50**	-	<1.0	<1.0	1.0	3815304
Total Silicon (Si)	ug/L	**-**	-	1900	2000	500	3815304
Total Silver (Ag)	ug/L	**-**	-	<0.10	<0.10	0.10	3815304
Total Sodium (Na)	ug/L	**-**	200000	8900	12000	100	3815304
Total Strontium (Sr)	ug/L	**-**	-	21	25	2.0	3815304
Total Sulphur (S)	ug/L	**-**	-	<5000	<5000	5000	3815304
Total Tellurium (Te)	ug/L	**-**	-	<2.0	<2.0	2.0	3815304
Total Thallium (Tl)	ug/L	**-**	-	<0.10	<0.10	0.10	3815304
Total Tin (Sn)	ug/L	**-**	-	<2.0	<2.0	2.0	3815304
Total Titanium (Ti)	ug/L	**-**	-	5.6	6.0	2.0	3815304
Total Uranium (U)	ug/L	**20**	-	0.58	0.74	0.10	3815304
Total Vanadium (V)	ug/L	**-**	-	<2.0	<2.0	2.0	3815304
Total Zirconium (Zr)	ug/L	**-**	-	<2.0	<2.0	2.0	3815304
Total Zinc (Zn)	ug/L	**-**	5000	5.4	9.5	5.0	3815304

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3666	YI3666		
Sampling Date				2014/11/03 14:55	2014/11/03 14:55		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WS-10**	**WS-10 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	me/L	**-**	-	0.490		N/A	3813787
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	**-**	-	5.7		1.0	3813784
Calculated TDS	mg/L	**-**	500	31		1.0	3813791
Carb. Alkalinity (calc. as CaCO3)	mg/L	**-**	-	<1.0		1.0	3813784
Cation Sum	me/L	**-**	-	0.570		N/A	3813787
Hardness (CaCO3)	mg/L	**-**	-	11		1.0	3813785
Ion Balance (% Difference)	%	**-**	-	7.55		N/A	3813786
Langelier Index (@ 20C)	N/A	**-**	-	-3.60			3813789
Langelier Index (@ 4C)	N/A	**-**	-	-3.85			3813790
Nitrate (N)	mg/L	**10**	-	0.067		0.050	3813329
Saturation pH (@ 20C)	N/A	**-**	-	10.1			3813789
Saturation pH (@ 4C)	N/A	**-**	-	10.3			3813790
Inorganics							
Total Alkalinity (Total as CaCO3)	mg/L	**-**	-	5.7	5.3	5.0	3823280
Dissolved Chloride (Cl)	mg/L	**-**	250	12	12	1.0	3823281
Colour	TCU	**-**	15	140	140	25	3823284
Nitrate + Nitrite	mg/L	**-**	-	0.067	0.067	0.050	3823286
Nitrite (N)	mg/L	**1**	-	<0.010	<0.010	0.010	3823287
Nitrogen (Ammonia Nitrogen)	mg/L	**-**	-	<0.050		0.050	3823460
Total Organic Carbon (C)	mg/L	**-**	-	11		0.50	3821731
Orthophosphate (P)	mg/L	**-**	-	<0.010	<0.010	0.010	3823285
pH	pH	**-**	6.5 : 8.5	6.50		N/A	3823264

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3666	YI3666		
Sampling Date				2014/11/03 14:55	2014/11/03 14:55		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WS-10**	**WS-10 Lab-Dup**	**RDL**	**QC Batch**
Reactive Silica (SiO2)	mg/L	-	-	2.5	2.6	0.50	3823283
Dissolved Sulphate (SO4)	mg/L	-	500	<2.0	<2.0	2.0	3823282
Turbidity	NTU	**0.3**	-	**1.5**		0.10	3825931
Conductivity	uS/cm	-	-	55		1.0	3823265
Metals							
Total Aluminum (Al)	ug/L	-	100	290		5.0	3815304
Total Antimony (Sb)	ug/L	**6**	-	<1.0		1.0	3815304
Total Arsenic (As)	ug/L	**10**	-	<1.0		1.0	3815304
Total Barium (Ba)	ug/L	**1000**	-	19		1.0	3815304
Total Beryllium (Be)	ug/L	-	-	<1.0		1.0	3815304
Total Bismuth (Bi)	ug/L	-	-	<2.0		2.0	3815304
Total Boron (B)	ug/L	**5000**	-	<50		50	3815304
Total Cadmium (Cd)	ug/L	**5**	-	0.047		0.010	3815304
Total Calcium (Ca)	ug/L	-	-	2900		100	3815304
Total Chromium (Cr)	ug/L	**50**	-	<1.0		1.0	3815304
Total Cobalt (Co)	ug/L	-	-	<0.40		0.40	3815304
Total Copper (Cu)	ug/L	-	1000	<2.0		2.0	3815304
Total Iron (Fe)	ug/L	-	300	620		50	3815304
Total Lead (Pb)	ug/L	**10**	-	1.3		0.50	3815304
Total Lithium (Li)	ug/L	-	-	<2.0		2.0	3815304
Total Magnesium (Mg)	ug/L	-	-	890		100	3815304
Total Manganese (Mn)	ug/L	-	50	75		2.0	3815304
Total Molybdenum (Mo)	ug/L	-	-	<2.0		2.0	3815304

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3666	YI3666		
Sampling Date				2014/11/03 14:55	2014/11/03 14:55		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WS-10**	**WS-10 Lab-Dup**	**RDL**	**QC Batch**
Total Nickel (Ni)	ug/L	-	-	<2.0		2.0	3815304
Total Phosphorus (P)	ug/L	-	-	<100		100	3815304
Total Potassium (K)	ug/L	-	-	390		100	3815304
Total Selenium (Se)	ug/L	**50**	-	<1.0		1.0	3815304
Total Silicon (Si)	ug/L	-	-	1200		500	3815304
Total Silver (Ag)	ug/L	-	-	<0.10		0.10	3815304
Total Sodium (Na)	ug/L	-	200000	7400		100	3815304
Total Strontium (Sr)	ug/L	-	-	14		2.0	3815304
Total Sulphur (S)	ug/L	-	-	<5000		5000	3815304
Total Tellurium (Te)	ug/L	-	-	<2.0		2.0	3815304
Total Thallium (Tl)	ug/L	-	-	<0.10		0.10	3815304
Total Tin (Sn)	ug/L	-	-	<2.0		2.0	3815304
Total Titanium (Ti)	ug/L	-	-	3.9		2.0	3815304
Total Uranium (U)	ug/L	**20**	-	0.46		0.10	3815304
Total Vanadium (V)	ug/L	-	-	<2.0		2.0	3815304
Total Zirconium (Zr)	ug/L	-	-	<2.0		2.0	3815304
Total Zinc (Zn)	ug/L	-	5000	6.0		5.0	3815304

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3667	YI3668	YI3669		
Sampling Date				2014/11/03 16:00	2014/11/04 08:45	2014/11/04 09:05		
COC Number				B 128762	B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WQ STA-2**	**WQ STA-9**	**WQ STA-8**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	me/L	-	-	0.380	0.360	0.360	N/A	3813787
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	<1.0	<1.0	1.0	3813784
Calculated TDS	mg/L	-	500	27	24	23	1.0	3813791
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	<1.0	<1.0	1.0	3813784
Cation Sum	me/L	-	-	0.540	0.470	0.470	N/A	3813787
Hardness (CaCO3)	mg/L	-	-	7.7	4.5	4.6	1.0	3813785
Ion Balance (% Difference)	%	-	-	17.4	13.3	13.3	N/A	3813786
Langelier Index (@ 20C)	N/A	-	-	NC	NC	NC		3813789
Langelier Index (@ 4C)	N/A	-	-	NC	NC	NC		3813790
Nitrate (N)	mg/L	**10**	-	0.058	<0.050	<0.050	0.050	3813329
Saturation pH (@ 20C)	N/A	-	-	NC	NC	NC		3813789
Saturation pH (@ 4C)	N/A	-	-	NC	NC	NC		3813790
Inorganics								
Total Alkalinity (Total as CaCO3)	mg/L	-	-	<5.0	<5.0	<5.0	5.0	3823280
Dissolved Chloride (Cl)	mg/L	-	250	13	13	13	1.0	3823281
Colour	TCU	-	15	69	67	73	25	3823284
Nitrate + Nitrite	mg/L	-	-	0.058	<0.050	<0.050	0.050	3823286
Nitrite (N)	mg/L	**1**	-	<0.010	<0.010	<0.010	0.010	3823287
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	<0.050	<0.050	<0.050	0.050	3823467
Total Organic Carbon (C)	mg/L	-	-	6.9	7.5	6.6	0.50	3821731
Orthophosphate (P)	mg/L	-	-	<0.010	<0.010	<0.010	0.010	3823285
pH	pH	-	6.5 : 8.5	6.15	5.16	4.98	N/A	3823423
Reactive Silica (SiO2)	mg/L	-	-	2.2	0.67	0.60	0.50	3823283
Dissolved Sulphate (SO4)	mg/L	-	500	<2.0	<2.0	<2.0	2.0	3823282

RDL = Reportable Detection Limit
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Maxxam
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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3667	YI3668	YI3669		
Sampling Date				2014/11/03 16:00	2014/11/04 08:45	2014/11/04 09:05		
COC Number				B 128762	B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WQ STA-2**	**WQ STA-9**	**WQ STA-8**	**RDL**	**QC Batch**
Turbidity	NTU	**0.3**	-	**1.0**	**0.60**	**0.64**	0.10	3825931
Conductivity	uS/cm	**-**	-	54	54	53	1.0	3823429
Metals								
Total Aluminum (Al)	ug/L	**-**	100	330	280	290	5.0	3815304
Total Antimony (Sb)	ug/L	**6**	-	<1.0	<1.0	<1.0	1.0	3815304
Total Arsenic (As)	ug/L	**10**	-	<1.0	<1.0	<1.0	1.0	3815304
Total Barium (Ba)	ug/L	**1000**	-	3.7	2.6	3.1	1.0	3815304
Total Beryllium (Be)	ug/L	**-**	-	<1.0	<1.0	<1.0	1.0	3815304
Total Bismuth (Bi)	ug/L	**-**	-	<2.0	<2.0	<2.0	2.0	3815304
Total Boron (B)	ug/L	**5000**	-	<50	<50	<50	50	3815304
Total Cadmium (Cd)	ug/L	**5**	-	0.030	0.040	0.044	0.010	3815304
Total Calcium (Ca)	ug/L	**-**	-	1400	380	380	100	3815304
Total Chromium (Cr)	ug/L	**50**	-	<1.0	<1.0	<1.0	1.0	3815304
Total Cobalt (Co)	ug/L	**-**	-	<0.40	<0.40	<0.40	0.40	3815304
Total Copper (Cu)	ug/L	**-**	1000	<2.0	<2.0	<2.0	2.0	3815304
Total Iron (Fe)	ug/L	**-**	300	440	200	150	50	3815304
Total Lead (Pb)	ug/L	**10**	-	0.88	0.68	0.96	0.50	3815304
Total Lithium (Li)	ug/L	**-**	-	2.1	<2.0	<2.0	2.0	3815304
Total Magnesium (Mg)	ug/L	**-**	-	1000	860	890	100	3815304
Total Manganese (Mn)	ug/L	**-**	50	19	35	34	2.0	3815304
Total Molybdenum (Mo)	ug/L	**-**	-	<2.0	<2.0	<2.0	2.0	3815304
Total Nickel (Ni)	ug/L	**-**	-	<2.0	<2.0	<2.0	2.0	3815304
Total Phosphorus (P)	ug/L	**-**	-	<100	<100	<100	100	3815304
Total Potassium (K)	ug/L	**-**	-	400	270	250	100	3815304
Total Selenium (Se)	ug/L	**50**	-	<1.0	<1.0	<1.0	1.0	3815304

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3667	YI3668	YI3669		
Sampling Date				2014/11/03 16:00	2014/11/04 08:45	2014/11/04 09:05		
COC Number				B 128762	B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WQ STA-2**	**WQ STA-9**	**WQ STA-8**	**RDL**	**QC Batch**
Total Silicon (Si)	ug/L	-	-	1100	<500	<500	500	3815304
Total Silver (Ag)	ug/L	-	-	<0.10	<0.10	<0.10	0.10	3815304
Total Sodium (Na)	ug/L	-	200000	8300	8300	8200	100	3815304
Total Strontium (Sr)	ug/L	-	-	9.6	5.3	5.7	2.0	3815304
Total Sulphur (S)	ug/L	-	-	<5000	<5000	<5000	5000	3815304
Total Tellurium (Te)	ug/L	-	-	<2.0	<2.0	<2.0	2.0	3815304
Total Thallium (Tl)	ug/L	-	-	<0.10	<0.10	<0.10	0.10	3815304
Total Tin (Sn)	ug/L	-	-	<2.0	<2.0	<2.0	2.0	3815304
Total Titanium (Ti)	ug/L	-	-	2.8	2.5	2.9	2.0	3815304
Total Uranium (U)	ug/L	**20**	-	<0.10	<0.10	<0.10	0.10	3815304
Total Vanadium (V)	ug/L	-	-	<2.0	<2.0	<2.0	2.0	3815304
Total Zirconium (Zr)	ug/L	-	-	<2.0	<2.0	<2.0	2.0	3815304
Total Zinc (Zn)	ug/L	-	5000	6.3	7.7	8.9	5.0	3815304

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3670	YI3670		
Sampling Date				2014/11/04 10:10	2014/11/04 10:10		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WQ STA-3**	**WQ STA-3 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	me/L	-	-	0.380		N/A	3813787
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0		1.0	3813784
Calculated TDS	mg/L	-	500	25		1.0	3813791
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0		1.0	3813784
Cation Sum	me/L	-	-	0.490		N/A	3813787
Hardness (CaCO3)	mg/L	-	-	6.6		1.0	3813785
Ion Balance (% Difference)	%	-	-	12.6		N/A	3813786
Langelier Index (@ 20C)	N/A	-	-	NC			3813789
Langelier Index (@ 4C)	N/A	-	-	NC			3813790
Nitrate (N)	mg/L	**10**	-	<0.050		0.050	3813329
Saturation pH (@ 20C)	N/A	-	-	NC			3813789
Saturation pH (@ 4C)	N/A	-	-	NC			3813790
Inorganics							
Total Alkalinity (Total as CaCO3)	mg/L	-	-	<5.0		5.0	3823280
Dissolved Chloride (Cl)	mg/L	-	250	13		1.0	3823281
Colour	TCU	-	15	31		5.0	3823284
Nitrate + Nitrite	mg/L	-	-	<0.050		0.050	3823286
Nitrite (N)	mg/L	**1**	-	<0.010		0.010	3823287
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	<0.050		0.050	3821900
Total Organic Carbon (C)	mg/L	-	-	4.1	4.0	0.50	3821731
Orthophosphate (P)	mg/L	-	-	<0.010		0.010	3823285
pH	pH	-	6.5 : 8.5	5.65		N/A	3823423

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Maxxam
A Bureau Veritas Group Company

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3670	YI3670		
Sampling Date				2014/11/04 10:10	2014/11/04 10:10		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WQ STA-3**	**WQ STA-3 Lab-Dup**	**RDL**	**QC Batch**
Reactive Silica (SiO2)	mg/L	**-**	-	0.84		0.50	3823283
Dissolved Sulphate (SO4)	mg/L	**-**	500	<2.0		2.0	3823282
Turbidity	NTU	**0.3**	-	**0.92**	**0.95**	0.10	3825931
Conductivity	uS/cm	**-**	-	52		1.0	3823429
Metals							
Total Aluminum (Al)	ug/L	**-**	100	170		5.0	3815304
Total Antimony (Sb)	ug/L	**6**	-	<1.0		1.0	3815304
Total Arsenic (As)	ug/L	**10**	-	<1.0		1.0	3815304
Total Barium (Ba)	ug/L	**1000**	-	3.2		1.0	3815304
Total Beryllium (Be)	ug/L	**-**	-	<1.0		1.0	3815304
Total Bismuth (Bi)	ug/L	**-**	-	<2.0		2.0	3815304
Total Boron (B)	ug/L	**5000**	-	<50		50	3815304
Total Cadmium (Cd)	ug/L	**5**	-	0.017		0.010	3815304
Total Calcium (Ca)	ug/L	**-**	-	1100		100	3815304
Total Chromium (Cr)	ug/L	**50**	-	<1.0		1.0	3815304
Total Cobalt (Co)	ug/L	**-**	-	<0.40		0.40	3815304
Total Copper (Cu)	ug/L	**-**	1000	<2.0		2.0	3815304
Total Iron (Fe)	ug/L	**-**	300	140		50	3815304
Total Lead (Pb)	ug/L	**10**	-	<0.50		0.50	3815304
Total Lithium (Li)	ug/L	**-**	-	<2.0		2.0	3815304
Total Magnesium (Mg)	ug/L	**-**	-	960		100	3815304
Total Manganese (Mn)	ug/L	**-**	50	6.1		2.0	3815304
Total Molybdenum (Mo)	ug/L	**-**	-	<2.0		2.0	3815304

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3670	YI3670		
Sampling Date				2014/11/04 10:10	2014/11/04 10:10		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WQ STA-3**	**WQ STA-3 Lab-Dup**	**RDL**	**QC Batch**
Total Nickel (Ni)	ug/L	**-**	-	<2.0		2.0	3815304
Total Phosphorus (P)	ug/L	**-**	-	<100		100	3815304
Total Potassium (K)	ug/L	**-**	-	300		100	3815304
Total Selenium (Se)	ug/L	**50**	-	<1.0		1.0	3815304
Total Silicon (Si)	ug/L	**-**	-	<500		500	3815304
Total Silver (Ag)	ug/L	**-**	-	<0.10		0.10	3815304
Total Sodium (Na)	ug/L	**-**	200000	7900		100	3815304
Total Strontium (Sr)	ug/L	**-**	-	8.3		2.0	3815304
Total Sulphur (S)	ug/L	**-**	-	<5000		5000	3815304
Total Tellurium (Te)	ug/L	**-**	-	<2.0		2.0	3815304
Total Thallium (Tl)	ug/L	**-**	-	<0.10		0.10	3815304
Total Tin (Sn)	ug/L	**-**	-	<2.0		2.0	3815304
Total Titanium (Ti)	ug/L	**-**	-	<2.0		2.0	3815304
Total Uranium (U)	ug/L	**20**	-	<0.10		0.10	3815304
Total Vanadium (V)	ug/L	**-**	-	<2.0		2.0	3815304
Total Zirconium (Zr)	ug/L	**-**	-	<2.0		2.0	3815304
Total Zinc (Zn)	ug/L	**-**	5000	<5.0		5.0	3815304

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3671		YI3672		
Sampling Date				2014/11/04 10:20		2014/11/04 11:15		
COC Number				B 128762		B 128762		
	Units	**Criteria A**	**AO**	**WQ STA-4**	**QC Batch**	**MW14-04A**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	me/L	-	-	0.410	3813787	2.74	N/A	3813787
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	3813784	93	1.0	3813784
Calculated TDS	mg/L	-	500	26	3813791	150	1.0	3813791
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	3813784	<1.0	1.0	3813784
Cation Sum	me/L	-	-	0.490	3813787	2.54	N/A	3813787
Hardness (CaCO3)	mg/L	-	-	6.7	3813785	92	1.0	3813785
Ion Balance (% Difference)	%	-	-	8.89	3813786	3.79	N/A	3813786
Langelier Index (@ 20C)	N/A	-	-	NC	3813789	-0.327		3813789
Langelier Index (@ 4C)	N/A	-	-	NC	3813790	-0.577		3813790
Nitrate (N)	mg/L	**10**	-	<0.050	3813788	<0.050	0.050	3813788
Saturation pH (@ 20C)	N/A	-	-	NC	3813789	7.90		3813789
Saturation pH (@ 4C)	N/A	-	-	NC	3813790	8.15		3813790
Inorganics								
Total Alkalinity (Total as CaCO3)	mg/L	-	-	<5.0	3823280	93	5.0	3823280
Dissolved Chloride (Cl)	mg/L	-	250	14	3823281	16	1.0	3823281
Colour	TCU	-	15	34	3823284	10	5.0	3823284
Nitrate + Nitrite	mg/L	-	-	<0.050	3823286	<0.050	0.050	3823286
Nitrite (N)	mg/L	**1**	-	<0.010	3823287	<0.010	0.010	3823287
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	<0.050	3821900	0.075	0.050	3823467
Total Organic Carbon (C)	mg/L	-	-	4.1	3821731	4.2	0.50	3821731
Orthophosphate (P)	mg/L	-	-	<0.010	3823285	<0.010	0.010	3823285
pH	pH	-	6.5 : 8.5	5.65	3823423	7.57	N/A	3823423
Reactive Silica (SiO2)	mg/L	-	-	0.90	3823283	7.6	0.50	3823283

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3671		YI3672		
Sampling Date				2014/11/04 10:20		2014/11/04 11:15		
COC Number				B 128762		B 128762		
	Units	**Criteria A**	**AO**	**WQ STA-4**	**QC Batch**	**MW14-04A**	**RDL**	**QC Batch**
Dissolved Sulphate (SO4)	mg/L	**-**	500	<2.0	3823282	16	2.0	3823282
Turbidity	NTU	**0.3**	-	**0.63**	3825931	**6.0**	0.10	3825931
Conductivity	uS/cm	**-**	-	52	3823429	250	1.0	3823429
Metals								
Total Aluminum (Al)	ug/L	**-**	100	180	3815304	170	5.0	3815304
Total Antimony (Sb)	ug/L	**6**	-	<1.0	3815304	<1.0	1.0	3815304
Total Arsenic (As)	ug/L	**10**	-	<1.0	3815304	<1.0	1.0	3815304
Total Barium (Ba)	ug/L	**1000**	-	3.1	3815304	97	1.0	3815304
Total Beryllium (Be)	ug/L	**-**	-	<1.0	3815304	<1.0	1.0	3815304
Total Bismuth (Bi)	ug/L	**-**	-	<2.0	3815304	<2.0	2.0	3815304
Total Boron (B)	ug/L	**5000**	-	<50	3815304	<50	50	3815304
Total Cadmium (Cd)	ug/L	**5**	-	0.022	3815304	0.25	0.010	3815304
Total Calcium (Ca)	ug/L	**-**	-	1100	3815304	32000	100	3815304
Total Chromium (Cr)	ug/L	**50**	-	<1.0	3815304	2.7	1.0	3815304
Total Cobalt (Co)	ug/L	**-**	-	<0.40	3815304	0.75	0.40	3815304
Total Copper (Cu)	ug/L	**-**	1000	<2.0	3815304	7.8	2.0	3815304
Total Iron (Fe)	ug/L	**-**	300	140	3815304	340	50	3815304
Total Lead (Pb)	ug/L	**10**	-	<0.50	3815304	2.9	0.50	3815304
Total Lithium (Li)	ug/L	**-**	-	<2.0	3815304	17	2.0	3815304
Total Magnesium (Mg)	ug/L	**-**	-	980	3815304	2600	100	3815304
Total Manganese (Mn)	ug/L	**-**	50	6.9	3815304	170	2.0	3815304
Total Molybdenum (Mo)	ug/L	**-**	-	<2.0	3815304	13	2.0	3815304
Total Nickel (Ni)	ug/L	**-**	-	<2.0	3815304	3.9	2.0	3815304
Total Phosphorus (P)	ug/L	**-**	-	<100	3815304	<100	100	3815304

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3671		YI3672		
Sampling Date				2014/11/04 10:20		2014/11/04 11:15		
COC Number				B 128762		B 128762		
	Units	**Criteria A**	**AO**	**WQ STA-4**	**QC Batch**	**MW14-04A**	**RDL**	**QC Batch**
Total Potassium (K)	ug/L	-	-	290	3815304	1300	100	3815304
Total Selenium (Se)	ug/L	**50**	-	<1.0	3815304	<1.0	1.0	3815304
Total Silicon (Si)	ug/L	-	-	<500	3815304	3500	500	3815304
Total Silver (Ag)	ug/L	-	-	<0.10	3815304	<0.10	0.10	3815304
Total Sodium (Na)	ug/L	-	200000	7800	3815304	15000	100	3815304
Total Strontium (Sr)	ug/L	-	-	8.4	3815304	140	2.0	3815304
Total Sulphur (S)	ug/L	-	-	<5000	3815304	<5000	5000	3815304
Total Tellurium (Te)	ug/L	-	-	<2.0	3815304	<2.0	2.0	3815304
Total Thallium (Tl)	ug/L	-	-	<0.10	3815304	<0.10	0.10	3815304
Total Tin (Sn)	ug/L	-	-	<2.0	3815304	2.7	2.0	3815304
Total Titanium (Ti)	ug/L	-	-	<2.0	3815304	6.3	2.0	3815304
Total Uranium (U)	ug/L	**20**	-	<0.10	3815304	5.1	0.10	3815304
Total Vanadium (V)	ug/L	-	-	<2.0	3815304	<2.0	2.0	3815304
Total Zirconium (Zr)	ug/L	-	-	<2.0	3815304	<2.0	2.0	3815304
Total Zinc (Zn)	ug/L	-	5000	<5.0	3815304	800	5.0	3815304

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3673	YI3673		
Sampling Date				2014/11/04 11:50	2014/11/04 11:50		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WQ STN-1**	**WQ STN-1 Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	me/L	-	-	0.390		N/A	3813787
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0		1.0	3813784
Calculated TDS	mg/L	-	500	28		1.0	3813791
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0		1.0	3813784
Cation Sum	me/L	-	-	0.550		N/A	3813787
Hardness (CaCO3)	mg/L	-	-	7.8		1.0	3813785
Ion Balance (% Difference)	%	-	-	17.0		N/A	3813786
Langelier Index (@ 20C)	N/A	-	-	NC			3813789
Langelier Index (@ 4C)	N/A	-	-	NC			3813790
Nitrate (N)	mg/L	**10**	-	<0.050		0.050	3813788
Saturation pH (@ 20C)	N/A	-	-	NC			3813789
Saturation pH (@ 4C)	N/A	-	-	NC			3813790
Inorganics							
Total Alkalinity (Total as CaCO3)	mg/L	-	-	<5.0		5.0	3823280
Dissolved Chloride (Cl)	mg/L	-	250	13		1.0	3823281
Colour	TCU	-	15	120		25	3823284
Nitrate + Nitrite	mg/L	-	-	<0.050		0.050	3823286
Nitrite (N)	mg/L	**1**	-	<0.010		0.010	3823287
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	<0.050	0.052	0.050	3821900
Total Organic Carbon (C)	mg/L	-	-	11		0.50	3821731
Orthophosphate (P)	mg/L	-	-	<0.010		0.010	3823285
pH	pH	-	6.5 : 8.5	5.88		N/A	3823423

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3673	YI3673		
Sampling Date				2014/11/04 11:50	2014/11/04 11:50		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WQ STN-1**	**WQ STN-1 Lab-Dup**	**RDL**	**QC Batch**
Reactive Silica (SiO2)	mg/L	**-**	-	2.8		0.50	3823283
Dissolved Sulphate (SO4)	mg/L	**-**	500	<2.0		2.0	3823282
Turbidity	NTU	**0.3**	-	**2.9**		0.10	3825931
Conductivity	uS/cm	**-**	-	56		1.0	3823429
Metals							
Total Aluminum (Al)	ug/L	**-**	100	610		5.0	3815304
Total Antimony (Sb)	ug/L	**6**	-	<1.0		1.0	3815304
Total Arsenic (As)	ug/L	**10**	-	1.2		1.0	3815304
Total Barium (Ba)	ug/L	**1000**	-	8.3		1.0	3815304
Total Beryllium (Be)	ug/L	**-**	-	<1.0		1.0	3815304
Total Bismuth (Bi)	ug/L	**-**	-	<2.0		2.0	3815304
Total Boron (B)	ug/L	**5000**	-	<50		50	3815304
Total Cadmium (Cd)	ug/L	**5**	-	0.037		0.010	3815304
Total Calcium (Ca)	ug/L	**-**	-	1400		100	3815304
Total Chromium (Cr)	ug/L	**50**	-	<1.0		1.0	3815304
Total Cobalt (Co)	ug/L	**-**	-	0.54		0.40	3815304
Total Copper (Cu)	ug/L	**-**	1000	<2.0		2.0	3815304
Total Iron (Fe)	ug/L	**-**	300	660		50	3815304
Total Lead (Pb)	ug/L	**10**	-	1.4		0.50	3815304
Total Lithium (Li)	ug/L	**-**	-	2.7		2.0	3815304
Total Magnesium (Mg)	ug/L	**-**	-	1000		100	3815304
Total Manganese (Mn)	ug/L	**-**	50	22		2.0	3815304
Total Molybdenum (Mo)	ug/L	**-**	-	<2.0		2.0	3815304

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3673	YI3673		
Sampling Date				2014/11/04 11:50	2014/11/04 11:50		
COC Number				B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WQ STN-1**	**WQ STN-1 Lab-Dup**	**RDL**	**QC Batch**
Total Nickel (Ni)	ug/L	**-**	-	<2.0		2.0	3815304
Total Phosphorus (P)	ug/L	**-**	-	<100		100	3815304
Total Potassium (K)	ug/L	**-**	-	490		100	3815304
Total Selenium (Se)	ug/L	**50**	-	<1.0		1.0	3815304
Total Silicon (Si)	ug/L	**-**	-	1500		500	3815304
Total Silver (Ag)	ug/L	**-**	-	<0.10		0.10	3815304
Total Sodium (Na)	ug/L	**-**	200000	8300		100	3815304
Total Strontium (Sr)	ug/L	**-**	-	10		2.0	3815304
Total Sulphur (S)	ug/L	**-**	-	<5000		5000	3815304
Total Tellurium (Te)	ug/L	**-**	-	<2.0		2.0	3815304
Total Thallium (Tl)	ug/L	**-**	-	<0.10		0.10	3815304
Total Tin (Sn)	ug/L	**-**	-	<2.0		2.0	3815304
Total Titanium (Ti)	ug/L	**-**	-	7.2		2.0	3815304
Total Uranium (U)	ug/L	**20**	-	<0.10		0.10	3815304
Total Vanadium (V)	ug/L	**-**	-	<2.0		2.0	3815304
Total Zirconium (Zr)	ug/L	**-**	-	<2.0		2.0	3815304
Total Zinc (Zn)	ug/L	**-**	5000	8.9		5.0	3815304

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Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3674		YI3675		
Sampling Date				2014/11/04 12:15		2014/11/04 14:50		
COC Number				B 128763		B 128763		
	Units	**Criteria A**	**AO**	**WQ STN-7**	**QC Batch**	**WQ STN-6**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	me/L	-	-	0.420	3813787	0.270	N/A	3813787
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	3813784	<1.0	1.0	3813784
Calculated TDS	mg/L	-	500	29	3813791	21	1.0	3813791
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	3813784	<1.0	1.0	3813784
Cation Sum	me/L	-	-	0.540	3813787	0.420	N/A	3813787
Hardness (CaCO3)	mg/L	-	-	7.8	3813785	6.5	1.0	3813785
Ion Balance (% Difference)	%	-	-	12.5	3813786	21.7	N/A	3813786
Langelier Index (@ 20C)	N/A	-	-	NC	3813789	NC		3813789
Langelier Index (@ 4C)	N/A	-	-	NC	3813790	NC		3813790
Nitrate (N)	mg/L	**10**	-	<0.050	3813788	<0.050	0.050	3813788
Saturation pH (@ 20C)	N/A	-	-	NC	3813789	NC		3813789
Saturation pH (@ 4C)	N/A	-	-	NC	3813790	NC		3813790
Inorganics								
Total Alkalinity (Total as CaCO3)	mg/L	-	-	<5.0	3823280	<5.0	5.0	3823280
Dissolved Chloride (Cl)	mg/L	-	250	14	3823281	9.7	1.0	3823281
Colour	TCU	-	15	89	3823284	69	25	3823284
Nitrate + Nitrite	mg/L	-	-	<0.050	3823286	<0.050	0.050	3823286
Nitrite (N)	mg/L	**1**	-	<0.010	3823287	<0.010	0.010	3823287
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	<0.050	3823467	<0.050	0.050	3823467
Total Organic Carbon (C)	mg/L	-	-	9.3	3821731	6.9	0.50	3821731
Orthophosphate (P)	mg/L	-	-	<0.010	3823285	<0.010	0.010	3823285
pH	pH	-	6.5 : 8.5	5.92	3823423	6.02	N/A	3823423
Reactive Silica (SiO2)	mg/L	-	-	2.3	3823283	1.9	0.50	3823283

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3674		YI3675		
Sampling Date				2014/11/04 12:15		2014/11/04 14:50		
COC Number				B 128763		B 128763		
	Units	**Criteria A**	**AO**	**WQ STN-7**	**QC Batch**	**WQ STN-6**	**RDL**	**QC Batch**
Dissolved Sulphate (SO4)	mg/L	**-**	500	<2.0	3823282	<2.0	2.0	3823282
Turbidity	NTU	**0.3**	-	**2.6**	3825931	**1.0**	0.10	3825931
Conductivity	uS/cm	**-**	-	54	3823429	40	1.0	3823429
Metals								
Total Aluminum (Al)	ug/L	**-**	100	460	3815304	130	5.0	3817191
Total Antimony (Sb)	ug/L	**6**	-	<1.0	3815304	<1.0	1.0	3817191
Total Arsenic (As)	ug/L	**10**	-	1.1	3815304	<1.0	1.0	3817191
Total Barium (Ba)	ug/L	**1000**	-	8.5	3815304	13	1.0	3817191
Total Beryllium (Be)	ug/L	**-**	-	<1.0	3815304	<1.0	1.0	3817191
Total Bismuth (Bi)	ug/L	**-**	-	<2.0	3815304	<2.0	2.0	3817191
Total Boron (B)	ug/L	**5000**	-	<50	3815304	<50	50	3817191
Total Cadmium (Cd)	ug/L	**5**	-	0.029	3815304	0.025	0.010	3817191
Total Calcium (Ca)	ug/L	**-**	-	1400	3815304	1500	100	3817191
Total Chromium (Cr)	ug/L	**50**	-	<1.0	3815304	<1.0	1.0	3817191
Total Cobalt (Co)	ug/L	**-**	-	<0.40	3815304	<0.40	0.40	3817191
Total Copper (Cu)	ug/L	**-**	1000	<2.0	3815304	<2.0	2.0	3817191
Total Iron (Fe)	ug/L	**-**	300	520	3815304	530	50	3817191
Total Lead (Pb)	ug/L	**10**	-	0.92	3815304	<0.50	0.50	3817191
Total Lithium (Li)	ug/L	**-**	-	2.2	3815304	<2.0	2.0	3817191
Total Magnesium (Mg)	ug/L	**-**	-	1000	3815304	680	100	3817191
Total Manganese (Mn)	ug/L	**-**	50	11	3815304	24	2.0	3817191
Total Molybdenum (Mo)	ug/L	**-**	-	<2.0	3815304	<2.0	2.0	3817191
Total Nickel (Ni)	ug/L	**-**	-	<2.0	3815304	<2.0	2.0	3817191
Total Phosphorus (P)	ug/L	**-**	-	<100	3815304	<100	100	3817191

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3674		YI3675		
Sampling Date				2014/11/04 12:15		2014/11/04 14:50		
COC Number				B 128763		B 128763		
	Units	**Criteria A**	**AO**	**WQ STN-7**	**QC Batch**	**WQ STN-6**	**RDL**	**QC Batch**
Total Potassium (K)	ug/L	**-**	-	400	3815304	300	100	3817191
Total Selenium (Se)	ug/L	**50**	-	<1.0	3815304	<1.0	1.0	3817191
Total Silicon (Si)	ug/L	**-**	-	1200	3815304	880	500	3817191
Total Silver (Ag)	ug/L	**-**	-	<0.10	3815304	<0.10	0.10	3817191
Total Sodium (Na)	ug/L	**-**	200000	8200	3815304	6100	100	3817191
Total Strontium (Sr)	ug/L	**-**	-	9.8	3815304	12	2.0	3817191
Total Sulphur (S)	ug/L	**-**	-	<5000	3815304	<5000	5000	3817191
Total Tellurium (Te)	ug/L	**-**	-	<2.0	3815304	<2.0	2.0	3817191
Total Thallium (Tl)	ug/L	**-**	-	<0.10	3815304	<0.10	0.10	3817191
Total Tin (Sn)	ug/L	**-**	-	<2.0	3815304	<2.0	2.0	3817191
Total Titanium (Ti)	ug/L	**-**	-	3.7	3815304	<2.0	2.0	3817191
Total Uranium (U)	ug/L	**20**	-	<0.10	3815304	0.21	0.10	3817191
Total Vanadium (V)	ug/L	**-**	-	<2.0	3815304	<2.0	2.0	3817191
Total Zirconium (Zr)	ug/L	**-**	-	<2.0	3815304	<2.0	2.0	3817191
Total Zinc (Zn)	ug/L	**-**	5000	5.0	3815304	<5.0	5.0	3817191

RDL = Reportable Detection Limit
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Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3676		
Sampling Date				2014/11/04 15:15		
COC Number				B 128763		
	Units	**Criteria A**	**AO**	**WQ STN-5**	**RDL**	**QC Batch**
Calculated Parameters						
Anion Sum	me/L	-	-	0.290	N/A	3813787
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	1.0	3813784
Calculated TDS	mg/L	-	500	21	1.0	3813791
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	1.0	3813784
Cation Sum	me/L	-	-	0.410	N/A	3813787
Hardness (CaCO3)	mg/L	-	-	6.3	1.0	3813785
Ion Balance (% Difference)	%	-	-	17.1	N/A	3813786
Langelier Index (@ 20C)	N/A	-	-	NC		3813789
Langelier Index (@ 4C)	N/A	-	-	NC		3813790
Nitrate (N)	mg/L	**10**	-	<0.050	0.050	3813788
Saturation pH (@ 20C)	N/A	-	-	NC		3813789
Saturation pH (@ 4C)	N/A	-	-	NC		3813790
Inorganics						
Total Alkalinity (Total as CaCO3)	mg/L	-	-	<5.0	5.0	3823280
Dissolved Chloride (Cl)	mg/L	-	250	10	1.0	3823281
Colour	TCU	-	15	65	25	3823284
Nitrate + Nitrite	mg/L	-	-	<0.050	0.050	3823286
Nitrite (N)	mg/L	**1**	-	<0.010	0.010	3823287
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	<0.050	0.050	3823467
Total Organic Carbon (C)	mg/L	-	-	6.9	0.50	3821731
Orthophosphate (P)	mg/L	-	-	<0.010	0.010	3823285
pH	pH	-	6.5 : 8.5	6.03	N/A	3823423

RDL = Reportable Detection Limit
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Maxxam Job #: B4K8828
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Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3676		
Sampling Date				2014/11/04 15:15		
COC Number				B 128763		
	Units	**Criteria A**	**AO**	**WQ STN-5**	**RDL**	**QC Batch**
Reactive Silica (SiO2)	mg/L	-	-	1.9	0.50	3823283
Dissolved Sulphate (SO4)	mg/L	-	500	<2.0	2.0	3823282
Turbidity	NTU	**0.3**	-	**0.83**	0.10	3825931
Conductivity	uS/cm	-	-	39	1.0	3823429
Metals						
Total Aluminum (Al)	ug/L	-	100	130	5.0	3817191
Total Antimony (Sb)	ug/L	**6**	-	<1.0	1.0	3817191
Total Arsenic (As)	ug/L	**10**	-	<1.0	1.0	3817191
Total Barium (Ba)	ug/L	**1000**	-	14	1.0	3817191
Total Beryllium (Be)	ug/L	-	-	<1.0	1.0	3817191
Total Bismuth (Bi)	ug/L	-	-	<2.0	2.0	3817191
Total Boron (B)	ug/L	**5000**	-	<50	50	3817191
Total Cadmium (Cd)	ug/L	**5**	-	0.021	0.010	3817191
Total Calcium (Ca)	ug/L	-	-	1500	100	3817191
Total Chromium (Cr)	ug/L	**50**	-	<1.0	1.0	3817191
Total Cobalt (Co)	ug/L	-	-	<0.40	0.40	3817191
Total Copper (Cu)	ug/L	-	1000	<2.0	2.0	3817191
Total Iron (Fe)	ug/L	-	300	530	50	3817191
Total Lead (Pb)	ug/L	**10**	-	<0.50	0.50	3817191
Total Lithium (Li)	ug/L	-	-	<2.0	2.0	3817191
Total Magnesium (Mg)	ug/L	-	-	640	100	3817191
Total Manganese (Mn)	ug/L	-	50	25	2.0	3817191
Total Molybdenum (Mo)	ug/L	-	-	<2.0	2.0	3817191

RDL = Reportable Detection Limit
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Report Date: 2014/11/24

Golder Associates Ltd
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Site Location: CFI/ST.LAWRENCE,NL
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ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3676		
Sampling Date				2014/11/04 15:15		
COC Number				B 128763		
	Units	**Criteria A**	**AO**	**WQ STN-5**	**RDL**	**QC Batch**
Total Nickel (Ni)	ug/L	-	-	<2.0	2.0	3817191
Total Phosphorus (P)	ug/L	-	-	<100	100	3817191
Total Potassium (K)	ug/L	-	-	320	100	3817191
Total Selenium (Se)	ug/L	**50**	-	<1.0	1.0	3817191
Total Silicon (Si)	ug/L	-	-	830	500	3817191
Total Silver (Ag)	ug/L	-	-	<0.10	0.10	3817191
Total Sodium (Na)	ug/L	-	200000	5900	100	3817191
Total Strontium (Sr)	ug/L	-	-	11	2.0	3817191
Total Sulphur (S)	ug/L	-	-	<5000	5000	3817191
Total Tellurium (Te)	ug/L	-	-	<2.0	2.0	3817191
Total Thallium (Tl)	ug/L	-	-	<0.10	0.10	3817191
Total Tin (Sn)	ug/L	-	-	<2.0	2.0	3817191
Total Titanium (Ti)	ug/L	-	-	2.5	2.0	3817191
Total Uranium (U)	ug/L	**20**	-	0.19	0.10	3817191
Total Vanadium (V)	ug/L	-	-	<2.0	2.0	3817191
Total Zirconium (Zr)	ug/L	-	-	<2.0	2.0	3817191
Total Zinc (Zn)	ug/L	-	5000	<5.0	5.0	3817191

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Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

RESULTS OF ANALYSES OF WATER

Maxxam ID				YI3664	YI3664		YI3665		
Sampling Date				2014/11/03 13:35	2014/11/03 13:35		2014/11/03 14:00		
COC Number				B 128762	B 128762		B 128762		
	Units	**Criteria A**	**AO**	**WS-2**	**WS-2 Lab-Dup**	**RDL**	**WS-5**	**RDL**	**QC Batch**
Field Measurements									
Field pH	pH	-	-	6.00		N/A	6.23	N/A	ONSITE
Inorganics									
Total Dissolved Solids	mg/L	-	500	52		20	85	10	3821546
Dissolved Fluoride (F-)	mg/L	**1.5**	-	**1.6**		0.10	1.5	0.10	3815638
Dissolved Organic Carbon (C)	mg/L	-	-	8.9		0.50	9.7	0.50	3821726
Total Phosphorus	mg/L	-	-	<0.020		0.020	<0.020	0.020	3823358
Total Suspended Solids	mg/L	-	-	1.6		1.0	3.6	1.0	3817326
Sulphide	mg/L	-	0.05	<0.020	<0.020	0.020	<0.020	0.020	3816944
Bromide (Br-)	mg/L	-	-	<1.0		1.0	<1.0	1.0	3817015

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
QC Batch = Quality Control Batch
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Site Location: CFI/ST.LAWRENCE,NL
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RESULTS OF ANALYSES OF WATER

Maxxam ID				YI3666	YI3666	YI3667		
Sampling Date				2014/11/03 14:55	2014/11/03 14:55	2014/11/03 16:00		
COC Number				B 128762	B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WS-10**	**WS-10 Lab-Dup**	**WQ STA-2**	**RDL**	**QC Batch**
Field Measurements								
Field pH	pH	-	-	6.11		5.95	N/A	ONSITE
Inorganics								
Total Dissolved Solids	mg/L	-	500	48		49	10	3821546
Dissolved Fluoride (F-)	mg/L	**1.5**	-	0.41	0.40	0.24	0.10	3815638
Dissolved Organic Carbon (C)	mg/L	-	-	11		7.2	0.50	3821726
Total Phosphorus	mg/L	-	-	0.029		<0.020	0.020	3823358
Total Suspended Solids	mg/L	-	-	3.6		1.4	1.0	3817326
Sulphide	mg/L	-	0.05	<0.020		<0.020	0.020	3816944
Bromide (Br-)	mg/L	-	-	<1.0		<1.0	1.0	3817015

RDL = Reportable Detection Limit
Lab-Dup = Laboratory Initiated Duplicate
QC Batch = Quality Control Batch
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Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

RESULTS OF ANALYSES OF WATER

Maxxam ID				YI3668	YI3669	YI3670		
Sampling Date				2014/11/04 08:45	2014/11/04 09:05	2014/11/04 10:10		
COC Number				B 128762	B 128762	B 128762		
	Units	**Criteria A**	**AO**	**WQ STA-9**	**WQ STA-8**	**WQ STA-3**	**RDL**	**QC Batch**
Field Measurements								
Field pH	pH	**-**	-	3.70	3.94	4.69	N/A	ONSITE
Inorganics								
Total Dissolved Solids	mg/L	**-**	500	36	37	38	10	3821546
Dissolved Fluoride (F-)	mg/L	**1.5**	-	<0.10	<0.10	0.16	0.10	3815638
Dissolved Organic Carbon (C)	mg/L	**-**	-	7.5	7.0	4.1	0.50	3821726
Total Phosphorus	mg/L	**-**	-	<0.020	0.030	<0.020	0.020	3823358
Total Suspended Solids	mg/L	**-**	-	<1.0	<1.0	1.0	1.0	3817326
Sulphide	mg/L	**-**	0.05	<0.020	<0.020	<0.020	0.020	3816944
Bromide (Br-)	mg/L	**-**	-	<1.0	<1.0	<1.0	1.0	3817015

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

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Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

RESULTS OF ANALYSES OF WATER

Maxxam ID				YI3671			YI3672		
Sampling Date				2014/11/04 10:20			2014/11/04 11:15		
COC Number				B 128762			B 128762		
	Units	**Criteria A**	**AO**	**WQ STA-4**	**RDL**	**QC Batch**	**MW14-04A**	**RDL**	**QC Batch**
Field Measurements									
Field pH	pH	**-**	-	4.76	N/A	ONSITE	6.22	N/A	ONSITE
Inorganics									
Total Dissolved Solids	mg/L	**-**	500	38	10	3821546	170	20	3823470
Dissolved Fluoride (F-)	mg/L	**1.5**	-	0.16	0.10	3815638	**1.7**	0.10	3815638
Dissolved Organic Carbon (C)	mg/L	**-**	-	4.3	0.50	3825851	3.5	0.50	3825851
Total Phosphorus	mg/L	**-**	-	0.030	0.020	3823358	0.028	0.020	3823358
Total Suspended Solids	mg/L	**-**	-	<1.0	1.0	3817326	7.9	2.0	3817326
Sulphide	mg/L	**-**	0.05	<0.020	0.020	3816944	<0.020	0.020	3816944
Bromide (Br-)	mg/L	**-**	-	<1.0	1.0	3817015	<1.0	1.0	3817015

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

RESULTS OF ANALYSES OF WATER

Maxxam ID				YI3673	YI3674	YI3675		
Sampling Date				2014/11/04 11:50	2014/11/04 12:15	2014/11/04 14:50		
COC Number				B 128762	B 128763	B 128763		
	Units	**Criteria A**	**AO**	**WQ STN-1**	**WQ STN-7**	**WQ STN-6**	**RDL**	**QC Batch**
Field Measurements								
Field pH	pH	-	-	5.92	5.94	5.68	N/A	ONSITE
Inorganics								
Total Dissolved Solids	mg/L	-	500	63	61	51	20	3823470
Dissolved Fluoride (F-)	mg/L	**1.5**	-	0.22	0.21	<0.10	0.10	3815638
Dissolved Organic Carbon (C)	mg/L	-	-	12	9.6	6.6	0.50	3825851
Total Phosphorus	mg/L	-	-	0.027	0.031	0.025	0.020	3823358
Total Suspended Solids	mg/L	-	-	1.6	1.2	1.4	1.0	3817326
Sulphide	mg/L	-	0.05	<0.020	<0.020	<0.020	0.020	3816944
Bromide (Br-)	mg/L	-	-	<1.0	<1.0	<1.0	1.0	3817015

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

RESULTS OF ANALYSES OF WATER

Maxxam ID				YI3675	YI3676		
Sampling Date				2014/11/04 14:50	2014/11/04 15:15		
COC Number				B 128763	B 128763		
	Units	**Criteria A**	**AO**	**WQ STN-6 Lab-Dup**	**WQ STN-5**	**RDL**	**QC Batch**
Field Measurements							
Field pH	pH	-	-		5.53	N/A	ONSITE
Inorganics							
Total Dissolved Solids	mg/L	-	500		46	20	3823470
Dissolved Fluoride (F-)	mg/L	**1.5**	-		<0.10	0.10	3815638
Dissolved Organic Carbon (C)	mg/L	-	-		6.7	0.50	3825851
Total Phosphorus	mg/L	-	-		0.025	0.020	3823358
Total Suspended Solids	mg/L	-	-		1.4	1.0	3817326
Sulphide	mg/L	-	0.05		<0.020	0.020	3816944
Bromide (Br-)	mg/L	-	-	<1.0	<1.0	1.0	3817015

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

MERCURY BY COLD VAPOUR AA (WATER)

Maxxam ID			YI3664	YI3665	YI3666	YI3667		
Sampling Date			2014/11/03 13:35	2014/11/03 14:00	2014/11/03 14:55	2014/11/03 16:00		
COC Number			B 128762	B 128762	B 128762	B 128762		
	Units	**MAC**	**WS-2**	**WS-5**	**WS-10**	**WQ STA-2**	**RDL**	**QC Batch**
Metals								
Total Mercury (Hg)	ug/L	**1**	<0.013	<0.013	<0.013	<0.013	0.013	3817872

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
MAC: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

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Maxxam ID			YI3668	YI3669	YI3670	YI3671		
Sampling Date			2014/11/04 08:45	2014/11/04 09:05	2014/11/04 10:10	2014/11/04 10:20		
COC Number			B 128762	B 128762	B 128762	B 128762		
	Units	**MAC**	**WQ STA-9**	**WQ STA-8**	**WQ STA-3**	**WQ STA-4**	**RDL**	**QC Batch**
Metals								
Total Mercury (Hg)	ug/L	**1**	<0.013	<0.013	<0.013	<0.013	0.013	3817872

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
MAC: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

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Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

MERCURY BY COLD VAPOUR AA (WATER)

Maxxam ID			YI3672	YI3673	YI3674		YI3675		
Sampling Date			2014/11/04 11:15	2014/11/04 11:50	2014/11/04 12:15		2014/11/04 14:50		
COC Number			B 128762	B 128762	B 128763		B 128763		
	Units	**MAC**	**MW14-04A**	**WQ STN-1**	**WQ STN-7**	**QC Batch**	**WQ STN-6**	**RDL**	**QC Batch**
Metals									
Total Mercury (Hg)	ug/L	**1**	<0.013	<0.013	<0.013	3817872	<0.013	0.013	3825963

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
MAC: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

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Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

MERCURY BY COLD VAPOUR AA (WATER)

Maxxam ID			YI3676		
Sampling Date			2014/11/04 15:15		
COC Number			B 128763		
	Units	**MAC**	**WQ STN-5**	**RDL**	**QC Batch**
Metals					
Total Mercury (Hg)	ug/L	**1**	<0.013	0.013	3825966

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
MAC: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

Maxxam ID YI3664
Sample ID WS-2
Matrix Water

Collected 2014/11/03
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/14	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3821726	N/A	2014/11/13	Megan Cyr
Conductance - water	AT	3823265	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/18	Automated Statchk
Nitrogen Ammonia - water	AC	3823460	N/A	2014/11/17	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813329	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823264	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3821546	N/A	2014/11/14	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825930	N/A	2014/11/17	Kerstin Surgenor

Maxxam ID YI3664 Dup
Sample ID WS-2
Matrix Water

Collected 2014/11/03
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake

Maxxam ID YI3665
Sample ID WS-5
Matrix Water

Collected 2014/11/03
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/14	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3821726	N/A	2014/11/13	Megan Cyr
Conductance - water	AT	3823265	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters

Test Summary

Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/18	Automated Statchk
Nitrogen Ammonia - water	AC	3823460	N/A	2014/11/17	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813329	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823264	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3821546	N/A	2014/11/14	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825930	N/A	2014/11/17	Kerstin Surgenor

Maxxam ID YI3666
Sample ID WS-10
Matrix Water

Collected 2014/11/03
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/14	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3821726	N/A	2014/11/13	Megan Cyr
Conductance - water	AT	3823265	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/18	Automated Statchk
Nitrogen Ammonia - water	AC	3823460	N/A	2014/11/17	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813329	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823264	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3821546	N/A	2014/11/14	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru

Test Summary

Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

Maxxam ID YI3666 Dup
Sample ID WS-10
Matrix Water

Collected 2014/11/03
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey

Maxxam ID YI3667
Sample ID WQ STA-2
Matrix Water

Collected 2014/11/03
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/17	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3821726	N/A	2014/11/13	Megan Cyr
Conductance - water	AT	3823429	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/18	Automated Statchk
Nitrogen Ammonia - water	AC	3823467	N/A	2014/11/17	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813329	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823423	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3821546	N/A	2014/11/14	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Test Summary

Maxxam ID YI3668
Sample ID WQ STA-9
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/17	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3821726	N/A	2014/11/13	Megan Cyr
Conductance - water	AT	3823429	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/18	Automated Statchk
Nitrogen Ammonia - water	AC	3823467	N/A	2014/11/17	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813329	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823423	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3821546	N/A	2014/11/14	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

Maxxam ID YI3669
Sample ID WQ STA-8
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/17	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3821726	N/A	2014/11/13	Megan Cyr
Conductance - water	AT	3823429	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/18	Automated Statchk
Nitrogen Ammonia - water	AC	3823467	N/A	2014/11/17	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

Nitrogen - Nitrate (as N)	CALC	3813329	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823423	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3821546	N/A	2014/11/14	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

Maxxam ID YI3670
Sample ID WQ STA-3
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/17	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3821726	N/A	2014/11/13	Megan Cyr
Conductance - water	AT	3823429	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/17	Automated Statchk
Nitrogen Ammonia - water	AC	3821900	N/A	2014/11/14	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813329	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823423	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3821546	N/A	2014/11/14	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

Maxxam ID YI3670 Dup
Sample ID WQ STA-3
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

Maxxam ID YI3671
Sample ID WQ STA-4
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/17	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3825851	N/A	2014/11/17	Megan Cyr
Conductance - water	AT	3823429	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/17	Automated Statchk
Nitrogen Ammonia - water	AC	3821900	N/A	2014/11/14	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813788	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823423	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3821546	N/A	2014/11/14	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

Maxxam ID YI3672
Sample ID MW14-04A
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/17	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3825851	N/A	2014/11/17	Megan Cyr
Conductance - water	AT	3823429	N/A	2014/11/14	Kerstin Surgenor

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/18	Automated Statchk
Nitrogen Ammonia - water	AC	3823467	N/A	2014/11/17	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813788	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823423	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3823470	N/A	2014/11/17	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

Maxxam ID YI3673
Sample ID WQ STN-1
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/17	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3825851	N/A	2014/11/17	Megan Cyr
Conductance - water	AT	3823429	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/17	Automated Statchk
Nitrogen Ammonia - water	AC	3821900	N/A	2014/11/14	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813788	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823423	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3823470	N/A	2014/11/17	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

Maxxam ID YI3673 Dup
Sample ID WQ STN-1
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Nitrogen Ammonia - water	AC	3821900	N/A	2014/11/14	Arlene Rossiter

Maxxam ID YI3674
Sample ID WQ STN-7
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/17	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3825851	N/A	2014/11/17	Megan Cyr
Conductance - water	AT	3823429	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/18	Automated Statchk
Nitrogen Ammonia - water	AC	3823467	N/A	2014/11/17	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813788	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823423	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3823470	N/A	2014/11/17	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

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Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

Maxxam ID YI3675
Sample ID WQ STN-6
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/17	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3825851	N/A	2014/11/17	Megan Cyr
Conductance - water	AT	3823429	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/13	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3825963	2014/11/10	2014/11/17	Adam Logan
Metals Water Total MS	CICP/MS	3817191	2014/11/10	2014/11/12	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/18	Automated Statchk
Nitrogen Ammonia - water	AC	3823467	N/A	2014/11/17	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813788	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823423	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3823470	N/A	2014/11/17	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

Maxxam ID YI3675 Dup
Sample ID WQ STN-6
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi

Maxxam ID YI3676
Sample ID WQ STN-5
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/11/06

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/17	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3825851	N/A	2014/11/17	Megan Cyr
Conductance - water	AT	3823429	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters

Maxxam Job #: B4K8828
Report Date: 2014/11/24

Golder Associates Ltd
Client Project #: 1407707
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

Hardness (calculated as CaCO3)		3813785	N/A	2014/11/13	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3825966	2014/11/17	2014/11/17	Adam Logan
Metals Water Total MS	CICP/MS	3817191	2014/11/10	2014/11/12	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/18	Automated Statchk
Nitrogen Ammonia - water	AC	3823467	N/A	2014/11/17	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813788	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823423	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3823470	N/A	2014/11/17	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

GENERAL COMMENTS

Reissued report to include CWQG. HM Nov 24/14

Sample YI3665-01: RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample YI3666-01: RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample YI3667-01: RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample YI3668-01: RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample YI3669-01: RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample YI3670-01: RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample YI3671-01: RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample YI3673-01: RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample YI3674-01: RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample YI3675-01: RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Sample YI3676-01: RCAp Ion Balance acceptable. Anion/cation agreement within 0.2 meq/L.

Results relate only to the items tested.

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Golder Associates Ltd
Attention: Phyllis McCrindle
Client Project #: 1407707
P.O. #:
Site Location: CFI/ST.LAWRENCE,NL

Quality Assurance Report

Maxxam Job Number: ZB4K8828

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3815304 DLB	Matrix Spike	Total Aluminum (Al)	2014/11/08		105	%	80 - 120
		Total Antimony (Sb)	2014/11/08		99	%	80 - 120
		Total Arsenic (As)	2014/11/08		101	%	80 - 120
		Total Barium (Ba)	2014/11/08		96	%	80 - 120
		Total Beryllium (Be)	2014/11/08		100	%	80 - 120
		Total Bismuth (Bi)	2014/11/08		100	%	80 - 120
		Total Boron (B)	2014/11/08		100	%	80 - 120
		Total Cadmium (Cd)	2014/11/08		97	%	80 - 120
		Total Calcium (Ca)	2014/11/08		99	%	80 - 120
		Total Chromium (Cr)	2014/11/08		98	%	80 - 120
		Total Cobalt (Co)	2014/11/08		98	%	80 - 120
		Total Copper (Cu)	2014/11/08		97	%	80 - 120
		Total Iron (Fe)	2014/11/08		105	%	80 - 120
		Total Lead (Pb)	2014/11/08		97	%	80 - 120
		Total Lithium (Li)	2014/11/08		103	%	80 - 120
		Total Magnesium (Mg)	2014/11/08		NC	%	80 - 120
		Total Manganese (Mn)	2014/11/08		103	%	80 - 120
		Total Molybdenum (Mo)	2014/11/08		102	%	80 - 120
		Total Nickel (Ni)	2014/11/08		101	%	80 - 120
		Total Phosphorus (P)	2014/11/08		108	%	80 - 120
		Total Potassium (K)	2014/11/08		107	%	80 - 120
		Total Selenium (Se)	2014/11/08		101	%	80 - 120
		Total Silicon (Si)	2014/11/08		NC	%	80 - 120
		Total Silver (Ag)	2014/11/08		100	%	80 - 120
		Total Sodium (Na)	2014/11/08		114	%	80 - 120
		Total Strontium (Sr)	2014/11/08		99	%	80 - 120
		Total Sulphur (S)	2014/11/08		109	%	80 - 120
		Total Tellurium (Te)	2014/11/08		93	%	80 - 120
		Total Thallium (Tl)	2014/11/08		100	%	80 - 120
		Total Tin (Sn)	2014/11/08		101	%	80 - 120
		Total Titanium (Ti)	2014/11/08		104	%	80 - 120
		Total Uranium (U)	2014/11/08		106	%	80 - 120
		Total Vanadium (V)	2014/11/08		100	%	80 - 120
		Total Zirconium (Zr)	2014/11/08		103	%	80 - 120
		Total Zinc (Zn)	2014/11/08		99	%	80 - 120
	Spiked Blank	Total Aluminum (Al)	2014/11/07		103	%	80 - 120
		Total Antimony (Sb)	2014/11/07		99	%	80 - 120
		Total Arsenic (As)	2014/11/07		100	%	80 - 120
		Total Barium (Ba)	2014/11/07		97	%	80 - 120
		Total Beryllium (Be)	2014/11/07		100	%	80 - 120
		Total Bismuth (Bi)	2014/11/07		100	%	80 - 120
		Total Boron (B)	2014/11/07		100	%	80 - 120
		Total Cadmium (Cd)	2014/11/07		97	%	80 - 120
		Total Calcium (Ca)	2014/11/07		97	%	80 - 120
		Total Chromium (Cr)	2014/11/07		98	%	80 - 120
		Total Cobalt (Co)	2014/11/07		99	%	80 - 120
		Total Copper (Cu)	2014/11/07		98	%	80 - 120
		Total Iron (Fe)	2014/11/07		103	%	80 - 120
		Total Lead (Pb)	2014/11/07		96	%	80 - 120
		Total Lithium (Li)	2014/11/07		102	%	80 - 120
		Total Magnesium (Mg)	2014/11/07		108	%	80 - 120
		Total Manganese (Mn)	2014/11/07		102	%	80 - 120
		Total Molybdenum (Mo)	2014/11/07		100	%	80 - 120
		Total Nickel (Ni)	2014/11/07		101	%	80 - 120
		Total Phosphorus (P)	2014/11/07		105	%	80 - 120

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Golder Associates Ltd
Attention: Phyllis McCrindle
Client Project #: 1407707
P.O. #:
Site Location: CFI/ST.LAWRENCE,NL

Quality Assurance Report (Continued)

Maxxam Job Number: ZB4K8828

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3815304 DLB	Spiked Blank	Total Potassium (K)	2014/11/07		105	%	80 - 120
		Total Selenium (Se)	2014/11/07		100	%	80 - 120
		Total Silicon (Si)	2014/11/07		103	%	80 - 120
		Total Silver (Ag)	2014/11/07		99	%	80 - 120
		Total Sodium (Na)	2014/11/07		110	%	80 - 120
		Total Strontium (Sr)	2014/11/07		98	%	80 - 120
		Total Sulphur (S)	2014/11/07		91	%	80 - 120
		Total Tellurium (Te)	2014/11/07		96	%	80 - 120
		Total Thallium (Tl)	2014/11/07		99	%	80 - 120
		Total Tin (Sn)	2014/11/07		99	%	80 - 120
		Total Titanium (Ti)	2014/11/07		105	%	80 - 120
		Total Uranium (U)	2014/11/07		105	%	80 - 120
		Total Vanadium (V)	2014/11/07		98	%	80 - 120
		Total Zirconium (Zr)	2014/11/07		103	%	80 - 120
		Total Zinc (Zn)	2014/11/07		97	%	80 - 120
	Method Blank	Total Aluminum (Al)	2014/11/07	<5.0		ug/L	
		Total Antimony (Sb)	2014/11/07	<1.0		ug/L	
		Total Arsenic (As)	2014/11/07	<1.0		ug/L	
		Total Barium (Ba)	2014/11/07	<1.0		ug/L	
		Total Beryllium (Be)	2014/11/07	<1.0		ug/L	
		Total Bismuth (Bi)	2014/11/07	<2.0		ug/L	
		Total Boron (B)	2014/11/07	<50		ug/L	
		Total Cadmium (Cd)	2014/11/07	<0.010		ug/L	
		Total Calcium (Ca)	2014/11/07	<100		ug/L	
		Total Chromium (Cr)	2014/11/07	<1.0		ug/L	
		Total Cobalt (Co)	2014/11/07	<0.40		ug/L	
		Total Copper (Cu)	2014/11/07	<2.0		ug/L	
		Total Iron (Fe)	2014/11/07	<50		ug/L	
		Total Lead (Pb)	2014/11/07	<0.50		ug/L	
		Total Lithium (Li)	2014/11/07	<2.0		ug/L	
		Total Magnesium (Mg)	2014/11/07	<100		ug/L	
		Total Manganese (Mn)	2014/11/07	<2.0		ug/L	
		Total Molybdenum (Mo)	2014/11/07	<2.0		ug/L	
		Total Nickel (Ni)	2014/11/07	<2.0		ug/L	
		Total Phosphorus (P)	2014/11/07	<100		ug/L	
		Total Potassium (K)	2014/11/07	<100		ug/L	
		Total Selenium (Se)	2014/11/07	<1.0		ug/L	
		Total Silicon (Si)	2014/11/07	<500		ug/L	
		Total Silver (Ag)	2014/11/07	<0.10		ug/L	
		Total Sodium (Na)	2014/11/07	<100		ug/L	
		Total Strontium (Sr)	2014/11/07	<2.0		ug/L	
		Total Sulphur (S)	2014/11/07	<5000		ug/L	
		Total Tellurium (Te)	2014/11/07	<2.0		ug/L	
		Total Thallium (Tl)	2014/11/07	<0.10		ug/L	
		Total Tin (Sn)	2014/11/07	<2.0		ug/L	
		Total Titanium (Ti)	2014/11/07	<2.0		ug/L	
		Total Uranium (U)	2014/11/07	<0.10		ug/L	
		Total Vanadium (V)	2014/11/07	<2.0		ug/L	
		Total Zirconium (Zr)	2014/11/07	<2.0		ug/L	
		Total Zinc (Zn)	2014/11/07	<5.0		ug/L	
	RPD	Total Arsenic (As)	2014/11/07	NC		%	20
		Total Copper (Cu)	2014/11/07	NC		%	20
		Total Lead (Pb)	2014/11/07	NC		%	20
		Total Manganese (Mn)	2014/11/07	1.4		%	20
		Total Nickel (Ni)	2014/11/07	NC		%	20

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Golder Associates Ltd
Attention: Phyllis McCrindle
Client Project #: 1407707
P.O. #:
Site Location: CFI/ST.LAWRENCE,NL

Quality Assurance Report (Continued)

Maxxam Job Number: ZB4K8828

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3815304 DLB	RPD	Total Zinc (Zn)	2014/11/07	NC		%	20
3815638 TPE	Matrix Spike						
	[YI3666-03]	Dissolved Fluoride (F-)	2014/11/07		101	%	80 - 120
	Spiked Blank	Dissolved Fluoride (F-)	2014/11/07		103	%	80 - 120
	Method Blank	Dissolved Fluoride (F-)	2014/11/07	<0.10		mg/L	
	RPD [YI3666-03]	Dissolved Fluoride (F-)	2014/11/07	NC		%	25
3816944 NYS	Matrix Spike						
	[YI3664-02]	Sulphide	2014/11/09		86	%	80 - 120
	Spiked Blank	Sulphide	2014/11/09		89	%	80 - 120
	Method Blank	Sulphide	2014/11/09	<0.020		mg/L	
	RPD [YI3664-02]	Sulphide	2014/11/09	NC		%	20
3817015 FD	Matrix Spike						
	[YI3675-04]	Bromide (Br-)	2014/11/10		104	%	80 - 120
	Spiked Blank	Bromide (Br-)	2014/11/10		100	%	80 - 120
	Method Blank	Bromide (Br-)	2014/11/10	<1.0		mg/L	
	RPD [YI3675-04]	Bromide (Br-)	2014/11/10	NC		%	20
3817191 DLB	Matrix Spike	Total Aluminum (Al)	2014/11/11		102	%	80 - 120
		Total Antimony (Sb)	2014/11/11		101	%	80 - 120
		Total Arsenic (As)	2014/11/11		102	%	80 - 120
		Total Barium (Ba)	2014/11/11		100	%	80 - 120
		Total Beryllium (Be)	2014/11/11		102	%	80 - 120
		Total Bismuth (Bi)	2014/11/11		101	%	80 - 120
		Total Boron (B)	2014/11/11		99	%	80 - 120
		Total Cadmium (Cd)	2014/11/11		99	%	80 - 120
		Total Calcium (Ca)	2014/11/11		95	%	80 - 120
		Total Chromium (Cr)	2014/11/11		101	%	80 - 120
		Total Cobalt (Co)	2014/11/11		100	%	80 - 120
		Total Copper (Cu)	2014/11/11		99	%	80 - 120
		Total Iron (Fe)	2014/11/11		105	%	80 - 120
		Total Lead (Pb)	2014/11/11		99	%	80 - 120
		Total Lithium (Li)	2014/11/11		107	%	80 - 120
		Total Magnesium (Mg)	2014/11/11		110	%	80 - 120
		Total Manganese (Mn)	2014/11/11		105	%	80 - 120
		Total Molybdenum (Mo)	2014/11/11		104	%	80 - 120
		Total Nickel (Ni)	2014/11/11		103	%	80 - 120
		Total Phosphorus (P)	2014/11/11		106	%	80 - 120
		Total Potassium (K)	2014/11/11		107	%	80 - 120
		Total Selenium (Se)	2014/11/11		100	%	80 - 120
		Total Silicon (Si)	2014/11/11		NC	%	80 - 120
		Total Silver (Ag)	2014/11/11		102	%	80 - 120
		Total Sodium (Na)	2014/11/11		NC	%	80 - 120
		Total Strontium (Sr)	2014/11/11		101	%	80 - 120
		Total Sulphur (S)	2014/11/11		106	%	80 - 120
		Total Tellurium (Te)	2014/11/11		94	%	80 - 120
		Total Thallium (Tl)	2014/11/11		101	%	80 - 120
		Total Tin (Sn)	2014/11/11		104	%	80 - 120
		Total Titanium (Ti)	2014/11/11		107	%	80 - 120
		Total Uranium (U)	2014/11/11		110	%	80 - 120
		Total Vanadium (V)	2014/11/11		102	%	80 - 120
		Total Zirconium (Zr)	2014/11/11		107	%	80 - 120
		Total Zinc (Zn)	2014/11/11		102	%	80 - 120
	Spiked Blank	Total Aluminum (Al)	2014/11/11		103	%	80 - 120
		Total Antimony (Sb)	2014/11/11		101	%	80 - 120
		Total Arsenic (As)	2014/11/11		101	%	80 - 120
		Total Barium (Ba)	2014/11/11		101	%	80 - 120

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Golder Associates Ltd
Attention: Phyllis McCrindle
Client Project #: 1407707
P.O. #:
Site Location: CFI/ST.LAWRENCE,NL

Quality Assurance Report (Continued)

Maxxam Job Number: ZB4K8828

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3817191 DLB	Spiked Blank	Total Beryllium (Be)	2014/11/11		101	%	80 - 120
		Total Bismuth (Bi)	2014/11/11		103	%	80 - 120
		Total Boron (B)	2014/11/11		97	%	80 - 120
		Total Cadmium (Cd)	2014/11/11		99	%	80 - 120
		Total Calcium (Ca)	2014/11/11		94	%	80 - 120
		Total Chromium (Cr)	2014/11/11		103	%	80 - 120
		Total Cobalt (Co)	2014/11/11		102	%	80 - 120
		Total Copper (Cu)	2014/11/11		100	%	80 - 120
		Total Iron (Fe)	2014/11/11		107	%	80 - 120
		Total Lead (Pb)	2014/11/11		99	%	80 - 120
		Total Lithium (Li)	2014/11/11		106	%	80 - 120
		Total Magnesium (Mg)	2014/11/11		109	%	80 - 120
		Total Manganese (Mn)	2014/11/11		107	%	80 - 120
		Total Molybdenum (Mo)	2014/11/11		104	%	80 - 120
		Total Nickel (Ni)	2014/11/11		105	%	80 - 120
		Total Phosphorus (P)	2014/11/11		105	%	80 - 120
		Total Potassium (K)	2014/11/11		105	%	80 - 120
		Total Selenium (Se)	2014/11/11		99	%	80 - 120
		Total Silicon (Si)	2014/11/11		99	%	80 - 120
		Total Silver (Ag)	2014/11/11		101	%	80 - 120
		Total Sodium (Na)	2014/11/11		110	%	80 - 120
		Total Strontium (Sr)	2014/11/11		103	%	80 - 120
		Total Sulphur (S)	2014/11/11		100	%	80 - 120
		Total Tellurium (Te)	2014/11/11		92	%	80 - 120
		Total Thallium (Tl)	2014/11/11		101	%	80 - 120
		Total Tin (Sn)	2014/11/11		102	%	80 - 120
		Total Titanium (Ti)	2014/11/11		107	%	80 - 120
		Total Uranium (U)	2014/11/11		111	%	80 - 120
		Total Vanadium (V)	2014/11/11		103	%	80 - 120
		Total Zirconium (Zr)	2014/11/11		108	%	80 - 120
		Total Zinc (Zn)	2014/11/11		103	%	80 - 120
	Method Blank	Total Aluminum (Al)	2014/11/11	<5.0		ug/L	
		Total Antimony (Sb)	2014/11/11	<1.0		ug/L	
		Total Arsenic (As)	2014/11/11	<1.0		ug/L	
		Total Barium (Ba)	2014/11/11	<1.0		ug/L	
		Total Beryllium (Be)	2014/11/11	<1.0		ug/L	
		Total Bismuth (Bi)	2014/11/11	<2.0		ug/L	
		Total Boron (B)	2014/11/11	<50		ug/L	
		Total Cadmium (Cd)	2014/11/11	0.017, RDL=0.010		ug/L	
		Total Calcium (Ca)	2014/11/11	<100		ug/L	
		Total Chromium (Cr)	2014/11/11	<1.0		ug/L	
		Total Cobalt (Co)	2014/11/11	<0.40		ug/L	
		Total Copper (Cu)	2014/11/11	<2.0		ug/L	
		Total Iron (Fe)	2014/11/11	<50		ug/L	
		Total Lead (Pb)	2014/11/11	<0.50		ug/L	
		Total Lithium (Li)	2014/11/11	<2.0		ug/L	
		Total Magnesium (Mg)	2014/11/11	<100		ug/L	
		Total Manganese (Mn)	2014/11/11	<2.0		ug/L	
		Total Molybdenum (Mo)	2014/11/11	<2.0		ug/L	
		Total Nickel (Ni)	2014/11/11	<2.0		ug/L	
		Total Phosphorus (P)	2014/11/11	<100		ug/L	
		Total Potassium (K)	2014/11/11	<100		ug/L	
		Total Selenium (Se)	2014/11/11	<1.0		ug/L	
		Total Silicon (Si)	2014/11/11	<500		ug/L	
		Total Silver (Ag)	2014/11/11	<0.10		ug/L	

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Client Project #: 1407707
P.O. #:
Site Location: CFI/ST.LAWRENCE,NL

Quality Assurance Report (Continued)

Maxxam Job Number: ZB4K8828

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3817191 DLB	Method Blank	Total Sodium (Na)	2014/11/11	<100		ug/L	
		Total Strontium (Sr)	2014/11/11	<2.0		ug/L	
		Total Sulphur (S)	2014/11/11	<5000		ug/L	
		Total Tellurium (Te)	2014/11/11	<2.0		ug/L	
		Total Thallium (Tl)	2014/11/11	<0.10		ug/L	
		Total Tin (Sn)	2014/11/11	<2.0		ug/L	
		Total Titanium (Ti)	2014/11/11	<2.0		ug/L	
		Total Uranium (U)	2014/11/11	0.14, RDL=0.10		ug/L	
		Total Vanadium (V)	2014/11/11	<2.0		ug/L	
		Total Zirconium (Zr)	2014/11/11	<2.0		ug/L	
		Total Zinc (Zn)	2014/11/11	<5.0		ug/L	
	RPD	Total Aluminum (Al)	2014/11/12	NC		%	20
		Total Antimony (Sb)	2014/11/12	NC		%	20
		Total Arsenic (As)	2014/11/12	NC		%	20
		Total Barium (Ba)	2014/11/12	1.0		%	20
		Total Beryllium (Be)	2014/11/12	NC		%	20
		Total Bismuth (Bi)	2014/11/12	NC		%	20
		Total Boron (B)	2014/11/12	NC		%	20
		Total Cadmium (Cd)	2014/11/12	NC		%	20
		Total Calcium (Ca)	2014/11/12	1.2		%	20
		Total Chromium (Cr)	2014/11/12	NC		%	20
		Total Cobalt (Co)	2014/11/12	NC		%	20
		Total Copper (Cu)	2014/11/12	NC		%	20
		Total Iron (Fe)	2014/11/12	NC		%	20
		Total Lead (Pb)	2014/11/12	NC		%	20
		Total Magnesium (Mg)	2014/11/12	1.1		%	20
		Total Manganese (Mn)	2014/11/12	NC		%	20
		Total Molybdenum (Mo)	2014/11/12	NC		%	20
		Total Nickel (Ni)	2014/11/12	NC		%	20
		Total Phosphorus (P)	2014/11/12	NC		%	20
		Total Potassium (K)	2014/11/12	NC		%	20
		Total Selenium (Se)	2014/11/12	NC		%	20
		Total Silver (Ag)	2014/11/12	NC		%	20
		Total Sodium (Na)	2014/11/12	0.02		%	20
		Total Strontium (Sr)	2014/11/12	1.7		%	20
		Total Thallium (Tl)	2014/11/12	NC		%	20
		Total Tin (Sn)	2014/11/12	NC		%	20
		Total Titanium (Ti)	2014/11/12	NC		%	20
		Total Uranium (U)	2014/11/12	7.0		%	20
		Total Vanadium (V)	2014/11/12	NC		%	20
		Total Zinc (Zn)	2014/11/12	NC		%	20
3817326 AYN	QC Standard	Total Suspended Solids	2014/11/12		103	%	80 - 120
	Method Blank	Total Suspended Solids	2014/11/12	<1.0		mg/L	
	RPD	Total Suspended Solids	2014/11/12	13.9		%	25
3817872 ALG	Matrix Spike	Total Mercury (Hg)	2014/11/13		95	%	80 - 120
	Spiked Blank	Total Mercury (Hg)	2014/11/13		94	%	80 - 120
	Method Blank	Total Mercury (Hg)	2014/11/13	<0.013		ug/L	
	RPD	Total Mercury (Hg)	2014/11/13	NC		%	20
3821546 AYN	QC Standard	Total Dissolved Solids	2014/11/14		93	%	80 - 120
	Method Blank	Total Dissolved Solids	2014/11/14	<10		mg/L	
	RPD	Total Dissolved Solids	2014/11/14	3.5		%	25
3821726 MCY	Matrix Spike	Dissolved Organic Carbon (C)	2014/11/13		95	%	80 - 120
	Spiked Blank	Dissolved Organic Carbon (C)	2014/11/13		107	%	80 - 120
	Method Blank	Dissolved Organic Carbon (C)	2014/11/13	<0.50		mg/L	
	RPD	Dissolved Organic Carbon (C)	2014/11/13	6.1		%	20

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Golder Associates Ltd
Attention: Phyllis McCrindle
Client Project #: 1407707
P.O. #:
Site Location: CFI/ST.LAWRENCE,NL

Quality Assurance Report (Continued)

Maxxam Job Number: ZB4K8828

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3821731 MCY	Matrix Spike						
	[YI3670-06]	Total Organic Carbon (C)	2014/11/13		93	%	80 - 120
	Spiked Blank	Total Organic Carbon (C)	2014/11/13		103	%	80 - 120
	Method Blank	Total Organic Carbon (C)	2014/11/13	<0.50		mg/L	
	RPD [YI3670-06]	Total Organic Carbon (C)	2014/11/13	2.4		%	20
3821900 ARS	Matrix Spike						
	[YI3673-06]	Nitrogen (Ammonia Nitrogen)	2014/11/14		99	%	80 - 120
	Spiked Blank	Nitrogen (Ammonia Nitrogen)	2014/11/14		106	%	80 - 120
	Method Blank	Nitrogen (Ammonia Nitrogen)	2014/11/14	<0.050		mg/L	
	RPD [YI3673-06]	Nitrogen (Ammonia Nitrogen)	2014/11/14	NC		%	25
3823264 KSR	QC Standard	pH	2014/11/14		100	%	97 - 103
	RPD	pH	2014/11/14	1		%	N/A
3823265 KSR	Spiked Blank	Conductivity	2014/11/14		99	%	80 - 120
	Method Blank	Conductivity	2014/11/14	1.1, RDL=1.0		uS/cm	
	RPD	Conductivity	2014/11/14	0.5		%	25
3823280 ARS	Matrix Spike						
	[YI3666-03]	Total Alkalinity (Total as CaCO3)	2014/11/19		110	%	80 - 120
	Spiked Blank	Total Alkalinity (Total as CaCO3)	2014/11/19		112	%	80 - 120
	Method Blank	Total Alkalinity (Total as CaCO3)	2014/11/19	<5.0		mg/L	
	RPD [YI3666-03]	Total Alkalinity (Total as CaCO3)	2014/11/19	NC		%	25
3823281 MCN	Matrix Spike						
	[YI3666-03]	Dissolved Chloride (Cl)	2014/11/18		NC	%	80 - 120
	QC Standard	Dissolved Chloride (Cl)	2014/11/18		112	%	80 - 120
	Spiked Blank	Dissolved Chloride (Cl)	2014/11/18		96	%	80 - 120
	Method Blank	Dissolved Chloride (Cl)	2014/11/18	<1.0		mg/L	
	RPD [YI3666-03]	Dissolved Chloride (Cl)	2014/11/18	5.0		%	25
3823282 MCN	Matrix Spike						
	[YI3666-03]	Dissolved Sulphate (SO4)	2014/11/18		109	%	80 - 120
	Spiked Blank	Dissolved Sulphate (SO4)	2014/11/18		103	%	80 - 120
	Method Blank	Dissolved Sulphate (SO4)	2014/11/18	<2.0		mg/L	
	RPD [YI3666-03]	Dissolved Sulphate (SO4)	2014/11/18	NC		%	25
3823283 ARS	Matrix Spike						
	[YI3666-03]	Reactive Silica (SiO2)	2014/11/17		111	%	80 - 120
	Spiked Blank	Reactive Silica (SiO2)	2014/11/17		101	%	80 - 120
	Method Blank	Reactive Silica (SiO2)	2014/11/17	<0.50		mg/L	
	RPD [YI3666-03]	Reactive Silica (SiO2)	2014/11/17	2.3		%	25
3823284 MCN	Spiked Blank	Colour	2014/11/17		103	%	80 - 120
	Method Blank	Colour	2014/11/17	<5.0		TCU	
	RPD [YI3666-03]	Colour	2014/11/17	3.0		%	25
3823285 MCN	Matrix Spike						
	[YI3666-03]	Orthophosphate (P)	2014/11/17		92	%	80 - 120
	Spiked Blank	Orthophosphate (P)	2014/11/17		98	%	80 - 120
	Method Blank	Orthophosphate (P)	2014/11/17	<0.010		mg/L	
	RPD [YI3666-03]	Orthophosphate (P)	2014/11/17	NC		%	25
3823286 ARS	Matrix Spike						
	[YI3666-03]	Nitrate + Nitrite	2014/11/18		96	%	80 - 120
	Spiked Blank	Nitrate + Nitrite	2014/11/18		100	%	80 - 120
	Method Blank	Nitrate + Nitrite	2014/11/18	<0.050		mg/L	
	RPD [YI3666-03]	Nitrate + Nitrite	2014/11/18	NC		%	25
3823287 MCN	Matrix Spike						
	[YI3666-03]	Nitrite (N)	2014/11/17		83	%	80 - 120
	Spiked Blank	Nitrite (N)	2014/11/17		93	%	80 - 120
	Method Blank	Nitrite (N)	2014/11/17	<0.010		mg/L	
	RPD [YI3666-03]	Nitrite (N)	2014/11/17	NC		%	25
3823358 VRO	Matrix Spike	Total Phosphorus	2014/11/14		96	%	80 - 120

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Quality Assurance Report (Continued)

Maxxam Job Number: ZB4K8828

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3823358 VRO	QC Standard	Total Phosphorus	2014/11/14		100	%	80 - 120
	Spiked Blank	Total Phosphorus	2014/11/14		98	%	80 - 120
	Method Blank	Total Phosphorus	2014/11/14	<0.020		mg/L	
	RPD	Total Phosphorus	2014/11/14	0.5		%	20
3823423 KSR	QC Standard	pH	2014/11/14		100	%	97 - 103
	RPD	pH	2014/11/14	2.0		%	N/A
3823429 KSR	Spiked Blank	Conductivity	2014/11/14		101	%	80 - 120
	Method Blank	Conductivity	2014/11/14	1.1, RDL=1.0		uS/cm	
	RPD	Conductivity	2014/11/14	0		%	25
3823460 ARS	Matrix Spike	Nitrogen (Ammonia Nitrogen)	2014/11/17		107	%	80 - 120
	Spiked Blank	Nitrogen (Ammonia Nitrogen)	2014/11/17		107	%	80 - 120
	Method Blank	Nitrogen (Ammonia Nitrogen)	2014/11/17	<0.050		mg/L	
	RPD	Nitrogen (Ammonia Nitrogen)	2014/11/17	NC		%	25
3823467 ARS	Matrix Spike	Nitrogen (Ammonia Nitrogen)	2014/11/18		124 (1)	%	80 - 120
	Spiked Blank	Nitrogen (Ammonia Nitrogen)	2014/11/17		107	%	80 - 120
	Method Blank	Nitrogen (Ammonia Nitrogen)	2014/11/17	<0.050		mg/L	
	RPD	Nitrogen (Ammonia Nitrogen)	2014/11/17	6.0		%	25
3823470 AYN	QC Standard	Total Dissolved Solids	2014/11/17		103	%	80 - 120
	Method Blank	Total Dissolved Solids	2014/11/17	<20 (2)		mg/L	
	RPD	Total Dissolved Solids	2014/11/17	2.9		%	25
3825851 MCY	Matrix Spike	Dissolved Organic Carbon (C)	2014/11/17		94	%	80 - 120
	Spiked Blank	Dissolved Organic Carbon (C)	2014/11/17		100	%	80 - 120
	Method Blank	Dissolved Organic Carbon (C)	2014/11/17	<0.50		mg/L	
	RPD	Dissolved Organic Carbon (C)	2014/11/17	NC		%	20
3825930 KSR	QC Standard	Turbidity	2014/11/17		100	%	80 - 120
	Method Blank	Turbidity	2014/11/17	<0.10		NTU	
	RPD	Turbidity	2014/11/17	7.9		%	25
3825931 KSR	QC Standard	Turbidity	2014/11/17		102	%	80 - 120
	Method Blank	Turbidity	2014/11/17	<0.10		NTU	
	RPD [YI3670-03]	Turbidity	2014/11/17	3.2		%	25
3825963 ALG	Matrix Spike	Total Mercury (Hg)	2014/11/17		89	%	80 - 120
	Spiked Blank	Total Mercury (Hg)	2014/11/17		99	%	80 - 120
	Method Blank	Total Mercury (Hg)	2014/11/17	<0.013		ug/L	
	RPD	Total Mercury (Hg)	2014/11/17	NC		%	20
3825966 ALG	Matrix Spike	Total Mercury (Hg)	2014/11/17		87	%	80 - 120
	Spiked Blank	Total Mercury (Hg)	2014/11/17		97	%	80 - 120
	Method Blank	Total Mercury (Hg)	2014/11/17	<0.013		ug/L	
	RPD	Total Mercury (Hg)	2014/11/17	NC		%	20

N/A = Not Applicable
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).
(1) Matrix spike recovery outside of acceptance range due to sample matrix.
(2) Elevated TDS RDL due to method blank performance.

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Validation Signature Page

Maxxam Job #: B4K8828

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

CHARTERED
Eva Pranjic
CHEMIST

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Kevin MacDonald, Inorganics Supervisor

===

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. For Service Group specific validation please refer to the Validation Signature Page.

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MAXXAM Chain of Custody Record

COC #: B 128762 Page 1 of ____

This column for lab use only:

Client Code:

Maxxam Job #: B4K8828

Cooler ID	Seal Present	Seal Intact	Temp 1	Temp 2	Temp 3	Average Temp
			8	9	1	
			0	0	1	

Integrity: YES / NO (NO circled) Integrity/Checklist by: OMG

Labelled by: Location / Bin #:

B4K8828

INVOICE INFORMATION:

Company Name: Golder Associates
Contact Name: Phyllis McCrindle
Address: 6925 Century Ave, Suite 100 Mississauga, ON Postal Code: L5N 7K2
Email: Phyllis_McCrindle@golder.com
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REPORT INFORMATION (if differs from invoice):

Company Name:
Contact Name:
Address:
Postal Code:
Email: Cell# 647-278-1056
Ph: Fax:

PO #:
Project # / Phase #: 1407707
Project Name / Site Location: CFI / St. Lawrence, NL
Quote:
Site #:
Task Order #:
Sampled by: Alex IVANOFF

TURNAROUND TIME
Standard ☑
10 day ☐
If RUSH Specify Date:
Pre-schedule rush work
Charge for # Jars used but not submitted

Guideline Requirements / Detection Limits / Special Instructions

See attached Parameters Sheet.

*Specify Matrix: Surface/Salt/Ground/Tapwater/Sewage/Effluent/Potable/NonPotable/Tissue/Soil/Sludge/Metal/Seawater

Analysis columns: Field Filtered & Preserved; Lab Filtration Required; RCAP-30 Choose Total or Diss Metals; RCAP-MS Choose Total or Diss Metals; Metals Water: Total Digest (Default Method) for well water, surface water; Dissolved for ground water; Mercury; Metals Soil: Metals & Mercury Default Available Digest Method; Metals Total Digest - for Ocean sediments (HNO3/HF/HCLO4); Mercury Low level by Cold Vapour AA; Selenium (low level) Req'd for CCME Residential, Parklands, Agricultural; Hot Water soluble Boron (required for CCME Agricultural); Hydrocarbons: RBCA Hydrocarbons (BTEX, C6-C32); Hydrocarbons Soil (Potable), NS Fuel Oil Spill Policy Low Level BTEX, C6-C32; NB Potable Water BTEX, VPH, Low level T.E.H.; TPH Fractionation; PAH's; PAH's with Acridine, Quinoline

#	Field Sample Identification	Matrix*	Date/Time Sampled	# & type of bottles	Field Filtered & Preserved	Notes (Hydrocarbons columns)
1	WS-2	Surface	Nov 3 13:35	9	N	pH: 6.0/cond: 0.10 mS.
2	WS-5	↓	Nov 3 14:00	↓	↓	pH: 6.23/ Cond 0.03 mS
3	WS-10	↓	Nov 3 14:55	↓	↓	pH: 6.11/ cond = 0.06 mS
4	WQ STA-2	↓	Nov 3 16:00	↓	↓	pH: 5.95/cond: 0.04 mS
5	WQ STA-9	↓	Nov 4 8:45 AM	↓	↓	pH: 3.70/cond 0.04 mS
6	WQ STA-8	↓	Nov 4 9:05 AM	↓	↓	pH = 3.94/cond 0.04 mS
7	WQ STA-3	↓	Nov 4 10:10 AM	↓	↓	pH = 4.69/cond 0.04 mS
8	WQ STA-4	↓	Nov 4 10:20 AM	↓	↓	pH = 4.76/cond 0.02 mS
9	MW14-04A	GW	Nov 4 11:15	↓	↓	pH = 6.22/cond 0.22 mS
10	WQ STN-1	Surface	Nov 4 11:50	↓	↓	pH = 5.92/cond 0.04 mS.

2014 NOV 3 10:07

RELINQUISHED BY: (Signature/Print)	Date	Time	RECEIVED BY: (Signature/Print)	Date	Time
[signature] Alex Ivanoff.			[signature] Sara Nason SARA NASON	2014/11/05	2:50

SHIPPED FROM 05-11-2014 MAXXAM NL

White: Maxxam Yellow: Mail Pink: Client ATL FCD 00149 / Revision 10

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Maxxam Analytics International Corporation

200 Bluewater Road, Suite 105, Bedford, Nova Scotia B4B 1G9 Tel: 902-420-0203 Fax: 902-420-8612 Toll Free: 1-800-565-7227
49 Elizabeth Ave., St John's, NL A1A 1W9 Tel: 709-754-0203 Fax: 709-754-8612 Toll Free: 1-888-492-7227
90 Esplanade Sydney, NS B1P 1A1 Tel: 902-567-1255 Fax: 902-539-6504 Toll Free: 1-888-535-7770
www.maxxamanalytics.com E-mail: Clientservicesbedford@maxxamanalytics.com

MAXXAM Chain of Custody Record

COC #: B 128763 Page ____ of ____

This column for lab use only:
Client Code
Maxxam Job # B4K8828

Cooler ID	Seal Present	Seal Intact	Temp 1	Temp 2	Temp 3	Average Temp
			8	9	7	
			0	0	1	

Integrity: YES / NO (NO circled) — Integrity / Checklist by: 06Nov14 [initials]
Labelled by — Location / Bin #

INVOICE INFORMATION:
Company Name: Golder Associates
Contact Name: Phyllis McCrindle
Address: 6925 Century Ave, Suite 600
Mississauga ON Postal Code L5N 7K2
Email: Phyllis_McCrindle@golder.com
Ph: 905-567-4444 Fax: 905-567-6561

REPORT INFORMATION (if differs from invoice):
Company Name:
Contact Name:
Address:
Postal Code
Email: cell # 647-278-1056
Ph: Fax:

PO #
Project # / Phase # 1407707
Project Name / Site Location: CFI / St. Lawrence NL
Quote
Site #
Task Order #
Sampled by: ALEX IVANOFF

TURNAROUND TIME
Standard ☑
10 day ☐
If RUSH Specify Date:
Pre-schedule rush work
Charge for # Jars used but not submitted

Guideline Requirements / Detection Limits / Special Instructions

*Specify Matrix: Surface/Salt/Ground/Tapwater/Sewage/Effluent/Potable/NonPotable/Tissue/Soil/Sludge/Metal/Seawater

Analysis columns: Field Filtered & Preserved; Lab Filtration Required; RCAP-30 Choose Total or Diss Metals; RCAP-MS Choose Total or Diss Metals; Metals Water: Total Digest (Default Method) for well water, surface water; Dissolved for ground water; Mercury; Metals Soil: Metals & Mercury Default Available Digest Method; Metals Total Digest - for Ocean sediments (HNO3/HF/HCLO4); Mercury Low level by Cold Vapour AA; Selenium (low level) Req'd for CCME Residential, Parklands, Agricultural; Hot Water soluble Boron (required for CCME Agricultural); Hydrocarbons: RBCA Hydrocarbons (BTEX, C6-C32); Hydrocarbons Soil (Potable), NS Fuel Oil Spill Policy Low Level BTEX, C6-C32; NB Potable Water BTEX, VPH, Low level T.E.H.; TPH Fractionation; PAH's; PAH's with Acridine, Quinoline

#	Field Sample Identification	Matrix*	Date/Time Sampled	# & type of bottles	Field Filtered & Preserved	Notes
1	WQ STN 7	surface	Nov 4 12:15PM	9	N	pH = 5.94 Cond = 0.04mS
2	WQ STN 6	↓	Nov 4 14:50	↓	↓	pH = 5.68 Cond = 0.01mS
3	WQ STN 5	↓	Nov 4 15:15	↓	↓	pH = 5.53 Cond = 0.01mS
4						
5						
6						
7						
8						
9						
10						

SHIPPED FROM 05-11-2014 MAXXAM NL

2014 NOV 6 10:07

RELINQUISHED BY: (Signature/Print)	Date	Time	RECEIVED BY: (Signature/Print)	Date	Time
[signature] Alex Ivanoff.			[signature] Sara Mason SARA MASON	2014/11/05	2:50

White: Maxxam Yellow: Mail

Your Project #: B4K8828
Your C.O.C. #: NA

Attention:Heather Macumber

Maxxam Analytics
200 Bluewater road
Bedford, NS
CANADA B4B 1G9

Report Date: 2014/11/18
Report #: R1945303
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B471636
Received: 2014/11/11, 08:30

Sample Matrix: WATER
Samples Received: 26

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Primary Reference
Weak Acid Dissociable Cyanides*	13	2014/11/17	2014/11/17	STL SOP-00035	MA300-CN 1.2 R2 m
Total Extractable Metals (Low Level)*	13	2014/11/13	2014/11/13	STL SOP-00006	MA200–Mét 1.2 R4 m

Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

* Maxxam is accredited as per the MDDELCC program.

Encryption Key

Rodrigo Caffarengo
18 Nov 2014 14:38:36 -05:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Rodrigo Caffarengo, Customer Service
Email: RCaffarengo@maxxam.ca
Phone# (514)448-9001 Ext:4336
==
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. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Job #: B471636
Report Date: 2014/11/18

Maxxam Analytics
Client Project #: B4K8828

TOTAL EXTRACTABLE METALS (WATER)

Maxxam ID		AF8559	AF8560	AF8561	AF8562		
Sampling Date		2014/11/03 13:35	2014/11/03 14:00	2014/11/03 14:55	2014/11/03 16:00		
COC Number		NA	NA	NA	NA		
	Units	**YI3664-04R/WS-2**	**YI3665-04R/WS-5**	**YI3666-04R/WS-10**	**YI3667-04R/WQ STA-2**	**RDL**	**QC Batch**
METALS ICP-MS							
Thorium (Th)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	1388584
Tungsten (W)	ug/L	<10	<10	<10	<10	10	1388584

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AF8563	AF8564	AF8565	AF8566		
Sampling Date		2014/11/04 08:45	2014/11/04 09:05	2014/11/04 10:10	2014/11/04 10:20		
COC Number		NA	NA	NA	NA		
	Units	**YI3668-04R/WQ STA-9**	**YI3669-04R/WQ STA-8**	**YI3670-04R/WQ STA-3**	**YI3671-04R/WQ STA-4**	**RDL**	**QC Batch**
METALS ICP-MS							
Thorium (Th)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	1388584
Tungsten (W)	ug/L	<10	<10	<10	<10	10	1388584

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AF8567	AF8568	AF8569	AF8570		
Sampling Date		2014/11/04 11:15	2014/11/04 11:50	2014/11/04 12:15	2014/11/04 14:50		
COC Number		NA	NA	NA	NA		
	Units	**YI3672-04R/MW14-04A**	**YI3673-04R/WQ STN-1**	**YI3674-04R/WQ STN-7**	**YI3675-04R/WQ STN-6**	**RDL**	**QC Batch**
METALS ICP-MS							
Thorium (Th)	ug/L	<1.0	<1.0	<1.0	<1.0	1.0	1388584
Tungsten (W)	ug/L	<10	<10	<10	<10	10	1388584

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AF8571		
Sampling Date		2014/11/04 15:15		
COC Number		NA		
	Units	**YI3676-04R/WQ STN-5**	**RDL**	**QC Batch**
METALS ICP-MS				
Thorium (Th)	ug/L	<1.0	1.0	1388584
Tungsten (W)	ug/L	<10	10	1388584

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

Maxxam Job #: B471636
Report Date: 2014/11/18

Maxxam Analytics
Client Project #: B4K8828

CONVENTIONAL PARAMETERS (WATER)

Maxxam ID		AF8572	AF8573	AF8574	AF8575		
Sampling Date		2014/11/03 13:35	2014/11/03 14:00	2014/11/03 14:55	2014/11/03 16:00		
COC Number		NA	NA	NA	NA		
	Units	**YI3664-08R/WS-2**	**YI3665-08R/WS-5**	**YI3666-08R/WS-10**	**YI3667-08R/WQ STA-2**	**RDL**	**QC Batch**
CONVENTIONALS							
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.003	<0.003	<0.003	<0.003	0.003	1389819

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AF8576	AF8577	AF8578		
Sampling Date		2014/11/04 08:45	2014/11/04 09:05	2014/11/04 10:10		
COC Number		NA	NA	NA		
	Units	**YI3668-08R/WQ STA-9**	**YI3669-08R/WQ STA-8**	**YI3670-08R/WQ STA-3**	**RDL**	**QC Batch**
CONVENTIONALS						
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.003	<0.003	<0.003	0.003	1389819

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AF8579	AF8580	AF8581		
Sampling Date		2014/11/04 10:20	2014/11/04 11:15	2014/11/04 11:50		
COC Number		NA	NA	NA		
	Units	**YI3671-08R/WQ STA-4**	**YI3672-08R/MW14-04A**	**YI3673-08R/WQ STN-1**	**RDL**	**QC Batch**
CONVENTIONALS						
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.003	<0.003	<0.003	0.003	1389819

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AF8581	AF8582	AF8583		
Sampling Date		2014/11/04 11:50	2014/11/04 12:15	2014/11/04 14:50		
COC Number		NA	NA	NA		
	Units	**YI3673-08R/WQ STN-1 Lab-Dup**	**YI3674-08R/WQ STN-7**	**YI3675-08R/WQ STN-6**	**RDL**	**QC Batch**
CONVENTIONALS						
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.003	<0.003	<0.003	0.003	1389819

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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CONVENTIONAL PARAMETERS (WATER)

Maxxam ID		AF8584		
Sampling Date		2014/11/04 15:15		
COC Number		NA		
	Units	**YI3676-08R/WQ STN-5**	**RDL**	**QC Batch**
CONVENTIONALS				
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.003	0.003	1389819

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

GENERAL COMMENTS

Condition of sample(s) upon receipt: GOOD except for the following:
Total Extractable Metals (Low Level): Arrived unpreserved, preserved upon reception at the laboratory.: AF8559, AF8560, AF8561, AF8562, AF8563, AF8564, AF8565, AF8566, AF8567, AF8568, AF8569, AF8570, AF8571

TOTAL EXTRACTABLE METALS (WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

CONVENTIONAL PARAMETERS (WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

Results relate only to the items tested.

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QUALITY ASSURANCE REPORT

Q /QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
1388584	AL5	Spiked Blank	Thorium (Th)	2014/11/13		94	%	80 - 120
			Tungsten (W)	2014/11/13		102	%	80 - 120
1388584	AL5	Method Blank	Thorium (Th)	2014/11/13	<1.0		ug/L	
			Tungsten (W)	2014/11/13	<10		ug/L	
1389819	DB2	QC Standard	Weak Acid Dissociable Cyanide (CN-)	2014/11/17		88	%	80 - 120
1389819	DB2	Spiked Blank	Weak Acid Dissociable Cyanide (CN-)	2014/11/17		103	%	75 - 125
1389819	DB2	Method Blank	Weak Acid Dissociable Cyanide (CN-)	2014/11/17	<0.003		mg/L	

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

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VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Delia Barbul, B.Sc., Chemist

Jonathan Fauvel, B.Sc, Chimiste, Analyste II

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. For Service Group specific validation please refer to the Validation Signature Page.

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

Purolator

FROM/DE
MAXXAM ANALYTICS
200 BLUEWATER ROAD
BEDFORD, NS B4B1G9
902-420-0203

Ref. SAMPLES FOR TESTING

TO/A
SAMPLE RECEIVING
MAXXAM ANALYTICS INC.
889 MONTEE DE LIESSE
SAINT-LAURENT, QC H4T1P5 COLLECT
514-448-9001

NOTE:
Purolator's published terms and conditions of service apply - see www.purolator.com.
Les Modalités et conditions de service publiées de Purolator s'appliquent - voir www.purolator.com

DATE	PIECES	WEIGHT/POIDS
10 NOV 2014	1 of/de 1	34.70 LB

PUROLATOR PIN: 603430573502

YUL 38

SD: 2014/10/28 - Shipping System 1.0

Your Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Your C.O.C. #: B 128761, B 128762

Attention: Phyllis McCrindle
Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2014/11/28
Report #: R3237394
Version: 3R

CERTIFICATE OF ANALYSIS – REVISED REPORT

MAXXAM JOB #: B4K1255
Received: 2014/10/28, 09:17

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Carbonate, Bicarbonate and Hydroxide	1	N/A	2014/10/30	N/A	SM 22 4500-CO2 D
Carbonate, Bicarbonate and Hydroxide	4	N/A	2014/11/05	N/A	SM 22 4500-CO2 D
Carbonate, Bicarbonate and Hydroxide	1	N/A	2014/11/17	N/A	SM 22 4500-CO2 D
Alkalinity	5	N/A	2014/10/30	ATL SOP 00013	EPA 310.2 R1974 m
Alkalinity	1	N/A	2014/11/19	ATL SOP 00013	EPA 310.2 R1974 m
Anions (1)	5	N/A	2014/11/05	CAM SOP-00435	SM 22 4110 B m
Anions (1)	1	N/A	2014/11/10	CAM SOP-00435	SM 22 4110 B m
Chloride	5	N/A	2014/11/03	ATL SOP 00014	SM 22 4500-Cl- E m
Chloride	1	N/A	2014/11/18	ATL SOP 00014	SM 22 4500-Cl- E m
Colour	5	N/A	2014/10/30	ATL SOP 00020	SM 22 2120C m
Colour	1	N/A	2014/11/17	ATL SOP 00020	SM 22 2120C m
Organic carbon - Diss (DOC) (2)	3	N/A	2014/10/28	ATL SOP 00037	SM 22 5310C m
Organic carbon - Diss (DOC) (2)	2	N/A	2014/11/06	ATL SOP 00037	SM 22 5310C m
Organic carbon - Diss (DOC) (2)	1	N/A	2014/11/17	ATL SOP 00037	SM 22 5310C m
Conductance - water	1	N/A	2014/10/29	ATL SOP 00004	SM 22 2510B m
Conductance - water	4	N/A	2014/11/04	ATL SOP 00004	SM 22 2510B m
Conductance - water	1	N/A	2014/11/14	ATL SOP 00004	SM 22 2510B m
Fluoride	5	N/A	2014/10/31	ATL SOP 00043	SM 22 4500-F- C m
Fluoride	1	N/A	2014/11/07	ATL SOP 00043	SM 22 4500-F- C m
Hardness (calculated as CaCO3)	5	N/A	2014/10/30	ATL SOP 00048	SM 22 2340 B
Hardness (calculated as CaCO3)	1	N/A	2014/11/10	ATL SOP 00048	SM 22 2340 B
Mercury - Total (CVAA,LL)	5	2014/10/31	2014/10/31	ATL SOP 00026	EPA 245.1 R3 m
Mercury - Total (CVAA,LL)	1	2014/11/12	2014/11/13	ATL SOP 00026	EPA 245.1 R3 m
Metals Water Total MS (3)	5	2014/10/29	2014/10/30	ATL SOP 00058	EPA 6020A R1 m
Metals Water Total MS (3)	1	2014/11/07	2014/11/08	ATL SOP 00058	EPA 6020A R1 m
Ion Balance (% Difference)	1	N/A	2014/11/04		Auto Calc.
Ion Balance (% Difference)	4	N/A	2014/11/05		Auto Calc.
Ion Balance (% Difference)	1	N/A	2014/11/19		Auto Calc.
Anion and Cation Sum	1	N/A	2014/11/04		Auto Calc.
Anion and Cation Sum	4	N/A	2014/11/05		Auto Calc.
Anion and Cation Sum	1	N/A	2014/11/18		Auto Calc.
Nitrogen Ammonia - water	5	N/A	2014/11/04	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen Ammonia - water	1	N/A	2014/11/17	ATL SOP 00015	EPA 350.1 R2 m
Nitrogen - Nitrate + Nitrite	5	N/A	2014/10/31	ATL SOP 00016	USGS SOPINCF0452.2 m

Your Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Your C.O.C. #: B 128761, B 128762

Attention: Phyllis McCrindle
Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2014/11/28
Report #: R3237394
Version: 3R

CERTIFICATE OF ANALYSIS – REVISED REPORT

-2-

Sample Matrix: Water
Samples Received: 6

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Method Reference
Nitrogen - Nitrate + Nitrite	1	N/A	2014/11/18	ATL SOP 00016	USGS SOPINCF0452.2 m
Nitrogen - Nitrite	5	N/A	2014/10/31	ATL SOP 00017	SM 22 4500-NO2- B m
Nitrogen - Nitrite	1	N/A	2014/11/17	ATL SOP 00017	SM 22 4500-NO2- B m
Nitrogen - Nitrate (as N)	5	N/A	2014/10/31	ATL SOP 00018	ASTM D3867
Nitrogen - Nitrate (as N)	1	N/A	2014/11/18	ATL SOP 00018	ASTM D3867
pH - On-Site	1	N/A	2014/11/06		
pH (4)	1	N/A	2014/10/29	ATL SOP 00003	SM 22 4500-H+ B m
pH (4)	4	N/A	2014/11/04	ATL SOP 00003	SM 22 4500-H+ B m
pH (4)	1	N/A	2014/11/14	ATL SOP 00003	SM 22 4500-H+ B m
Phosphorus - ortho	5	N/A	2014/10/31	ATL SOP 00021	EPA 365.2 m
Phosphorus - ortho	1	N/A	2014/11/17	ATL SOP 00021	EPA 365.2 m
Sat. pH and Langelier Index (@ 20C)	1	N/A	2014/11/04	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 20C)	4	N/A	2014/11/05	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 20C)	1	N/A	2014/11/19	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C)	1	N/A	2014/11/04	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C)	4	N/A	2014/11/05	ATL SOP 00049	Auto Calc.
Sat. pH and Langelier Index (@ 4C)	1	N/A	2014/11/19	ATL SOP 00049	Auto Calc.
Reactive Silica	5	N/A	2014/10/30	ATL SOP 00022	EPA 366.0 m
Reactive Silica	1	N/A	2014/11/17	ATL SOP 00022	EPA 366.0 m
Sulphate	5	N/A	2014/11/03	ATL SOP 00023	EPA 375.4 R1978 m
Sulphate	1	N/A	2014/11/18	ATL SOP 00023	EPA 375.4 R1978 m
Sulphide (1)	5	N/A	2014/10/29	CAM SOP-00455	SM 22 4500-S G m
Sulphide (1)	1	N/A	2014/11/09	CAM SOP-00455	SM 22 4500-S G m
Total Dissolved Solids (Filt. Residue)	5	N/A	2014/11/06	ATL SOP 00009	EPA 160.1 m
Total Dissolved Solids (Filt. Residue)	1	N/A	2014/11/17	ATL SOP 00009	EPA 160.1 m
Total Dissolved Solids (TDS calc)	4	N/A	2014/11/04		Auto Calc.
Total Dissolved Solids (TDS calc)	1	N/A	2014/11/05		Auto Calc.
Total Dissolved Solids (TDS calc)	1	N/A	2014/11/19		Auto Calc.
Organic carbon - Total (TOC) (2)	3	N/A	2014/10/28	ATL SOP 00037	SM 22 5310C m
Organic carbon - Total (TOC) (2)	2	N/A	2014/11/06	ATL SOP 00037	SM 22 5310C m
Organic carbon - Total (TOC) (2)	1	N/A	2014/11/13	ATL SOP 00037	SM 22 5310C m
Total Phosphorus (Colourimetric) (1)	5	2014/11/04	2014/11/05	CAM SOP-00407	SM 4500 P B F m
Total Phosphorus (Colourimetric) (1)	1	2014/11/14	2014/11/14	CAM SOP-00407	SM 4500 P B F m
Total Suspended Solids	5	N/A	2014/11/03	ATL SOP 00007	EPA 160.2 m
Total Suspended Solids	1	N/A	2014/11/12	ATL SOP 00007	EPA 160.2 m
Turbidity	5	N/A	2014/11/04	ATL SOP 00011	EPA 180.1 R2 m
Turbidity	1	N/A	2014/11/17	ATL SOP 00011	EPA 180.1 R2 m

Your Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Your C.O.C. #: B 128761, B 128762

Attention: Phyllis McCrindle
Golder Associates Ltd
Mississauga - Standing Offer
6925 Century Ave
Suite 100
Mississauga, ON
CANADA L5N 7K2

Report Date: 2014/11/28

CERTIFICATE OF ANALYSIS – REVISED REPORT

Remarks:

Maxxam Analytics has performed all analytical testing herein in accordance with ISO 17025 and the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act. All methodologies comply with this document and are validated for use in the laboratory. The methods and techniques employed in this analysis conform to the performance criteria (detection limits, accuracy and precision) as outlined in the Protocol for Analytical Methods Used in the Assessment of Properties under Part XV.1 of the Environmental Protection Act.

The CWS PHC methods employed by Maxxam conform to all prescribed elements of the reference method and performance based elements have been validated. All modifications have been validated and proven equivalent following the 'Alberta Environment Draft Addenda to the CWS-PHC, Appendix 6, Validation of Alternate Methods'. Documentation is available upon request. Maxxam has made the following improvements to the CWS-PHC reference benchmark method: (i) Headspace for F1; and, (ii) Mechanical extraction for F2-F4. Note: F4G cannot be added to the C6 to C50 hydrocarbons. The extraction date for samples field preserved with methanol for F1 and Volatile Organic Compounds is considered to be the date sampled.

Maxxam Analytics is accredited for all specific parameters as required by Ontario Regulation 153/04. Maxxam Analytics is limited in liability to the actual cost of analysis unless otherwise agreed in writing. There is no other warranty expressed or implied. Samples will be retained at Maxxam Analytics for three weeks from receipt of data or as per contract.

* 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) TOC / DOC present in the sample should be considered as non-purgeable TOC / DOC.
(3) New RDLs in effect due to release of NS Contaminated Sites Regulations. Reduced RDL based on MDL study performance. Low level analytical run checks being implemented.
(4) The APHA Standard Method require pH to be analyzed within 15 minutes of sampling and therefore field analysis is required for compliance. All Laboratory pH analyses in this report are reported past the APHA Standard Method holding time.

Your Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
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6925 Century Ave
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CANADA L5N 7K2

Report Date: 2014/11/28

CERTIFICATE OF ANALYSIS – REVISED REPORT

-4-

Encryption Key

Heather Macumber.
Heather Macumber
28 Nov 2014 16:30:53 -04:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.

Mari Kenny, Project Manager
Email: MKenny@maxxam.ca
Phone# (902) 420-0203 Ext:291

==
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. For Service Group specific validation please refer to the Validation Signature Page.

Total cover pages: 4

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YE4528	YE4528	YE4529		
Sampling Date				2014/10/24 11:30	2014/10/24 11:30	2014/10/24 13:20		
COC Number				B 128761	B 128761	B 128761		
	Units	**Criteria A**	**AO**	**MW14-01A**	**MW14-01A Lab-Dup**	**MW14-02A**	**RDL**	**QC Batch**
Calculated Parameters								
Anion Sum	me/L	-	-	1.25		2.08	N/A	3801231
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	36		72	1.0	3801228
Calculated TDS	mg/L	-	500	74		120	1.0	3801237
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0		<1.0	1.0	3801228
Cation Sum	me/L	-	-	1.25		1.96	N/A	3801231
Hardness (CaCO3)	mg/L	-	-	39		64	1.0	3801229
Ion Balance (% Difference)	%	-	-	0.00		2.97	N/A	3801230
Langelier Index (@ 20C)	N/A	-	-	-1.30		-0.557		3801235
Langelier Index (@ 4C)	N/A	-	-	-1.55		-0.807		3801236
Nitrate (N)	mg/L	**10**	-	<0.050		<0.050	0.050	3801232
Saturation pH (@ 20C)	N/A	-	-	8.66		8.19		3801235
Saturation pH (@ 4C)	N/A	-	-	8.91		8.44		3801236
Inorganics								
Total Alkalinity (Total as CaCO3)	mg/L	-	-	36	36	73	5.0	3803507
Dissolved Chloride (Cl)	mg/L	-	250	15	14	17	1.0	3803513
Colour	TCU	-	15	<5.0	<5.0	8.5	5.0	3803517
Nitrate + Nitrite	mg/L	-	-	<0.050	<0.050	<0.050	0.050	3803519
Nitrite (N)	mg/L	**1**	-	<0.010	<0.010	<0.010	0.010	3803520
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	0.061		<0.050	0.050	3804761
Total Organic Carbon (C)	mg/L	-	-	3.5		8.7	0.50	3813443
Orthophosphate (P)	mg/L	-	-	<0.010	<0.010	<0.010	0.010	3803518
pH	pH	-	6.5 : 8.5	7.36		7.63	N/A	3810222
Reactive Silica (SiO2)	mg/L	-	-	6.7	6.7	11	0.50	3803516

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Success Through Science®

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YE4528	YE4528	YE4529		
Sampling Date				2014/10/24 11:30	2014/10/24 11:30	2014/10/24 13:20		
COC Number				B 128761	B 128761	B 128761		
	Units	**Criteria A**	**AO**	**MW14-01A**	**MW14-01A Lab-Dup**	**MW14-02A**	**RDL**	**QC Batch**
Dissolved Sulphate (SO4)	mg/L	-	500	4.0	3.9	4.6	2.0	3803514
Turbidity	NTU	**0.3**	-	**27**		**13**	0.10	3810731
Conductivity	uS/cm	-	-	120		180	1.0	3810230
Metals								
Total Aluminum (Al)	ug/L	-	100	610		710	5.0	3802699
Total Antimony (Sb)	ug/L	**6**	-	<1.0		<1.0	1.0	3802699
Total Arsenic (As)	ug/L	**10**	-	4.8		<1.0	1.0	3802699
Total Barium (Ba)	ug/L	**1000**	-	74		42	1.0	3802699
Total Beryllium (Be)	ug/L	-	-	<1.0		<1.0	1.0	3802699
Total Bismuth (Bi)	ug/L	-	-	<2.0		<2.0	2.0	3802699
Total Boron (B)	ug/L	**5000**	-	<50		<50	50	3802699
Total Cadmium (Cd)	ug/L	**5**	-	0.24		0.99	0.010	3802699
Total Calcium (Ca)	ug/L	-	-	13000		21000	100	3802699
Total Chromium (Cr)	ug/L	**50**	-	<1.0		<1.0	1.0	3802699
Total Cobalt (Co)	ug/L	-	-	<0.40		0.98	0.40	3802699
Total Copper (Cu)	ug/L	-	1000	5.2		4.4	2.0	3802699
Total Iron (Fe)	ug/L	-	300	490		670	50	3802699
Total Lead (Pb)	ug/L	**10**	-	7.3		4.4	0.50	3802699
Total Lithium (Li)	ug/L	-	-	8.3		13	2.0	3802699
Total Magnesium (Mg)	ug/L	-	-	1500		3100	100	3802699
Total Manganese (Mn)	ug/L	-	50	44		120	2.0	3802699
Total Molybdenum (Mo)	ug/L	-	-	2.1		<2.0	2.0	3802699
Total Nickel (Ni)	ug/L	-	-	<2.0		3.6	2.0	3802699
Total Phosphorus (P)	ug/L	-	-	100		<100	100	3802699

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YE4528	YE4528	YE4529		
Sampling Date				2014/10/24 11:30	2014/10/24 11:30	2014/10/24 13:20		
COC Number				B 128761	B 128761	B 128761		
	Units	**Criteria A**	**AO**	**MW14-01A**	**MW14-01A Lab-Dup**	**MW14-02A**	**RDL**	**QC Batch**
Total Potassium (K)	ug/L	**-**	-	1400		1400	100	3802699
Total Selenium (Se)	ug/L	**50**	-	<1.0		<1.0	1.0	3802699
Total Silicon (Si)	ug/L	**-**	-	3400		5500	500	3802699
Total Silver (Ag)	ug/L	**-**	-	0.10		0.15	0.10	3802699
Total Sodium (Na)	ug/L	**-**	200000	9700		14000	100	3802699
Total Strontium (Sr)	ug/L	**-**	-	86		87	2.0	3802699
Total Sulphur (S)	ug/L	**-**	-	<5000		<5000	5000	3802699
Total Tellurium (Te)	ug/L	**-**	-	<2.0		<2.0	2.0	3802699
Total Thallium (Tl)	ug/L	**-**	-	<0.10		<0.10	0.10	3802699
Total Tin (Sn)	ug/L	**-**	-	<2.0		<2.0	2.0	3802699
Total Titanium (Ti)	ug/L	**-**	-	4.1		6.4	2.0	3802699
Total Uranium (U)	ug/L	**20**	-	0.43		0.54	0.10	3802699
Total Vanadium (V)	ug/L	**-**	-	<2.0		<2.0	2.0	3802699
Total Zirconium (Zr)	ug/L	**-**	-	<2.0		<2.0	2.0	3802699
Total Zinc (Zn)	ug/L	**-**	5000	48		64	5.0	3802699

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YE4530	YE4530		
Sampling Date				2014/10/24 15:00	2014/10/24 15:00		
COC Number				B 128761	B 128761		
	Units	**Criteria A**	**AO**	**MW14-03A**	**MW14-03A Lab-Dup**	**RDL**	**QC Batch**
Calculated Parameters							
Anion Sum	me/L	-	-	0.720		N/A	3801231
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	11		1.0	3801228
Calculated TDS	mg/L	-	500	70		1.0	3801237
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0		1.0	3801228
Cation Sum	me/L	-	-	1.49		N/A	3801231
Hardness (CaCO3)	mg/L	-	-	19		1.0	3801229
Ion Balance (% Difference)	%	-	-	34.8		N/A	3801230
Langelier Index (@ 20C)	N/A	-	-	-3.30			3801235
Langelier Index (@ 4C)	N/A	-	-	-3.55			3801236
Nitrate (N)	mg/L	**10**	-	<0.050		0.050	3801232
Saturation pH (@ 20C)	N/A	-	-	9.81			3801235
Saturation pH (@ 4C)	N/A	-	-	10.1			3801236
Inorganics							
Total Alkalinity (Total as CaCO3)	mg/L	-	-	11		5.0	3803507
Dissolved Chloride (Cl)	mg/L	-	250	17		1.0	3803513
Colour	TCU	-	15	160		25	3803517
Nitrate + Nitrite	mg/L	-	-	<0.050		0.050	3803519
Nitrite (N)	mg/L	**1**	-	<0.010		0.010	3803520
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	0.085		0.050	3804761
Total Organic Carbon (C)	mg/L	-	-	38 (1)		5.0	3801325
Orthophosphate (P)	mg/L	-	-	0.011		0.010	3803518

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.
(1) Reporting limit was increased due to turbidity.

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YE4530	YE4530		
Sampling Date				2014/10/24 15:00	2014/10/24 15:00		
COC Number				B 128761	B 128761		
	Units	**Criteria A**	**AO**	**MW14-03A**	**MW14-03A Lab-Dup**	**RDL**	**QC Batch**
pH	pH	**-**	6.5 : 8.5	6.51	6.51	N/A	3802765
Reactive Silica (SiO2)	mg/L	**-**	-	9.9		0.50	3803516
Dissolved Sulphate (SO4)	mg/L	**-**	500	<2.0		2.0	3803514
Turbidity	NTU	**0.3**	-	**150**		0.50	3810731
Conductivity	uS/cm	**-**	-	83	83	1.0	3802766
Metals							
Total Aluminum (Al)	ug/L	**-**	100	15000		5.0	3802699
Total Antimony (Sb)	ug/L	**6**	-	4.0		1.0	3802699
Total Arsenic (As)	ug/L	**10**	-	**120**		1.0	3802699
Total Barium (Ba)	ug/L	**1000**	-	190		1.0	3802699
Total Beryllium (Be)	ug/L	**-**	-	3.0		1.0	3802699
Total Bismuth (Bi)	ug/L	**-**	-	<2.0		2.0	3802699
Total Boron (B)	ug/L	**5000**	-	<50		50	3802699
Total Cadmium (Cd)	ug/L	**5**	-	3.2		0.010	3802699
Total Calcium (Ca)	ug/L	**-**	-	3500		100	3802699
Total Chromium (Cr)	ug/L	**50**	-	12		1.0	3802699
Total Cobalt (Co)	ug/L	**-**	-	8.6		0.40	3802699
Total Copper (Cu)	ug/L	**-**	1000	110		2.0	3802699
Total Iron (Fe)	ug/L	**-**	300	15000		50	3802699
Total Lead (Pb)	ug/L	**10**	-	**1000**		0.50	3802699
Total Lithium (Li)	ug/L	**-**	-	30		2.0	3802699
Total Magnesium (Mg)	ug/L	**-**	-	2400		100	3802699
Total Manganese (Mn)	ug/L	**-**	50	800		2.0	3802699

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
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Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YE4530	YE4530		
Sampling Date				2014/10/24 15:00	2014/10/24 15:00		
COC Number				B 128761	B 128761		
	Units	**Criteria A**	**AO**	**MW14-03A**	**MW14-03A Lab-Dup**	**RDL**	**QC Batch**
Total Molybdenum (Mo)	ug/L	-	-	7.6		2.0	3802699
Total Nickel (Ni)	ug/L	-	-	12		2.0	3802699
Total Phosphorus (P)	ug/L	-	-	380		100	3802699
Total Potassium (K)	ug/L	-	-	1800		100	3802699
Total Selenium (Se)	ug/L	**50**	-	1.0		1.0	3802699
Total Silicon (Si)	ug/L	-	-	9900		500	3802699
Total Silver (Ag)	ug/L	-	-	0.86		0.10	3802699
Total Sodium (Na)	ug/L	-	200000	12000		100	3802699
Total Strontium (Sr)	ug/L	-	-	27		2.0	3802699
Total Sulphur (S)	ug/L	-	-	<5000		5000	3802699
Total Tellurium (Te)	ug/L	-	-	<2.0		2.0	3802699
Total Thallium (Tl)	ug/L	-	-	0.24		0.10	3802699
Total Tin (Sn)	ug/L	-	-	<2.0		2.0	3802699
Total Titanium (Ti)	ug/L	-	-	200		2.0	3802699
Total Uranium (U)	ug/L	**20**	-	6.1		0.10	3802699
Total Vanadium (V)	ug/L	-	-	22		2.0	3802699
Total Zirconium (Zr)	ug/L	-	-	3.3		2.0	3802699
Total Zinc (Zn)	ug/L	-	5000	380		5.0	3802699

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
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Success Through Science®

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YE4531			YE4532		
Sampling Date				2014/10/25 11:45			2014/10/26 15:10		
COC Number				B 128761			B 128761		
	Units	**Criteria A**	**AO**	**PGS-93B**	**RDL**	**QC Batch**	**PGS-124**	**RDL**	**QC Batch**
Calculated Parameters									
Anion Sum	me/L	-	-	1.93	N/A	3801231	1.26	N/A	3801231
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	61	1.0	3801228	13	1.0	3801228
Calculated TDS	mg/L	-	500	110	1.0	3801237	170	1.0	3801237
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	1.0	3801228	<1.0	1.0	3801228
Cation Sum	me/L	-	-	1.90	N/A	3801231	4.47	N/A	3801231
Hardness (CaCO3)	mg/L	-	-	64	1.0	3801229	80	1.0	3801229
Ion Balance (% Difference)	%	-	-	0.780	N/A	3801230	56.0	N/A	3801230
Langelier Index (@ 20C)	N/A	-	-	-0.167		3801235	-2.33		3801235
Langelier Index (@ 4C)	N/A	-	-	-0.418		3801236	-2.58		3801236
Nitrate (N)	mg/L	**10**	-	<0.050	0.050	3801232	0.17	0.050	3801232
Saturation pH (@ 20C)	N/A	-	-	8.19		3801235	9.13		3801235
Saturation pH (@ 4C)	N/A	-	-	8.44		3801236	9.38		3801236
Inorganics									
Total Alkalinity (Total as CaCO3)	mg/L	-	-	62	5.0	3803507	13	5.0	3803507
Dissolved Chloride (Cl)	mg/L	-	250	14	1.0	3803513	25	1.0	3803513
Colour	TCU	-	15	<5.0	5.0	3803517	95	25	3803517
Nitrate + Nitrite	mg/L	-	-	<0.050	0.050	3803519	0.17	0.050	3803519
Nitrite (N)	mg/L	**1**	-	<0.010	0.010	3803520	<0.010	0.010	3803520
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	<0.050	0.050	3804761	0.060	0.050	3809291
Total Organic Carbon (C)	mg/L	-	-	<0.50	0.50	3801325	21 (1)	5.0	3801325
Orthophosphate (P)	mg/L	-	-	<0.010	0.010	3803518	<0.010	0.010	3803518
pH	pH	-	6.5 : 8.5	8.02	N/A	3810222	6.80	N/A	3810222
Reactive Silica (SiO2)	mg/L	-	-	9.7	0.50	3803516	19	0.50	3803516

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
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(1) Reporting limit was increased due to turbidity.

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YE4531			YE4532		
Sampling Date				2014/10/25 11:45			2014/10/26 15:10		
COC Number				B 128761			B 128761		
	Units	**Criteria A**	**AO**	**PGS-93B**	**RDL**	**QC Batch**	**PGS-124**	**RDL**	**QC Batch**
Dissolved Sulphate (SO4)	mg/L	-	500	8.2	2.0	3803514	10	2.0	3803514
Turbidity	NTU	**0.3**	-	**7.6**	0.10	3810731	**660**	5.0	3810731
Conductivity	uS/cm	-	-	180	1.0	3810230	130	1.0	3810230
Metals									
Total Aluminum (Al)	ug/L	-	100	580	5.0	3802699	39000	5.0	3802699
Total Antimony (Sb)	ug/L	**6**	-	<1.0	1.0	3802699	<1.0	1.0	3802699
Total Arsenic (As)	ug/L	**10**	-	**26**	1.0	3802699	**23**	1.0	3802699
Total Barium (Ba)	ug/L	**1000**	-	32	1.0	3802699	740	1.0	3802699
Total Beryllium (Be)	ug/L	-	-	<1.0	1.0	3802699	3.6	1.0	3802699
Total Bismuth (Bi)	ug/L	-	-	<2.0	2.0	3802699	<2.0	2.0	3802699
Total Boron (B)	ug/L	**5000**	-	<50	50	3802699	<50	50	3802699
Total Cadmium (Cd)	ug/L	**5**	-	0.11	0.010	3802699	2.6	0.010	3802699
Total Calcium (Ca)	ug/L	-	-	24000	100	3802699	13000	100	3802699
Total Chromium (Cr)	ug/L	**50**	-	<1.0	1.0	3802699	**56**	1.0	3802699
Total Cobalt (Co)	ug/L	-	-	<0.40	0.40	3802699	26	0.40	3802699
Total Copper (Cu)	ug/L	-	1000	3.1	2.0	3802699	120	2.0	3802699
Total Iron (Fe)	ug/L	-	300	640	50	3802699	53000	50	3802699
Total Lead (Pb)	ug/L	**10**	-	4.6	0.50	3802699	**250**	0.50	3802699
Total Lithium (Li)	ug/L	-	-	65	2.0	3802699	140	2.0	3802699
Total Magnesium (Mg)	ug/L	-	-	1000	100	3802699	11000	100	3802699
Total Manganese (Mn)	ug/L	-	50	19	2.0	3802699	1100	2.0	3802699
Total Molybdenum (Mo)	ug/L	-	-	7.1	2.0	3802699	9.2	2.0	3802699
Total Nickel (Ni)	ug/L	-	-	<2.0	2.0	3802699	52	2.0	3802699
Total Phosphorus (P)	ug/L	-	-	100	100	3802699	840	100	3802699
Total Potassium (K)	ug/L	-	-	1200	100	3802699	10000	100	3802699

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
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Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YE4531			YE4532		
Sampling Date				2014/10/25 11:45			2014/10/26 15:10		
COC Number				B 128761			B 128761		
	Units	**Criteria A**	**AO**	**PGS-93B**	**RDL**	**QC Batch**	**PGS-124**	**RDL**	**QC Batch**
Total Selenium (Se)	ug/L	**50**	-	<1.0	1.0	3802699	1.1	1.0	3802699
Total Silicon (Si)	ug/L	**-**	-	5000	500	3802699	39000	500	3802699
Total Silver (Ag)	ug/L	**-**	-	0.17	0.10	3802699	13	0.10	3802699
Total Sodium (Na)	ug/L	**-**	200000	13000	100	3802699	16000	100	3802699
Total Strontium (Sr)	ug/L	**-**	-	270	2.0	3802699	52	2.0	3802699
Total Sulphur (S)	ug/L	**-**	-	<5000	5000	3802699	<5000	5000	3802699
Total Tellurium (Te)	ug/L	**-**	-	<2.0	2.0	3802699	<2.0	2.0	3802699
Total Thallium (Tl)	ug/L	**-**	-	<0.10	0.10	3802699	0.73	0.10	3802699
Total Tin (Sn)	ug/L	**-**	-	<2.0	2.0	3802699	2.3	2.0	3802699
Total Titanium (Ti)	ug/L	**-**	-	6.9	2.0	3802699	550	2.0	3802699
Total Uranium (U)	ug/L	**20**	-	3.6	0.10	3802699	3.5	0.10	3802699
Total Vanadium (V)	ug/L	**-**	-	<2.0	2.0	3802699	47	2.0	3802699
Total Zirconium (Zr)	ug/L	**-**	-	<2.0	2.0	3802699	3.6	2.0	3802699
Total Zinc (Zn)	ug/L	**-**	5000	25	5.0	3802699	540	5.0	3802699

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

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Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3672		
Sampling Date				2014/11/04 11:15		
COC Number				B 128762		
	Units	**Criteria A**	**AO**	**MW14-04A**	**RDL**	**QC Batch**
Calculated Parameters						
Anion Sum	me/L	-	-	2.74	N/A	3813787
Bicarb. Alkalinity (calc. as CaCO3)	mg/L	-	-	93	1.0	3813784
Calculated TDS	mg/L	-	500	150	1.0	3813791
Carb. Alkalinity (calc. as CaCO3)	mg/L	-	-	<1.0	1.0	3813784
Cation Sum	me/L	-	-	2.54	N/A	3813787
Hardness (CaCO3)	mg/L	-	-	92	1.0	3813785
Ion Balance (% Difference)	%	-	-	3.79	N/A	3813786
Langelier Index (@ 20C)	N/A	-	-	-0.327		3813789
Langelier Index (@ 4C)	N/A	-	-	-0.577		3813790
Nitrate (N)	mg/L	**10**	-	<0.050	0.050	3813788
Saturation pH (@ 20C)	N/A	-	-	7.90		3813789
Saturation pH (@ 4C)	N/A	-	-	8.15		3813790
Inorganics						
Total Alkalinity (Total as CaCO3)	mg/L	-	-	93	5.0	3823280
Dissolved Chloride (Cl)	mg/L	-	250	16	1.0	3823281
Colour	TCU	-	15	10	5.0	3823284
Nitrate + Nitrite	mg/L	-	-	<0.050	0.050	3823286
Nitrite (N)	mg/L	**1**	-	<0.010	0.010	3823287
Nitrogen (Ammonia Nitrogen)	mg/L	-	-	0.075	0.050	3823467
Total Organic Carbon (C)	mg/L	-	-	4.2	0.50	3821731
Orthophosphate (P)	mg/L	-	-	<0.010	0.010	3823285
pH	pH	-	6.5 : 8.5	7.57	N/A	3823423

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3672		
Sampling Date				2014/11/04 11:15		
COC Number				B 128762		
	Units	**Criteria A**	**AO**	**MW14-04A**	**RDL**	**QC Batch**
Reactive Silica (SiO2)	mg/L	-	-	7.6	0.50	3823283
Dissolved Sulphate (SO4)	mg/L	-	500	16	2.0	3823282
Turbidity	NTU	**0.3**	-	**6.0**	0.10	3825931
Conductivity	uS/cm	-	-	250	1.0	3823429
Metals						
Total Aluminum (Al)	ug/L	-	100	170	5.0	3815304
Total Antimony (Sb)	ug/L	**6**	-	<1.0	1.0	3815304
Total Arsenic (As)	ug/L	**10**	-	<1.0	1.0	3815304
Total Barium (Ba)	ug/L	**1000**	-	97	1.0	3815304
Total Beryllium (Be)	ug/L	-	-	<1.0	1.0	3815304
Total Bismuth (Bi)	ug/L	-	-	<2.0	2.0	3815304
Total Boron (B)	ug/L	**5000**	-	<50	50	3815304
Total Cadmium (Cd)	ug/L	**5**	-	0.25	0.010	3815304
Total Calcium (Ca)	ug/L	-	-	32000	100	3815304
Total Chromium (Cr)	ug/L	**50**	-	2.7	1.0	3815304
Total Cobalt (Co)	ug/L	-	-	0.75	0.40	3815304
Total Copper (Cu)	ug/L	-	1000	7.8	2.0	3815304
Total Iron (Fe)	ug/L	-	300	340	50	3815304
Total Lead (Pb)	ug/L	**10**	-	2.9	0.50	3815304
Total Lithium (Li)	ug/L	-	-	17	2.0	3815304
Total Magnesium (Mg)	ug/L	-	-	2600	100	3815304
Total Manganese (Mn)	ug/L	-	50	170	2.0	3815304
Total Molybdenum (Mo)	ug/L	-	-	13	2.0	3815304

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

ATLANTIC RCAP-MS TOTAL METALS IN WATER (WATER)

Maxxam ID				YI3672		
Sampling Date				2014/11/04 11:15		
COC Number				B 128762		
	Units	**Criteria A**	**AO**	**MW14-04A**	**RDL**	**QC Batch**
Total Nickel (Ni)	ug/L	-	-	3.9	2.0	3815304
Total Phosphorus (P)	ug/L	-	-	<100	100	3815304
Total Potassium (K)	ug/L	-	-	1300	100	3815304
Total Selenium (Se)	ug/L	**50**	-	<1.0	1.0	3815304
Total Silicon (Si)	ug/L	-	-	3500	500	3815304
Total Silver (Ag)	ug/L	-	-	<0.10	0.10	3815304
Total Sodium (Na)	ug/L	-	200000	15000	100	3815304
Total Strontium (Sr)	ug/L	-	-	140	2.0	3815304
Total Sulphur (S)	ug/L	-	-	<5000	5000	3815304
Total Tellurium (Te)	ug/L	-	-	<2.0	2.0	3815304
Total Thallium (Tl)	ug/L	-	-	<0.10	0.10	3815304
Total Tin (Sn)	ug/L	-	-	2.7	2.0	3815304
Total Titanium (Ti)	ug/L	-	-	6.3	2.0	3815304
Total Uranium (U)	ug/L	**20**	-	5.1	0.10	3815304
Total Vanadium (V)	ug/L	-	-	<2.0	2.0	3815304
Total Zirconium (Zr)	ug/L	-	-	<2.0	2.0	3815304
Total Zinc (Zn)	ug/L	-	5000	800	5.0	3815304

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

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Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

RESULTS OF ANALYSES OF WATER

Maxxam ID				YE4528		YE4529		
Sampling Date				2014/10/24 11:30		2014/10/24 13:20		
COC Number				B 128761		B 128761		
	Units	**Criteria A**	**AO**	**MW14-01A**	**RDL**	**MW14-02A**	**RDL**	**QC Batch**
Inorganics								
Total Dissolved Solids	mg/L	-	500	97	20	150	20	3811569
Dissolved Fluoride (F-)	mg/L	**1.5**	-	0.55	0.10	0.80	0.10	3806847
Dissolved Organic Carbon (C)	mg/L	-	-	7.8	0.50	11	0.50	3813442
Total Phosphorus	mg/L	-	-	0.026	0.020	0.027	0.020	3810800
Total Suspended Solids	mg/L	-	-	<10	10	<5.0	5.0	3806746
Sulphide	mg/L	-	0.05	<0.020	0.020	<0.020	0.020	3804000
Bromide (Br-)	mg/L	-	-	<1.0	1.0	<1.0	1.0	3806128

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
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Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

RESULTS OF ANALYSES OF WATER

Maxxam ID				YE4530		YE4531	YE4531		
Sampling Date				2014/10/24 15:00		2014/10/25 11:45	2014/10/25 11:45		
COC Number				B 128761		B 128761	B 128761		
	Units	**Criteria A**	**AO**	**MW14-03A**	**RDL**	**PGS-93B**	**PGS-93B Lab-Dup**	**RDL**	**QC Batch**
Inorganics									
Total Dissolved Solids	mg/L	-	500	210	40	110		20	3811569
Dissolved Fluoride (F-)	mg/L	**1.5**	-	0.28	0.10	**2.6**		0.10	3806847
Dissolved Organic Carbon (C)	mg/L	-	-	29 (1)	5.0	<0.50		0.50	3801537
Total Phosphorus	mg/L	-	-	0.24	0.020	0.028		0.020	3810800
Total Suspended Solids	mg/L	-	-	55	5.0	15		2.0	3806746
Sulphide	mg/L	-	0.05	0.025	0.020	<0.020		0.020	3804000
Bromide (Br-)	mg/L	-	-	<1.0	1.0	<1.0	<1.0	1.0	3806128

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

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(1) Elevated reporting limit due to sample matrix.

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

RESULTS OF ANALYSES OF WATER

Maxxam ID				YE4532			YI3672		
Sampling Date				2014/10/26 15:10			2014/11/04 11:15		
COC Number				B 128761			B 128762		
	Units	**Criteria A**	**AO**	**PGS-124**	**RDL**	**QC Batch**	**MW14-04A**	**RDL**	**QC Batch**
Field Measurements									
Field pH	pH	-	-		N/A		6.22	N/A	ONSITE
Inorganics									
Total Dissolved Solids	mg/L	-	500	140	20	3811569	170	20	3823470
Dissolved Fluoride (F-)	mg/L	**1.5**	-	1.3	0.10	3806847	**1.7**	0.10	3815638
Dissolved Organic Carbon (C)	mg/L	-	-	11	0.50	3801537	3.5	0.50	3825851
Total Phosphorus	mg/L	-	-	0.81	0.10	3810800	0.028	0.020	3823358
Total Suspended Solids	mg/L	-	-	1100	20	3806746	7.9	2.0	3817326
Sulphide	mg/L	-	0.05	<0.020	0.020	3804000	<0.020	0.020	3816944
Bromide (Br-)	mg/L	-	-	<1.0	1.0	3806128	<1.0	1.0	3817015

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
Criteria A,AO: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

MERCURY BY COLD VAPOUR AA (WATER)

Maxxam ID			YE4528	YE4529	YE4530	YE4531		
Sampling Date			2014/10/24 11:30	2014/10/24 13:20	2014/10/24 15:00	2014/10/25 11:45		
COC Number			B 128761	B 128761	B 128761	B 128761		
	Units	**MAC**	**MW14-01A**	**MW14-02A**	**MW14-03A**	**PGS-93B**	**RDL**	**QC Batch**
Metals								
Total Mercury (Hg)	ug/L	**1**	<0.013	<0.013	0.073	<0.013	0.013	3806358

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
MAC: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

Maxxam ID			YE4532		YI3672		
Sampling Date			2014/10/26 15:10		2014/11/04 11:15		
COC Number			B 128761		B 128762		
	Units	**MAC**	**PGS-124**	**QC Batch**	**MW14-04A**	**RDL**	**QC Batch**
Metals							
Total Mercury (Hg)	ug/L	**1**	0.033	3806358	<0.013	0.013	3817872

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch
MAC: Guideline - Summary of Guidelines for Canadian Drinking Water Quality (SGCDWQ), Health Canada, Oct. 2014.

A= Maximum Acceptable Concentration (MAC) - established for substances that are known or suspected to cause adverse effects on health.

AO= Aesthetic Objectives (AO) - apply to characteristics of drinking water that can affect its acceptance by consumers or interfere with practices for supplying good quality water.

Note 1 Turbidity guideline value of 0.3 NTU based on conventional treatment system. For slow sand or diatomaceous earth filtration 1.0 NTU and for membrane filtration 0.1 NTU.
Note 2 Aluminium guideline value of 0.1 mg/L is for treatment plants using aluminium-based coagulants, 0.2mg/L applies to other types of treatment systems.

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

Maxxam ID YE4528
Sample ID MW14-01A
Matrix Water

Collected 2014/10/24
Shipped
Received 2014/10/28

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3801228	N/A	2014/11/05	Automated Statchk
Alkalinity	AC	3803507	N/A	2014/10/30	Jessica Romo
Anions	IC	3806128	N/A	2014/11/05	Fari Dehdezi
Chloride	AC	3803513	N/A	2014/11/03	Mary Clancey
Colour	AC	3803517	N/A	2014/10/30	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3813442	N/A	2014/11/06	Megan Cyr
Conductance - water	AT	3810230	N/A	2014/11/04	Kerstin Surgenor
Fluoride	ISE	3806847	N/A	2014/10/31	Tammy Peters
Hardness (calculated as CaCO3)		3801229	N/A	2014/10/30	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3806358	2014/10/31	2014/10/31	Adam Logan
Metals Water Total MS	CICP/MS	3802699	2014/10/29	2014/10/30	Daren Leblanc
Ion Balance (% Difference)	CALC	3801230	N/A	2014/11/05	Automated Statchk
Anion and Cation Sum	CALC	3801231	N/A	2014/11/05	Automated Statchk
Nitrogen Ammonia - water	AC	3804761	N/A	2014/11/04	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3803519	N/A	2014/10/31	Jessica Romo
Nitrogen - Nitrite	AC	3803520	N/A	2014/10/31	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3801232	N/A	2014/10/31	Automated Statchk
pH	PHEL	3810222	N/A	2014/11/04	Kerstin Surgenor
Phosphorus - ortho	AC	3803518	N/A	2014/10/31	Jessica Romo
Sat. pH and Langelier Index (@ 20C)	CALC	3801235	N/A	2014/11/05	Mike MacGillivray
Sat. pH and Langelier Index (@ 4C)	CALC	3801236	N/A	2014/11/05	Mike MacGillivray
Reactive Silica	AC	3803516	N/A	2014/10/30	Jessica Romo
Sulphate	AC	3803514	N/A	2014/11/03	Jessica Romo
Sulphide	ISE/S	3804000	N/A	2014/10/29	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3811569	N/A	2014/11/06	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3801237	N/A	2014/11/04	Automated Statchk
Organic carbon - Total (TOC)	TECH	3813443	N/A	2014/11/06	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3810800	2014/11/04	2014/11/05	Viorica Rotaru
Total Suspended Solids	SLDS	3806746	N/A	2014/11/03	Leanne Lucas
Turbidity	TURB	3810731	N/A	2014/11/04	Kerstin Surgenor

Maxxam ID YE4528 Dup
Sample ID MW14-01A
Matrix Water

Collected 2014/10/24
Shipped
Received 2014/10/28

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Alkalinity	AC	3803507	N/A	2014/10/30	Jessica Romo
Chloride	AC	3803513	N/A	2014/11/03	Mary Clancey
Colour	AC	3803517	N/A	2014/10/30	Mary Clancey
Nitrogen - Nitrate + Nitrite	AC	3803519	N/A	2014/10/31	Jessica Romo
Nitrogen - Nitrite	AC	3803520	N/A	2014/10/31	Mary Clancey
Phosphorus - ortho	AC	3803518	N/A	2014/10/31	Jessica Romo
Reactive Silica	AC	3803516	N/A	2014/10/30	Jessica Romo
Sulphate	AC	3803514	N/A	2014/11/03	Jessica Romo

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

Maxxam ID YE4529
Sample ID MW14-02A
Matrix Water

Collected 2014/10/24
Shipped
Received 2014/10/28

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3801228	N/A	2014/11/05	Automated Statchk
Alkalinity	AC	3803507	N/A	2014/10/30	Jessica Romo
Anions	IC	3806128	N/A	2014/11/05	Fari Dehdezi
Chloride	AC	3803513	N/A	2014/11/03	Mary Clancey
Colour	AC	3803517	N/A	2014/10/30	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3813442	N/A	2014/11/06	Megan Cyr
Conductance - water	AT	3810230	N/A	2014/11/04	Kerstin Surgenor
Fluoride	ISE	3806847	N/A	2014/10/31	Tammy Peters
Hardness (calculated as CaCO3)		3801229	N/A	2014/10/30	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3806358	2014/10/31	2014/10/31	Adam Logan
Metals Water Total MS	CICP/MS	3802699	2014/10/29	2014/10/30	Daren Leblanc
Ion Balance (% Difference)	CALC	3801230	N/A	2014/11/05	Automated Statchk
Anion and Cation Sum	CALC	3801231	N/A	2014/11/05	Automated Statchk
Nitrogen Ammonia - water	AC	3804761	N/A	2014/11/04	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3803519	N/A	2014/10/31	Jessica Romo
Nitrogen - Nitrite	AC	3803520	N/A	2014/10/31	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3801232	N/A	2014/10/31	Automated Statchk
pH	PHEL	3810222	N/A	2014/11/04	Kerstin Surgenor
Phosphorus - ortho	AC	3803518	N/A	2014/10/31	Jessica Romo
Sat. pH and Langelier Index (@ 20C)	CALC	3801235	N/A	2014/11/05	Mike MacGillivray
Sat. pH and Langelier Index (@ 4C)	CALC	3801236	N/A	2014/11/05	Mike MacGillivray
Reactive Silica	AC	3803516	N/A	2014/10/30	Jessica Romo
Sulphate	AC	3803514	N/A	2014/11/03	Jessica Romo
Sulphide	ISE/S	3804000	N/A	2014/10/29	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3811569	N/A	2014/11/06	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3801237	N/A	2014/11/04	Automated Statchk
Organic carbon - Total (TOC)	TECH	3813443	N/A	2014/11/06	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3810800	2014/11/04	2014/11/05	Viorica Rotaru
Total Suspended Solids	SLDS	3806746	N/A	2014/11/03	Leanne Lucas
Turbidity	TURB	3810731	N/A	2014/11/04	Kerstin Surgenor

Maxxam ID YE4530
Sample ID MW14-03A
Matrix Water

Collected 2014/10/24
Shipped
Received 2014/10/28

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3801228	N/A	2014/10/30	Automated Statchk
Alkalinity	AC	3803507	N/A	2014/10/30	Jessica Romo
Anions	IC	3806128	N/A	2014/11/05	Fari Dehdezi
Chloride	AC	3803513	N/A	2014/11/03	Mary Clancey
Colour	AC	3803517	N/A	2014/10/30	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3801537	N/A	2014/10/28	Megan Cyr
Conductance - water	AT	3802766	N/A	2014/10/29	Kerstin Surgenor
Fluoride	ISE	3806847	N/A	2014/10/31	Tammy Peters
Hardness (calculated as CaCO3)		3801229	N/A	2014/10/30	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3806358	2014/10/31	2014/10/31	Adam Logan
Metals Water Total MS	CICP/MS	3802699	2014/10/29	2014/10/30	Daren Leblanc
Ion Balance (% Difference)	CALC	3801230	N/A	2014/11/04	Automated Statchk
Anion and Cation Sum	CALC	3801231	N/A	2014/11/04	Automated Statchk
Nitrogen Ammonia - water	AC	3804761	N/A	2014/11/04	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3803519	N/A	2014/10/31	Jessica Romo
Nitrogen - Nitrite	AC	3803520	N/A	2014/10/31	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3801232	N/A	2014/10/31	Automated Statchk

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

pH	PHEL	3802765	N/A	2014/10/29	Kerstin Surgenor
Phosphorus - ortho	AC	3803518	N/A	2014/10/31	Jessica Romo
Sat. pH and Langelier Index (@ 20C)	CALC	3801235	N/A	2014/11/04	Mike MacGillivray
Sat. pH and Langelier Index (@ 4C)	CALC	3801236	N/A	2014/11/04	Mike MacGillivray
Reactive Silica	AC	3803516	N/A	2014/10/30	Jessica Romo
Sulphate	AC	3803514	N/A	2014/11/03	Jessica Romo
Sulphide	ISE/S	3804000	N/A	2014/10/29	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3811569	N/A	2014/11/06	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3801237	N/A	2014/11/04	Automated Statchk
Organic carbon - Total (TOC)	TECH	3801325	N/A	2014/10/28	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3810800	2014/11/04	2014/11/05	Viorica Rotaru
Total Suspended Solids	SLDS	3806746	N/A	2014/11/03	Leanne Lucas
Turbidity	TURB	3810731	N/A	2014/11/04	Kerstin Surgenor

Maxxam ID YE4530 Dup
Sample ID MW14-03A
Matrix Water

Collected 2014/10/24
Shipped
Received 2014/10/28

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Conductance - water	AT	3802766	N/A	2014/10/29	Kerstin Surgenor
pH	PHEL	3802765	N/A	2014/10/29	Kerstin Surgenor

Maxxam ID YE4531
Sample ID PGS-93B
Matrix Water

Collected 2014/10/25
Shipped
Received 2014/10/28

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3801228	N/A	2014/11/05	Automated Statchk
Alkalinity	AC	3803507	N/A	2014/10/30	Jessica Romo
Anions	IC	3806128	N/A	2014/11/05	Fari Dehdezi
Chloride	AC	3803513	N/A	2014/11/03	Mary Clancey
Colour	AC	3803517	N/A	2014/10/30	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3801537	N/A	2014/10/28	Megan Cyr
Conductance - water	AT	3810230	N/A	2014/11/04	Kerstin Surgenor
Fluoride	ISE	3806847	N/A	2014/10/31	Tammy Peters
Hardness (calculated as CaCO3)		3801229	N/A	2014/10/30	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3806358	2014/10/31	2014/10/31	Adam Logan
Metals Water Total MS	CICP/MS	3802699	2014/10/29	2014/10/30	Daren Leblanc
Ion Balance (% Difference)	CALC	3801230	N/A	2014/11/05	Automated Statchk
Anion and Cation Sum	CALC	3801231	N/A	2014/11/05	Automated Statchk
Nitrogen Ammonia - water	AC	3804761	N/A	2014/11/04	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3803519	N/A	2014/10/31	Jessica Romo
Nitrogen - Nitrite	AC	3803520	N/A	2014/10/31	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3801232	N/A	2014/10/31	Automated Statchk
pH	PHEL	3810222	N/A	2014/11/04	Kerstin Surgenor
Phosphorus - ortho	AC	3803518	N/A	2014/10/31	Jessica Romo
Sat. pH and Langelier Index (@ 20C)	CALC	3801235	N/A	2014/11/05	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3801236	N/A	2014/11/05	Automated Statchk
Reactive Silica	AC	3803516	N/A	2014/10/30	Jessica Romo
Sulphate	AC	3803514	N/A	2014/11/03	Jessica Romo
Sulphide	ISE/S	3804000	N/A	2014/10/29	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3811569	N/A	2014/11/06	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3801237	N/A	2014/11/04	Automated Statchk
Organic carbon - Total (TOC)	TECH	3801325	N/A	2014/10/28	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3810800	2014/11/04	2014/11/05	Viorica Rotaru
Total Suspended Solids	SLDS	3806746	N/A	2014/11/03	Leanne Lucas
Turbidity	TURB	3810731	N/A	2014/11/04	Kerstin Surgenor

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

Maxxam ID YE4531 Dup
Sample ID PGS-93B
Matrix Water

Collected 2014/10/25
Shipped
Received 2014/10/28

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Anions	IC	3806128	N/A	2014/11/05	Fari Dehdezi

Maxxam ID YE4532
Sample ID PGS-124
Matrix Water

Collected 2014/10/26
Shipped
Received 2014/10/28

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3801228	N/A	2014/11/05	Automated Statchk
Alkalinity	AC	3803507	N/A	2014/10/30	Jessica Romo
Anions	IC	3806128	N/A	2014/11/05	Fari Dehdezi
Chloride	AC	3803513	N/A	2014/11/03	Mary Clancey
Colour	AC	3803517	N/A	2014/10/30	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3801537	N/A	2014/10/28	Megan Cyr
Conductance - water	AT	3810230	N/A	2014/11/04	Kerstin Surgenor
Fluoride	ISE	3806847	N/A	2014/10/31	Tammy Peters
Hardness (calculated as CaCO3)		3801229	N/A	2014/10/30	Automated Statchk
Mercury - Total (CVAA,LL)	CVAA	3806358	2014/10/31	2014/10/31	Adam Logan
Metals Water Total MS	CICP/MS	3802699	2014/10/29	2014/10/30	Daren Leblanc
Ion Balance (% Difference)	CALC	3801230	N/A	2014/11/05	Automated Statchk
Anion and Cation Sum	CALC	3801231	N/A	2014/11/05	Automated Statchk
Nitrogen Ammonia - water	AC	3809291	N/A	2014/11/04	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3803519	N/A	2014/10/31	Jessica Romo
Nitrogen - Nitrite	AC	3803520	N/A	2014/10/31	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3801232	N/A	2014/10/31	Automated Statchk
pH	PHEL	3810222	N/A	2014/11/04	Kerstin Surgenor
Phosphorus - ortho	AC	3803518	N/A	2014/10/31	Jessica Romo
Sat. pH and Langelier Index (@ 20C)	CALC	3801235	N/A	2014/11/05	Mike MacGillivray
Sat. pH and Langelier Index (@ 4C)	CALC	3801236	N/A	2014/11/05	Mike MacGillivray
Reactive Silica	AC	3803516	N/A	2014/10/30	Jessica Romo
Sulphate	AC	3803514	N/A	2014/11/03	Jessica Romo
Sulphide	ISE/S	3804000	N/A	2014/10/29	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3811569	N/A	2014/11/06	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3801237	N/A	2014/11/05	Automated Statchk
Organic carbon - Total (TOC)	TECH	3801325	N/A	2014/10/28	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3810800	2014/11/04	2014/11/05	Viorica Rotaru
Total Suspended Solids	SLDS	3806746	N/A	2014/11/03	Leanne Lucas
Turbidity	TURB	3810731	N/A	2014/11/04	Kerstin Surgenor

Maxxam ID YI3672
Sample ID MW14-04A
Matrix Water

Collected 2014/11/04
Shipped
Received 2014/10/28

Test Description	Instrumentation	Batch	Extracted	Analyzed	Analyst
Carbonate, Bicarbonate and Hydroxide	CALC	3813784	N/A	2014/11/17	Automated Statchk
Alkalinity	AC	3823280	N/A	2014/11/19	Arlene Rossiter
Anions	IC	3817015	N/A	2014/11/10	Fari Dehdezi
Chloride	AC	3823281	N/A	2014/11/18	Mary Clancey
Colour	AC	3823284	N/A	2014/11/17	Mary Clancey
Organic carbon - Diss (DOC)	TECH	3825851	N/A	2014/11/17	Megan Cyr
Conductance - water	AT	3823429	N/A	2014/11/14	Kerstin Surgenor
Fluoride	ISE	3815638	N/A	2014/11/07	Tammy Peters
Hardness (calculated as CaCO3)		3813785	N/A	2014/11/10	Automated Statchk

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

Test Summary

Mercury - Total (CVAA,LL)	CVAA	3817872	2014/11/12	2014/11/13	Adam Logan
Metals Water Total MS	CICP/MS	3815304	2014/11/07	2014/11/08	Daren Leblanc
Ion Balance (% Difference)	CALC	3813786	N/A	2014/11/19	Automated Statchk
Anion and Cation Sum	CALC	3813787	N/A	2014/11/18	Automated Statchk
Nitrogen Ammonia - water	AC	3823467	N/A	2014/11/17	Arlene Rossiter
Nitrogen - Nitrate + Nitrite	AC	3823286	N/A	2014/11/18	Arlene Rossiter
Nitrogen - Nitrite	AC	3823287	N/A	2014/11/17	Mary Clancey
Nitrogen - Nitrate (as N)	CALC	3813788	N/A	2014/11/18	Automated Statchk
pH - On-Site	PHEL	ONSITE	N/A	2014/11/06	Tania Sarson
pH	PHEL	3823423	N/A	2014/11/14	Kerstin Surgenor
Phosphorus - ortho	AC	3823285	N/A	2014/11/17	Mary Clancey
Sat. pH and Langelier Index (@ 20C)	CALC	3813789	N/A	2014/11/19	Automated Statchk
Sat. pH and Langelier Index (@ 4C)	CALC	3813790	N/A	2014/11/19	Automated Statchk
Reactive Silica	AC	3823283	N/A	2014/11/17	Arlene Rossiter
Sulphate	AC	3823282	N/A	2014/11/18	Mary Clancey
Sulphide	ISE/S	3816944	N/A	2014/11/09	Neil Dassanayake
Total Dissolved Solids (Filt. Residue)	BAL	3823470	N/A	2014/11/17	Angela Young
Total Dissolved Solids (TDS calc)	CALC	3813791	N/A	2014/11/19	Automated Statchk
Organic carbon - Total (TOC)	TECH	3821731	N/A	2014/11/13	Megan Cyr
Total Phosphorus (Colourimetric)	LACH/P	3823358	2014/11/14	2014/11/14	Viorica Rotaru
Total Suspended Solids	SLDS	3817326	N/A	2014/11/12	Angela Young
Turbidity	TURB	3825931	N/A	2014/11/17	Kerstin Surgenor

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Maxxam Job #: B4K1255
Report Date: 2014/11/28

Golder Associates Ltd
Client Project #: 1407707/4
Site Location: CFI/ST.LAWRENCE,NL
Sampler Initials: AI

GENERAL COMMENTS

Re-issued report to include the CWQG as requested by client. HM Nov 20/14

Re-issued report to include only the below samples as per client request: HM Nov 28/14

PGS-93B, PGS-124, MW14-01, MW-02, MW14-03, and MW14-04A.

Sample YE4528-01: DOCCOLB-W DIS Organic Carbon > TOCCOLB-W TOT: Results confirmed through re-analysis.

Sample YE4529-01: DOCCOLB-W DIS Organic Carbon > TOCCOLB-W TOT: Results confirmed through re-analysis.

Sample YE4530-01: Poor RCAp Ion Balance due to sample matrix. Excess cations due to presence of turbidity.

Sample YE4532-01: Poor RCAp Ion Balance due to sample matrix. Excess cations due to presence of turbidity.

Results relate only to the items tested.

Maxxam
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Success Through Science®

Golder Associates Ltd
Attention: Phyllis McCrindle
Client Project #: 1407707/4
P.O. #:
Site Location: CFI/ST.LAWRENCE,NL

Quality Assurance Report

Maxxam Job Number: DB4K1255

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3801325 MCY	Matrix Spike	Total Organic Carbon (C)	2014/10/28		101	%	80 - 120
	Spiked Blank	Total Organic Carbon (C)	2014/10/28		103	%	80 - 120
	Method Blank	Total Organic Carbon (C)	2014/10/28	<0.50		mg/L	
	RPD	Total Organic Carbon (C)	2014/10/28	NC		%	20
3801537 MCY	Matrix Spike						
	[YE4533-03]	Dissolved Organic Carbon (C)	2014/10/28		96	%	80 - 120
	Spiked Blank	Dissolved Organic Carbon (C)	2014/10/28		98	%	80 - 120
	Method Blank	Dissolved Organic Carbon (C)	2014/10/28	<0.50		mg/L	
3802699 DLB	Matrix Spike	Total Aluminum (Al)	2014/10/30		103	%	80 - 120
		Total Antimony (Sb)	2014/10/30		NC	%	80 - 120
		Total Arsenic (As)	2014/10/30		102	%	80 - 120
		Total Barium (Ba)	2014/10/30		99	%	80 - 120
		Total Beryllium (Be)	2014/10/30		99	%	80 - 120
		Total Bismuth (Bi)	2014/10/30		99	%	80 - 120
		Total Boron (B)	2014/10/30		95	%	80 - 120
		Total Cadmium (Cd)	2014/10/30		103	%	80 - 120
		Total Calcium (Ca)	2014/10/30		NC	%	80 - 120
		Total Chromium (Cr)	2014/10/30		100	%	80 - 120
		Total Cobalt (Co)	2014/10/30		100	%	80 - 120
		Total Copper (Cu)	2014/10/30		100	%	80 - 120
		Total Iron (Fe)	2014/10/30		104	%	80 - 120
		Total Lead (Pb)	2014/10/30		100	%	80 - 120
		Total Lithium (Li)	2014/10/30		104	%	80 - 120
		Total Magnesium (Mg)	2014/10/30		104	%	80 - 120
		Total Manganese (Mn)	2014/10/30		NC	%	80 - 120
		Total Molybdenum (Mo)	2014/10/30		NC	%	80 - 120
		Total Nickel (Ni)	2014/10/30		101	%	80 - 120
		Total Phosphorus (P)	2014/10/30		107	%	80 - 120
		Total Potassium (K)	2014/10/30		NC	%	80 - 120
		Total Selenium (Se)	2014/10/30		NC	%	80 - 120
		Total Silicon (Si)	2014/10/30		104	%	80 - 120
		Total Silver (Ag)	2014/10/30		101	%	80 - 120
		Total Sodium (Na)	2014/10/30		NC	%	80 - 120
		Total Strontium (Sr)	2014/10/30		NC	%	80 - 120
		Total Sulphur (S)	2014/10/30		NC	%	80 - 120
		Total Tellurium (Te)	2014/10/30		95	%	80 - 120
		Total Thallium (Tl)	2014/10/30		100	%	80 - 120
		Total Tin (Sn)	2014/10/30		102	%	80 - 120
		Total Titanium (Ti)	2014/10/30		100	%	80 - 120
		Total Uranium (U)	2014/10/30		108	%	80 - 120
		Total Vanadium (V)	2014/10/30		103	%	80 - 120
		Total Zirconium (Zr)	2014/10/30		109	%	80 - 120
		Total Zinc (Zn)	2014/10/30		100	%	80 - 120
	Spiked Blank	Total Aluminum (Al)	2014/10/30		106	%	80 - 120
		Total Antimony (Sb)	2014/10/30		100	%	80 - 120
		Total Arsenic (As)	2014/10/30		101	%	80 - 120
		Total Barium (Ba)	2014/10/30		95	%	80 - 120
		Total Beryllium (Be)	2014/10/30		97	%	80 - 120
		Total Bismuth (Bi)	2014/10/30		99	%	80 - 120
		Total Boron (B)	2014/10/30		92	%	80 - 120
		Total Cadmium (Cd)	2014/10/30		100	%	80 - 120
		Total Calcium (Ca)	2014/10/30		100	%	80 - 120
		Total Chromium (Cr)	2014/10/30		101	%	80 - 120
		Total Cobalt (Co)	2014/10/30		102	%	80 - 120
		Total Copper (Cu)	2014/10/30		104	%	80 - 120

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Quality Assurance Report (Continued)

Maxxam Job Number: DB4K1255

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3802699 DLB	Spiked Blank	Total Iron (Fe)	2014/10/30		108	%	80 - 120
		Total Lead (Pb)	2014/10/30		98	%	80 - 120
		Total Lithium (Li)	2014/10/30		103	%	80 - 120
		Total Magnesium (Mg)	2014/10/30		108	%	80 - 120
		Total Manganese (Mn)	2014/10/30		104	%	80 - 120
		Total Molybdenum (Mo)	2014/10/30		104	%	80 - 120
		Total Nickel (Ni)	2014/10/30		104	%	80 - 120
		Total Phosphorus (P)	2014/10/30		105	%	80 - 120
		Total Potassium (K)	2014/10/30		97	%	80 - 120
		Total Selenium (Se)	2014/10/30		101	%	80 - 120
		Total Silicon (Si)	2014/10/30		96	%	80 - 120
		Total Silver (Ag)	2014/10/30		102	%	80 - 120
		Total Sodium (Na)	2014/10/30		107	%	80 - 120
		Total Strontium (Sr)	2014/10/30		97	%	80 - 120
		Total Sulphur (S)	2014/10/30		103	%	80 - 120
		Total Tellurium (Te)	2014/10/30		91	%	80 - 120
		Total Thallium (Tl)	2014/10/30		99	%	80 - 120
		Total Tin (Sn)	2014/10/30		98	%	80 - 120
		Total Titanium (Ti)	2014/10/30		102	%	80 - 120
		Total Uranium (U)	2014/10/30		104	%	80 - 120
		Total Vanadium (V)	2014/10/30		102	%	80 - 120
		Total Zirconium (Zr)	2014/10/30		105	%	80 - 120
		Total Zinc (Zn)	2014/10/30		106	%	80 - 120
	Method Blank	Total Aluminum (Al)	2014/10/30	<5.0		ug/L	
		Total Antimony (Sb)	2014/10/30	<1.0		ug/L	
		Total Arsenic (As)	2014/10/30	<1.0		ug/L	
		Total Barium (Ba)	2014/10/30	<1.0		ug/L	
		Total Beryllium (Be)	2014/10/30	<1.0		ug/L	
		Total Bismuth (Bi)	2014/10/30	<2.0		ug/L	
		Total Boron (B)	2014/10/30	<50		ug/L	
		Total Cadmium (Cd)	2014/10/30	<0.010		ug/L	
		Total Calcium (Ca)	2014/10/30	<100		ug/L	
		Total Chromium (Cr)	2014/10/30	<1.0		ug/L	
		Total Cobalt (Co)	2014/10/30	<0.40		ug/L	
		Total Copper (Cu)	2014/10/30	<2.0		ug/L	
		Total Iron (Fe)	2014/10/30	<50		ug/L	
		Total Lead (Pb)	2014/10/30	<0.50		ug/L	
		Total Lithium (Li)	2014/10/30	<2.0		ug/L	
		Total Magnesium (Mg)	2014/10/30	<100		ug/L	
		Total Manganese (Mn)	2014/10/30	<2.0		ug/L	
		Total Molybdenum (Mo)	2014/10/30	<2.0		ug/L	
		Total Nickel (Ni)	2014/10/30	<2.0		ug/L	
		Total Phosphorus (P)	2014/10/30	<100		ug/L	
		Total Potassium (K)	2014/10/30	<100		ug/L	
		Total Selenium (Se)	2014/10/30	<1.0		ug/L	
		Total Silicon (Si)	2014/10/30	<500		ug/L	
		Total Silver (Ag)	2014/10/30	<0.10		ug/L	
		Total Sodium (Na)	2014/10/30	<100		ug/L	
		Total Strontium (Sr)	2014/10/30	<2.0		ug/L	
		Total Sulphur (S)	2014/10/30	<5000		ug/L	
		Total Tellurium (Te)	2014/10/30	<2.0		ug/L	
		Total Thallium (Tl)	2014/10/30	<0.10		ug/L	
		Total Tin (Sn)	2014/10/30	<2.0		ug/L	
		Total Titanium (Ti)	2014/10/30	<2.0		ug/L	
		Total Uranium (U)	2014/10/30	<0.10		ug/L	

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Quality Assurance Report (Continued)

Maxxam Job Number: DB4K1255

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3802699 DLB	Method Blank	Total Vanadium (V)	2014/10/30	<2.0		ug/L	
		Total Zirconium (Zr)	2014/10/30	<2.0		ug/L	
		Total Zinc (Zn)	2014/10/30	7.0, RDL=5.0		ug/L	
	RPD	Total Arsenic (As)	2014/10/30	NC		%	20
		Total Copper (Cu)	2014/10/30	1.2		%	20
		Total Lead (Pb)	2014/10/30	NC		%	20
		Total Nickel (Ni)	2014/10/30	2.1		%	20
		Total Zinc (Zn)	2014/10/30	0.4		%	20
3802765 KSR	QC Standard	pH	2014/10/29		101	%	97 - 103
	RPD [YE4530-03]	pH	2014/10/29	0.08		%	N/A
3802766 KSR	Spiked Blank	Conductivity	2014/10/29		99	%	80 - 120
	Method Blank	Conductivity	2014/10/29	<1.0		uS/cm	
	RPD [YE4530-03]	Conductivity	2014/10/29	0.1		%	25
3803507 JRM	Matrix Spike [YE4528-03]	Total Alkalinity (Total as CaCO3)	2014/10/30		NC	%	80 - 120
	Spiked Blank	Total Alkalinity (Total as CaCO3)	2014/10/30		103	%	80 - 120
	Method Blank	Total Alkalinity (Total as CaCO3)	2014/10/30	<5.0		mg/L	
	RPD [YE4528-03]	Total Alkalinity (Total as CaCO3)	2014/10/30	0.01		%	25
3803513 MCN	Matrix Spike [YE4528-03]	Dissolved Chloride (Cl)	2014/11/03		NC	%	80 - 120
	QC Standard	Dissolved Chloride (Cl)	2014/11/03		108	%	80 - 120
	Spiked Blank	Dissolved Chloride (Cl)	2014/11/03		108	%	80 - 120
	Method Blank	Dissolved Chloride (Cl)	2014/11/03	<1.0		mg/L	
	RPD [YE4528-03]	Dissolved Chloride (Cl)	2014/11/03	6.2		%	25
3803514 JRM	Matrix Spike [YE4528-03]	Dissolved Sulphate (SO4)	2014/11/03		102	%	80 - 120
	Spiked Blank	Dissolved Sulphate (SO4)	2014/11/03		100	%	80 - 120
	Method Blank	Dissolved Sulphate (SO4)	2014/11/03	<2.0		mg/L	
	RPD [YE4528-03]	Dissolved Sulphate (SO4)	2014/11/03	NC		%	25
3803516 JRM	Matrix Spike [YE4528-03]	Reactive Silica (SiO2)	2014/10/30		NC	%	80 - 120
	Spiked Blank	Reactive Silica (SiO2)	2014/10/31		101	%	80 - 120
	Method Blank	Reactive Silica (SiO2)	2014/10/31	<0.50		mg/L	
	RPD [YE4528-03]	Reactive Silica (SiO2)	2014/10/30	0.5		%	25
3803517 MCN	Spiked Blank	Colour	2014/10/30		97	%	80 - 120
	Method Blank	Colour	2014/10/30	<5.0		TCU	
	RPD [YE4528-03]	Colour	2014/10/30	NC		%	25
3803518 JRM	Matrix Spike [YE4528-03]	Orthophosphate (P)	2014/10/31		95	%	80 - 120
	Spiked Blank	Orthophosphate (P)	2014/10/31		97	%	80 - 120
	Method Blank	Orthophosphate (P)	2014/10/31	<0.010		mg/L	
	RPD [YE4528-03]	Orthophosphate (P)	2014/10/31	NC		%	25
3803519 JRM	Matrix Spike [YE4528-03]	Nitrate + Nitrite	2014/10/31		98	%	80 - 120
	Spiked Blank	Nitrate + Nitrite	2014/10/31		100	%	80 - 120
	Method Blank	Nitrate + Nitrite	2014/10/31	<0.050		mg/L	
	RPD [YE4528-03]	Nitrate + Nitrite	2014/10/31	NC		%	25
3803520 MCN	Matrix Spike [YE4528-03]	Nitrite (N)	2014/10/31		105	%	80 - 120
	Spiked Blank	Nitrite (N)	2014/10/31		107	%	80 - 120
	Method Blank	Nitrite (N)	2014/10/31	<0.010		mg/L	
	RPD [YE4528-03]	Nitrite (N)	2014/10/31	NC		%	25
3804000 NYS	Matrix Spike	Sulphide	2014/10/29		102	%	80 - 120
	Spiked Blank	Sulphide	2014/10/29		95	%	80 - 120
	Method Blank	Sulphide	2014/10/29	<0.020		mg/L	

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Quality Assurance Report (Continued)

Maxxam Job Number: DB4K1255

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3804000	NYS	RPD	Sulphide	2014/10/29	NC		%	20
3804761	ARS	Matrix Spike	Nitrogen (Ammonia Nitrogen)	2014/11/04		NC	%	80 - 120
		Spiked Blank	Nitrogen (Ammonia Nitrogen)	2014/11/04		103	%	80 - 120
		Method Blank	Nitrogen (Ammonia Nitrogen)	2014/11/04	<0.050		mg/L	
		RPD	Nitrogen (Ammonia Nitrogen)	2014/11/04	3.9		%	25
3806128	FD	Matrix Spike [YE4531-04]	Bromide (Br-)	2014/11/05		99	%	80 - 120
		Spiked Blank	Bromide (Br-)	2014/11/05		98	%	80 - 120
		Method Blank	Bromide (Br-)	2014/11/05	<1.0		mg/L	
		RPD [YE4531-04]	Bromide (Br-)	2014/11/05	NC		%	20
3806358	ALG	Matrix Spike	Total Mercury (Hg)	2014/10/31		89	%	80 - 120
		Spiked Blank	Total Mercury (Hg)	2014/10/31		96	%	80 - 120
		Method Blank	Total Mercury (Hg)	2014/10/31	<0.013		ug/L	
		RPD	Total Mercury (Hg)	2014/10/31	NC		%	20
3806746	LLC	QC Standard	Total Suspended Solids	2014/11/03		96	%	80 - 120
		Method Blank	Total Suspended Solids	2014/11/03	<1.0		mg/L	
		RPD	Total Suspended Solids	2014/11/03	NC		%	25
3806847	TPE	Matrix Spike	Dissolved Fluoride (F-)	2014/10/31		106	%	80 - 120
		Spiked Blank	Dissolved Fluoride (F-)	2014/10/31		104	%	80 - 120
		Method Blank	Dissolved Fluoride (F-)	2014/10/31	<0.10		mg/L	
		RPD	Dissolved Fluoride (F-)	2014/10/31	3.1		%	25
3809291	ARS	Matrix Spike	Nitrogen (Ammonia Nitrogen)	2014/11/04		NC	%	80 - 120
		Spiked Blank	Nitrogen (Ammonia Nitrogen)	2014/11/04		103	%	80 - 120
		Method Blank	Nitrogen (Ammonia Nitrogen)	2014/11/04	<0.050		mg/L	
		RPD	Nitrogen (Ammonia Nitrogen)	2014/11/04	10		%	25
3810222	KSR	QC Standard	pH	2014/11/04		100	%	97 - 103
		RPD	pH	2014/11/04	0.3		%	N/A
3810230	KSR	Spiked Blank	Conductivity	2014/11/04		100	%	80 - 120
		Method Blank	Conductivity	2014/11/04	1.2, RDL=1.0		uS/cm	
		RPD	Conductivity	2014/11/04	0.1		%	25
3810731	KSR	QC Standard	Turbidity	2014/11/04		101	%	80 - 120
		Method Blank	Turbidity	2014/11/04	<0.10		NTU	
		RPD	Turbidity	2014/11/04	2.6		%	25
3810800	VRO	Matrix Spike	Total Phosphorus	2014/11/05		100	%	80 - 120
		QC Standard	Total Phosphorus	2014/11/05		102	%	80 - 120
		Spiked Blank	Total Phosphorus	2014/11/05		103	%	80 - 120
		Method Blank	Total Phosphorus	2014/11/05	<0.020		mg/L	
		RPD	Total Phosphorus	2014/11/05	0.2		%	20
3811569	AYN	QC Standard	Total Dissolved Solids	2014/11/06		97	%	80 - 120
		Method Blank	Total Dissolved Solids	2014/11/06	<10		mg/L	
		RPD	Total Dissolved Solids	2014/11/06	2.8		%	25
3813442	MCY	Matrix Spike	Dissolved Organic Carbon (C)	2014/11/06		102	%	80 - 120
		Spiked Blank	Dissolved Organic Carbon (C)	2014/11/06		98	%	80 - 120
		Method Blank	Dissolved Organic Carbon (C)	2014/11/06	<0.50		mg/L	
		RPD	Dissolved Organic Carbon (C)	2014/11/06	1.2		%	20
3813443	MCY	Matrix Spike	Total Organic Carbon (C)	2014/11/06		107	%	80 - 120
		Spiked Blank	Total Organic Carbon (C)	2014/11/06		102	%	80 - 120
		Method Blank	Total Organic Carbon (C)	2014/11/06	<0.50		mg/L	
		RPD	Total Organic Carbon (C)	2014/11/06	4.7		%	20
3815304	DLB	Matrix Spike	Total Aluminum (Al)	2014/11/08		105	%	80 - 120
			Total Antimony (Sb)	2014/11/08		99	%	80 - 120
			Total Arsenic (As)	2014/11/08		101	%	80 - 120
			Total Barium (Ba)	2014/11/08		96	%	80 - 120
			Total Beryllium (Be)	2014/11/08		100	%	80 - 120
			Total Bismuth (Bi)	2014/11/08		100	%	80 - 120

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3815304 DLB	Matrix Spike	Total Boron (B)	2014/11/08		100	%	80 - 120
		Total Cadmium (Cd)	2014/11/08		97	%	80 - 120
		Total Calcium (Ca)	2014/11/08		99	%	80 - 120
		Total Chromium (Cr)	2014/11/08		98	%	80 - 120
		Total Cobalt (Co)	2014/11/08		98	%	80 - 120
		Total Copper (Cu)	2014/11/08		97	%	80 - 120
		Total Iron (Fe)	2014/11/08		105	%	80 - 120
		Total Lead (Pb)	2014/11/08		97	%	80 - 120
		Total Lithium (Li)	2014/11/08		103	%	80 - 120
		Total Magnesium (Mg)	2014/11/08		NC	%	80 - 120
		Total Manganese (Mn)	2014/11/08		103	%	80 - 120
		Total Molybdenum (Mo)	2014/11/08		102	%	80 - 120
		Total Nickel (Ni)	2014/11/08		101	%	80 - 120
		Total Phosphorus (P)	2014/11/08		108	%	80 - 120
		Total Potassium (K)	2014/11/08		107	%	80 - 120
		Total Selenium (Se)	2014/11/08		101	%	80 - 120
		Total Silicon (Si)	2014/11/08		NC	%	80 - 120
		Total Silver (Ag)	2014/11/08		100	%	80 - 120
		Total Sodium (Na)	2014/11/08		114	%	80 - 120
		Total Strontium (Sr)	2014/11/08		99	%	80 - 120
		Total Sulphur (S)	2014/11/08		109	%	80 - 120
		Total Tellurium (Te)	2014/11/08		93	%	80 - 120
		Total Thallium (Tl)	2014/11/08		100	%	80 - 120
		Total Tin (Sn)	2014/11/08		101	%	80 - 120
		Total Titanium (Ti)	2014/11/08		104	%	80 - 120
		Total Uranium (U)	2014/11/08		106	%	80 - 120
		Total Vanadium (V)	2014/11/08		100	%	80 - 120
		Total Zirconium (Zr)	2014/11/08		103	%	80 - 120
		Total Zinc (Zn)	2014/11/08		99	%	80 - 120
	Spiked Blank	Total Aluminum (Al)	2014/11/07		103	%	80 - 120
		Total Antimony (Sb)	2014/11/07		99	%	80 - 120
		Total Arsenic (As)	2014/11/07		100	%	80 - 120
		Total Barium (Ba)	2014/11/07		97	%	80 - 120
		Total Beryllium (Be)	2014/11/07		100	%	80 - 120
		Total Bismuth (Bi)	2014/11/07		100	%	80 - 120
		Total Boron (B)	2014/11/07		100	%	80 - 120
		Total Cadmium (Cd)	2014/11/07		97	%	80 - 120
		Total Calcium (Ca)	2014/11/07		97	%	80 - 120
		Total Chromium (Cr)	2014/11/07		98	%	80 - 120
		Total Cobalt (Co)	2014/11/07		99	%	80 - 120
		Total Copper (Cu)	2014/11/07		98	%	80 - 120
		Total Iron (Fe)	2014/11/07		103	%	80 - 120
		Total Lead (Pb)	2014/11/07		96	%	80 - 120
		Total Lithium (Li)	2014/11/07		102	%	80 - 120
		Total Magnesium (Mg)	2014/11/07		108	%	80 - 120
		Total Manganese (Mn)	2014/11/07		102	%	80 - 120
		Total Molybdenum (Mo)	2014/11/07		100	%	80 - 120
		Total Nickel (Ni)	2014/11/07		101	%	80 - 120
		Total Phosphorus (P)	2014/11/07		105	%	80 - 120
		Total Potassium (K)	2014/11/07		105	%	80 - 120
		Total Selenium (Se)	2014/11/07		100	%	80 - 120
		Total Silicon (Si)	2014/11/07		103	%	80 - 120
		Total Silver (Ag)	2014/11/07		99	%	80 - 120
		Total Sodium (Na)	2014/11/07		110	%	80 - 120
		Total Strontium (Sr)	2014/11/07		98	%	80 - 120

Golder Associates Ltd
Attention: Phyllis McCrindle
Client Project #: 1407707/4
P.O. #:
Site Location: CFI/ST.LAWRENCE,NL

Quality Assurance Report (Continued)

Maxxam Job Number: DB4K1255

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3815304 DLB	Spiked Blank	Total Sulphur (S)	2014/11/07		91	%	80 - 120
		Total Tellurium (Te)	2014/11/07		96	%	80 - 120
		Total Thallium (Tl)	2014/11/07		99	%	80 - 120
		Total Tin (Sn)	2014/11/07		99	%	80 - 120
		Total Titanium (Ti)	2014/11/07		105	%	80 - 120
		Total Uranium (U)	2014/11/07		105	%	80 - 120
		Total Vanadium (V)	2014/11/07		98	%	80 - 120
		Total Zirconium (Zr)	2014/11/07		103	%	80 - 120
		Total Zinc (Zn)	2014/11/07		97	%	80 - 120
	Method Blank	Total Aluminum (Al)	2014/11/07	<5.0		ug/L	
		Total Antimony (Sb)	2014/11/07	<1.0		ug/L	
		Total Arsenic (As)	2014/11/07	<1.0		ug/L	
		Total Barium (Ba)	2014/11/07	<1.0		ug/L	
		Total Beryllium (Be)	2014/11/07	<1.0		ug/L	
		Total Bismuth (Bi)	2014/11/07	<2.0		ug/L	
		Total Boron (B)	2014/11/07	<50		ug/L	
		Total Cadmium (Cd)	2014/11/07	<0.010		ug/L	
		Total Calcium (Ca)	2014/11/07	<100		ug/L	
		Total Chromium (Cr)	2014/11/07	<1.0		ug/L	
		Total Cobalt (Co)	2014/11/07	<0.40		ug/L	
		Total Copper (Cu)	2014/11/07	<2.0		ug/L	
		Total Iron (Fe)	2014/11/07	<50		ug/L	
		Total Lead (Pb)	2014/11/07	<0.50		ug/L	
		Total Lithium (Li)	2014/11/07	<2.0		ug/L	
		Total Magnesium (Mg)	2014/11/07	<100		ug/L	
		Total Manganese (Mn)	2014/11/07	<2.0		ug/L	
		Total Molybdenum (Mo)	2014/11/07	<2.0		ug/L	
		Total Nickel (Ni)	2014/11/07	<2.0		ug/L	
		Total Phosphorus (P)	2014/11/07	<100		ug/L	
		Total Potassium (K)	2014/11/07	<100		ug/L	
		Total Selenium (Se)	2014/11/07	<1.0		ug/L	
		Total Silicon (Si)	2014/11/07	<500		ug/L	
		Total Silver (Ag)	2014/11/07	<0.10		ug/L	
		Total Sodium (Na)	2014/11/07	<100		ug/L	
		Total Strontium (Sr)	2014/11/07	<2.0		ug/L	
		Total Sulphur (S)	2014/11/07	<5000		ug/L	
		Total Tellurium (Te)	2014/11/07	<2.0		ug/L	
		Total Thallium (Tl)	2014/11/07	<0.10		ug/L	
		Total Tin (Sn)	2014/11/07	<2.0		ug/L	
		Total Titanium (Ti)	2014/11/07	<2.0		ug/L	
		Total Uranium (U)	2014/11/07	<0.10		ug/L	
		Total Vanadium (V)	2014/11/07	<2.0		ug/L	
		Total Zirconium (Zr)	2014/11/07	<2.0		ug/L	
		Total Zinc (Zn)	2014/11/07	<5.0		ug/L	
	RPD	Total Arsenic (As)	2014/11/07	NC		%	20
		Total Copper (Cu)	2014/11/07	NC		%	20
		Total Lead (Pb)	2014/11/07	NC		%	20
		Total Manganese (Mn)	2014/11/07	1.4		%	20
		Total Nickel (Ni)	2014/11/07	NC		%	20
		Total Zinc (Zn)	2014/11/07	NC		%	20
3815638 TPE	Matrix Spike	Dissolved Fluoride (F-)	2014/11/07		101	%	80 - 120
	Spiked Blank	Dissolved Fluoride (F-)	2014/11/07		103	%	80 - 120
	Method Blank	Dissolved Fluoride (F-)	2014/11/07	<0.10		mg/L	
	RPD	Dissolved Fluoride (F-)	2014/11/07	NC		%	25
3816944 NYS	Matrix Spike	Sulphide	2014/11/09		86	%	80 - 120

Golder Associates Ltd
Attention: Phyllis McCrindle
Client Project #: 1407707/4
P.O. #:
Site Location: CFI/ST.LAWRENCE,NL

Quality Assurance Report (Continued)

Maxxam Job Number: DB4K1255

QA/QC Batch Num Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3816944 NYS	Spiked Blank	Sulphide	2014/11/09		89	%	80 - 120
	Method Blank	Sulphide	2014/11/09	<0.020		mg/L	
	RPD	Sulphide	2014/11/09	NC		%	20
3817015 FD	Matrix Spike	Bromide (Br-)	2014/11/10		104	%	80 - 120
	Spiked Blank	Bromide (Br-)	2014/11/10		100	%	80 - 120
	Method Blank	Bromide (Br-)	2014/11/10	<1.0		mg/L	
	RPD	Bromide (Br-)	2014/11/10	NC		%	20
3817326 AYN	QC Standard	Total Suspended Solids	2014/11/12		103	%	80 - 120
	Method Blank	Total Suspended Solids	2014/11/12	<1.0		mg/L	
	RPD	Total Suspended Solids	2014/11/12	13.9		%	25
3817872 ALG	Matrix Spike	Total Mercury (Hg)	2014/11/13		95	%	80 - 120
	Spiked Blank	Total Mercury (Hg)	2014/11/13		94	%	80 - 120
	Method Blank	Total Mercury (Hg)	2014/11/13	<0.013		ug/L	
	RPD	Total Mercury (Hg)	2014/11/13	NC		%	20
3821731 MCY	Matrix Spike	Total Organic Carbon (C)	2014/11/13		93	%	80 - 120
	Spiked Blank	Total Organic Carbon (C)	2014/11/13		103	%	80 - 120
	Method Blank	Total Organic Carbon (C)	2014/11/13	<0.50		mg/L	
	RPD	Total Organic Carbon (C)	2014/11/13	2.4		%	20
3823280 ARS	Matrix Spike	Total Alkalinity (Total as CaCO3)	2014/11/19		110	%	80 - 120
	Spiked Blank	Total Alkalinity (Total as CaCO3)	2014/11/19		112	%	80 - 120
	Method Blank	Total Alkalinity (Total as CaCO3)	2014/11/19	<5.0		mg/L	
	RPD	Total Alkalinity (Total as CaCO3)	2014/11/19	NC		%	25
3823281 MCN	Matrix Spike	Dissolved Chloride (Cl)	2014/11/18		NC	%	80 - 120
	QC Standard	Dissolved Chloride (Cl)	2014/11/18		112	%	80 - 120
	Spiked Blank	Dissolved Chloride (Cl)	2014/11/18		96	%	80 - 120
	Method Blank	Dissolved Chloride (Cl)	2014/11/18	<1.0		mg/L	
	RPD	Dissolved Chloride (Cl)	2014/11/18	5.0		%	25
3823282 MCN	Matrix Spike	Dissolved Sulphate (SO4)	2014/11/18		109	%	80 - 120
	Spiked Blank	Dissolved Sulphate (SO4)	2014/11/18		103	%	80 - 120
	Method Blank	Dissolved Sulphate (SO4)	2014/11/18	<2.0		mg/L	
	RPD	Dissolved Sulphate (SO4)	2014/11/18	NC		%	25
3823283 ARS	Matrix Spike	Reactive Silica (SiO2)	2014/11/17		111	%	80 - 120
	Spiked Blank	Reactive Silica (SiO2)	2014/11/17		101	%	80 - 120
	Method Blank	Reactive Silica (SiO2)	2014/11/17	<0.50		mg/L	
	RPD	Reactive Silica (SiO2)	2014/11/17	2.3		%	25
3823284 MCN	Spiked Blank	Colour	2014/11/17		103	%	80 - 120
	Method Blank	Colour	2014/11/17	<5.0		TCU	
	RPD	Colour	2014/11/17	3.0		%	25
3823285 MCN	Matrix Spike	Orthophosphate (P)	2014/11/17		92	%	80 - 120
	Spiked Blank	Orthophosphate (P)	2014/11/17		98	%	80 - 120
	Method Blank	Orthophosphate (P)	2014/11/17	<0.010		mg/L	
	RPD	Orthophosphate (P)	2014/11/17	NC		%	25
3823286 ARS	Matrix Spike	Nitrate + Nitrite	2014/11/18		96	%	80 - 120
	Spiked Blank	Nitrate + Nitrite	2014/11/18		100	%	80 - 120
	Method Blank	Nitrate + Nitrite	2014/11/18	<0.050		mg/L	
	RPD	Nitrate + Nitrite	2014/11/18	NC		%	25
3823287 MCN	Matrix Spike	Nitrite (N)	2014/11/17		83	%	80 - 120
	Spiked Blank	Nitrite (N)	2014/11/17		93	%	80 - 120
	Method Blank	Nitrite (N)	2014/11/17	<0.010		mg/L	
	RPD	Nitrite (N)	2014/11/17	NC		%	25
3823358 VRO	Matrix Spike	Total Phosphorus	2014/11/14		96	%	80 - 120
	QC Standard	Total Phosphorus	2014/11/14		100	%	80 - 120
	Spiked Blank	Total Phosphorus	2014/11/14		98	%	80 - 120
	Method Blank	Total Phosphorus	2014/11/14	<0.020		mg/L	
	RPD	Total Phosphorus	2014/11/14	0.5		%	20

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Golder Associates Ltd
Attention: Phyllis McCrindle
Client Project #: 1407707/4
P.O. #:
Site Location: CFI/ST.LAWRENCE,NL

Quality Assurance Report (Continued)

Maxxam Job Number: DB4K1255

QA/QC Batch Num	Init	QC Type	Parameter	Date Analyzed yyyy/mm/dd	Value	Recovery	Units	QC Limits
3823423	KSR	QC Standard	pH	2014/11/14		100	%	97 - 103
		RPD	pH	2014/11/14	2.0		%	N/A
3823429	KSR	Spiked Blank	Conductivity	2014/11/14		101	%	80 - 120
		Method Blank	Conductivity	2014/11/14	1.1, RDL=1.0		uS/cm	
		RPD	Conductivity	2014/11/14	0		%	25
3823467	ARS	Matrix Spike	Nitrogen (Ammonia Nitrogen)	2014/11/18		124 (1)	%	80 - 120
		Spiked Blank	Nitrogen (Ammonia Nitrogen)	2014/11/17		107	%	80 - 120
		Method Blank	Nitrogen (Ammonia Nitrogen)	2014/11/17	<0.050		mg/L	
		RPD	Nitrogen (Ammonia Nitrogen)	2014/11/17	6.0		%	25
3823470	AYN	QC Standard	Total Dissolved Solids	2014/11/17		103	%	80 - 120
		Method Blank	Total Dissolved Solids	2014/11/17	<20 (2)		mg/L	
		RPD	Total Dissolved Solids	2014/11/17	2.9		%	25
3825851	MCY	Matrix Spike	Dissolved Organic Carbon (C)	2014/11/17		94	%	80 - 120
		Spiked Blank	Dissolved Organic Carbon (C)	2014/11/17		100	%	80 - 120
		Method Blank	Dissolved Organic Carbon (C)	2014/11/17	<0.50		mg/L	
		RPD	Dissolved Organic Carbon (C)	2014/11/17	NC		%	20
3825931	KSR	QC Standard	Turbidity	2014/11/17		102	%	80 - 120
		Method Blank	Turbidity	2014/11/17	<0.10		NTU	
		RPD	Turbidity	2014/11/17	3.2		%	25

N/A = Not Applicable
Duplicate: Paired analysis of a separate portion of the same sample. Used to evaluate the variance in the measurement.
Matrix Spike: A sample to which a known amount of the analyte of interest has been added. Used to evaluate sample matrix interference.
QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.
Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.
Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.
NC (Matrix Spike): The recovery in the matrix spike was not calculated. The relative difference between the concentration in the parent sample and the spiked amount was too small to permit a reliable recovery calculation (matrix spike concentration was less than 2x that of the native sample concentration).
NC (Duplicate RPD): The duplicate RPD was not calculated. The concentration in the sample and/or duplicate was too low to permit a reliable RPD calculation (one or both samples < 5x RDL).
(1) Matrix spike recovery outside of acceptance range due to sample matrix.
(2) Elevated TDS RDL due to method blank performance.

Validation Signature Page

Maxxam Job #: B4K1255

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Ewa Pranjic, M.Sc., C.Chem, Scientific Specialist

Kevin MacDonald, Inorganics Supervisor

Mike MacGillivray, Scientific Specialist (Inorganics)

==

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. For Service Group specific validation please refer to the Validation Signature Page.

Maxxam Analytics International Corporation o/a Maxxam Analytics 200 Bluewater Rd, Suite 105, Bedford, Nova Scotia Canada B4B 1G9 Tel:902-420-0203 Toll-free:800-565-7227 Fax:902-420-8612 www.maxxamanalytics.com

Maxxam Analytics International Corporation

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MAXXAM Chain of Custody Record

COC #: B 128761 Page 1 of 1

This column for lab use only:
Client Code:
Maxxam Job #: B4K1255

Cooler ID	Seal Present	Seal Intact	Temp 1	Temp 2	Temp 3	Average Temp
			1	2	2	

Integrity: YES NO (circled) — Integrity / Checklist by: OBG
Labelled by: — Location / Bin #:

INVOICE INFORMATION:
Company Name: Golder Associates
Contact Name: Phyllis McCrindle
Address: 6925 Century Ave, Suite 100 Mississauga, Ont Postal Code L5N 7K2
Email: Phyllis_McCrindle@golder.com
Ph: (905) 567-4444 Fax: (905) 567-6561

REPORT INFORMATION (if differs from invoice):
Company Name:
Contact Name:
Address:
Postal Code:
Email:
Ph: OR cell 647-278-1056 Fax:

PO #:
Project # / Phase #: 1407707/4
Project Name / Site Location: CFI / St. Lawrence, NL
Quote:
Site #:
Task Order #:
Sampled by: Alex Ivanoff

TURNAROUND TIME
Standard ☑
10 day ☐
If RUSH Specify Date:
Pre-schedule rush work
Charge for # Jars used but not submitted

2014 OCT 28 9:17

Guideline Requirements / Detection Limits / Special Instructions: See attached Parameters sheet.

*Specify Matrix: Surface/Salt/Ground/Tapwater/Sewage/Effluent/Potable/NonPotable/Tissue/Soil/Sludge/Metal/Seawater

Analysis columns: Field Filtered & Preserved; Lab Filtration Required; RCAP-30 Choose Total or Diss Metals; RCAP-MS Choose Total or Diss Metals; Metals Water: Total Digest (Default Method) for well water, surface water; Dissolved for ground water; Mercury; Metals Soil: Metals & Mercury Default Available Digest Method; Metals Total Digest - for Ocean sediments (HNO3/HF/HCLO4); Mercury Low level by Cold Vapour AA; Selenium (low level) Req'd for CCME Residential, Parklands, Agricultural; Hot Water soluble Boron (required for CCME Agricultural); Hydrocarbons: RBCA Hydrocarbons (BTEX, C6-C32); Hydrocarbons Soil (Potable), NS Fuel Oil Spill Policy Low Level BTEX, C6-C32; NB Potable Water BTEX, VPH, Low level T.E.H.; TPH Fractionation; PAH's; PAH's with Acridine, Quinoline

#	Field Sample Identification	Matrix*	Date/Time Sampled	# & type of bottles	Field Filtered & Preserved	Field notes
1	MW14-01A	GW	Oct 24 11:30	9	N	pH=7.38 Cond=0.10 mS
2	MW14-02A	GW	Oct 24 13:20 hr	9	N	pH=7.69 Cond=0.17 mS
3	MW14-03A	GW	Oct 24 15:00	9	N	pH=6.65 Cond=0.07 mS
4	PGS-93b	GW	Oct 25 11:45AM	9	N	pH=8.05 Cond=0.16 mS
5	PGS-124	GW	Oct 26 15:10	9	N	pH=6.50 Cond=0.12 mS
6	Duplicate	GW	Oct 25 11:50	9	N	
7						in field measurements
8						Samples not filtered
9						in the field.

RELINQUISHED BY: (Signature/Print)	Date	Time	RECEIVED BY: (Signature/Print)	Date	Time
Alex Ivanoff	Oct. 27 2014	AM	Sara Mason SARA MASON		

B4K1255

White: Maxxam Yellow: Mail Pink: Client ATL FCD 00149 / Revision 10

Your Project #: B4K1255
Your C.O.C. #: n-a

Attention:Bedford Client Svc (SubContr)

Maxxam Analytics
200 Bluewater road
Bedford, NS
CANADA B4B 1G9

Report Date: 2014/11/04
Report #: R1939521
Version: 1 - Final

CERTIFICATE OF ANALYSIS

MAXXAM JOB #: B468544
Received: 2014/10/29, 08:20

Sample Matrix: WATER
Samples Received: 12

Analyses	Quantity	Date Extracted	Date Analyzed	Laboratory Method	Primary Reference
Weak Acid Dissociable Cyanides*	6	2014/10/31	2014/10/31	STL SOP-00035	MA300-CN 1.2 R2 m
Total Extractable Metals (Low Level)*	6	2014/10/30	2014/10/31	STL SOP-00006	MA200–Mét 1.2 R4 m

Note: RPDs calculated using raw data. The rounding of final results may result in the apparent difference.

* Maxxam is accredited as per the MDDELCC program.

Encryption Key

Rodrigo Caffarengo
04 Nov 2014 14:39:03 -05:00

Please direct all questions regarding this Certificate of Analysis to your Project Manager.
Rodrigo Caffarengo, Customer Service
Email: RCaffarengo@maxxam.ca
Phone# (514)448-9001 Ext:4336
==
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889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

Maxxam Job #: B468544
Report Date: 2014/11/04

Maxxam Analytics
Client Project #: B4K1255

TOTAL EXTRACTABLE METALS (WATER)

Maxxam ID		AE3179	AE3181	AE3183		
Sampling Date		2014/10/24 11:30	2014/10/24 13:20	2014/10/24 15:00		
COC Number		n-a	n-a	n-a		
	Units	**YE4528-04R/MW14-01A**	**YE4529-04R/MW14-02A**	**YE4530-04R/MW14-03A**	**RDL**	**QC Batch**
METALS ICP-MS						
Thorium (Th)	ug/L	<1.0	<1.0	6.0	1.0	1382384
Tungsten (W)	ug/L	<10	<10	13	10	1382384

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AE3183	AE3185	AE3187	AE3189		
Sampling Date		2014/10/24 15:00	2014/10/25 11:45	2014/10/26 15:10	2014/10/25 11:30		
COC Number		n-a	n-a	n-a	n-a		
	Units	**YE4530-04R/MW14-03A Lab-Dup**	**YE4531-04R/PGS-93B**	**YE4532-04R/PGS-124**	**YE4533-04R/DUPLICATE**	**RDL**	**QC Batch**
METALS ICP-MS							
Thorium (Th)	ug/L	6.3	<1.0	11	<1.0	1.0	1382384
Tungsten (W)	ug/L	14	<10	130	<10	10	1382384

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

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Maxxam Job #: B468544
Report Date: 2014/11/04

Maxxam Analytics
Client Project #: B4K1255

CONVENTIONAL PARAMETERS (WATER)

Maxxam ID		AE3180	AE3182	AE3184		
Sampling Date		2014/10/24 11:30	2014/10/24 13:20	2014/10/24 15:00		
COC Number		n-a	n-a	n-a		
	Units	**YE4528-08R/MW14-01A**	**YE4529-08R/MW14-02A**	**YE4530-08R/MW14-03A**	**RDL**	**QC Batch**
CONVENTIONALS						
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.003	<0.003	<0.003	0.003	1382929

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

Maxxam ID		AE3186	AE3188	AE3190		
Sampling Date		2014/10/25 11:45	2014/10/26 15:10	2014/10/25 11:30		
COC Number		n-a	n-a	n-a		
	Units	**YE4531-08R/PGS-93B**	**YE4532-08R/PGS-124**	**YE4533-08R/DUPLICATE**	**RDL**	**QC Batch**
CONVENTIONALS						
Weak Acid Dissociable Cyanide (CN-)	mg/L	<0.003	<0.003	<0.003	0.003	1382929

RDL = Reportable Detection Limit
QC Batch = Quality Control Batch

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

GENERAL COMMENTS

Condition of sample(s) upon receipt: GOOD except for the following:
Total Extractable Metals (Low Level): Arrived unpreserved, preserved upon reception at the laboratory.: AE3179, AE3181, AE3183, AE3185, AE3187, AE3189

TOTAL EXTRACTABLE METALS (WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

CONVENTIONAL PARAMETERS (WATER)

Please note that the results have not been corrected for QC recoveries nor for the method blank results.

Results relate only to the items tested.

889 Montée de Liesse, Ville St-Laurent, Québec, Canada H4T 1P5 Tel: (514) 448-9001 Fax: (514) 448-9199 Ligne sans frais : 1-877-4MAXXAM (462-9926)

Maxxam Job #: B468544
Report Date: 2014/11/04

Maxxam Analytics
Client Project #: B4K1255

QUALITY ASSURANCE REPORT

Q /QC Batch	Init	QC Type	Parameter	Date Analyzed	Value	Recovery	Units	QC Limits
1382384	MCA	Spiked Blank	Thorium (Th)	2014/10/31		101	%	80 - 120
			Tungsten (W)	2014/10/31		104	%	80 - 120
1382384	MCA	Method Blank	Thorium (Th)	2014/10/31	<1.0		ug/L	
			Tungsten (W)	2014/10/31	<10		ug/L	
1382929	MH1	QC Standard	Weak Acid Dissociable Cyanide (CN-)	2014/10/31		88	%	80 - 120
1382929	MH1	Spiked Blank	Weak Acid Dissociable Cyanide (CN-)	2014/10/31		102	%	75 - 125
1382929	MH1	Method Blank	Weak Acid Dissociable Cyanide (CN-)	2014/10/31	<0.003		mg/L	

QC Standard: A sample of known concentration prepared by an external agency under stringent conditions. Used as an independent check of method accuracy.

Spiked Blank: A blank matrix sample to which a known amount of the analyte, usually from a second source, has been added. Used to evaluate method accuracy.

Method Blank: A blank matrix containing all reagents used in the analytical procedure. Used to identify laboratory contamination.

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Maxxam Job #: B468544
Report Date: 2014/11/04

Maxxam Analytics
Client Project #: B4K1255

VALIDATION SIGNATURE PAGE

The analytical data and all QC contained in this report were reviewed and validated by the following individual(s).

Jonathan Fauvel, B.Sc, Chimiste, Analyste II

Madina Hamrouni, B.Sc., Chemist

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. For Service Group specific validation please refer to the Validation Signature Page.

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