July 25, 2012

Department of Environment & Conservation
Confederation Building
P.O. Box 8700
St. John's, Newfoundland
A1B 4J6

Attention: **Honourable Terry French**
Minister of Environment & Conservation

Dear Minister French,

Reference: **St. Lawrence Fluorspar Mine Reactivation Project – Environmental Effects Monitoring Program: Project Construction Phase**

SNC-Lavalin Reference No 723081-4EPL-I-0002-00

On behalf of our client, Newspar, SNC-Lavalin Inc. (SLI) is pleased to submit to your Department the final version of the *Environmental Effects Monitoring Plan: Project Construction Phase* in Adobe Acrobat PDF format. Also included is a Table of Concordance which outlines the Proponents responses to comments received by the Assessment Committee related to the previous version of the EEMP.

Submission of this report was required as a condition of environmental assessment release in October 2010 by the former Minister of Environment and Conservation, Honourable Charlene Johnson.

We trust this Plan meets with your Department's requirements. Should you or your staff have any questions or concerns, please do not hesitate to contact me at 368-0118.

Yours very truly

SNC-LAVALIN INC.

Andrew Peach, P. Geo., EP
Senior Environmental Scientist

cc P. Cooper/Newspar
J. Christian/LGL
J. McCarthy/AMEC

SNC·LAVALIN

ENVIRONMENTAL EFFECTS MONITORING PROGRAM: PROJECT CONSTRUCTION PHASE

St. Lawrence Fluorspar Mine Reactivation Project

Newspar

HYDROCARBONS & CHEMICALS

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CONTRACT > ORIGINAL
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St. Lawrence Fluorspar Mine Reactivation

Environmental Effects Monitoring Program Project Construction Phase

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1 INTRODUCTION

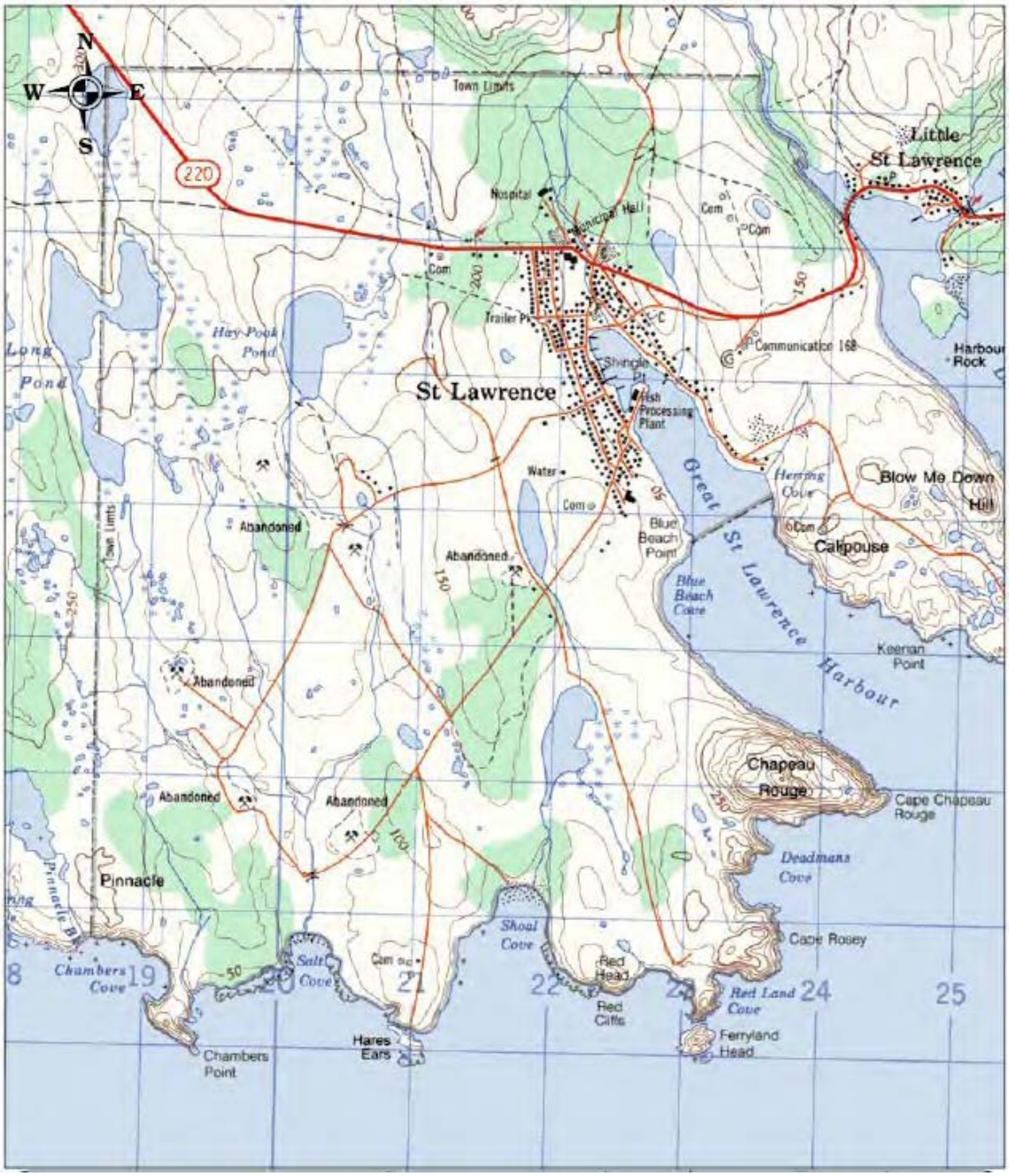
Newspar, a partnership between Canada Fluorspar (NL) Inc., (CFI) and Arkema Spar NL Inc., is planning to reactivate the fluorspar mine in St. Lawrence, Newfoundland and Labrador (the Project) (Figures 1-1 and 1-2). CFI filed the Environmental Preview Report (EPR) and the information required to conduct a Federal Environmental Assessment for the Project with the Provincial Department of Environment and Conservation (DOEC) and the Canadian Environmental Assessment Agency (CEAA) on November 9, 2009 (CFI 2009), followed by an Addendum submitted to DOEC and CEAA on March 22, 2010. The Project was released from further environmental assessment by the Minister of Environment and Conservation, Government of Newfoundland and Labrador, on October 22, 2010, subject to certain conditions. One of the conditions is that an Environmental Effects Monitoring Program (EEMP) must be submitted to and approved by the Minister of Environment and Conservation prior to the start of construction.

Section 1.9.3 of the Project's EPR states that "an Environmental Effects Monitoring (EEM) program will be required throughout the various stages of the project in order to confirm predictions made in this environmental assessment, and CFI commits to preparing such a plan, having it approved by regulatory agencies, and implementing it throughout various phases of site/mine development, operations, and decommissioning". The EEMP will focus on two valued ecosystem components (VECs): (1) Fish and Fish Habitat (freshwater and marine, including commercial fishery); and (2) Migratory Birds. The five primary objectives of this document are as follows:

1. Briefly describe: (a) project construction activities, (b) the potential environmental effects on freshwater and marine fish and fish habitat (including commercial fishery) and migratory birds described in the EPR, and (c) the mitigations proposed in the EPR;
2. Review the Project related environmental concerns of regulators and stakeholders identified in the EPR;
3. Briefly review the existing environmental data collected during previous field studies in the area;

4. Outline the monitoring design methodology for the Project Construction Phase EEMP; and

5. Design a Project Construction Phase EEMP that is scientifically defensible and cost effective.



Source: Energy, Mines and Resources Canada (1988) [NTS Map Sheet 01L/14]

Figure 1-1: Topographical Map of Project Area

Source: CFI, 2009

Figure 1-2: Site Location Map Showing Project Components

2 CONSTRUCTION ACTIVITIES, POTENTIAL EFFECTS AND MITIGATIONS

The estimated duration of construction, including the mine development works and commissioning of the mill and marine terminal, is 18 to 24 months. The Project construction activities can be categorized as follows:

- Mine development, commencing at BBN mine first, will be on a critical path and must commence as soon as possible after permits are available;
- Mill refurbishment, expansion and upgrades;
- Construction of the Tailings Management Facility (TMF) at Shoal Cove Pond and adjoining areas, including construction of earth-filled dams;
- Construction of general site infrastructure, including access roads, power lines and substations, water supply, sewage system, warehouses and office building; and
- Construction of the new deepwater marine terminal and associated infrastructure, including ore storage building and materials handling system.

Established and industry proven construction methods and best practices will be used throughout the construction phase of the Project. Before any work commences, there will be development of construction methodologies that are specific to the activities being undertaken. These methodologies will focus on reducing or eliminating the risk of negative effects on the environment. An Environmental Protection Plan (EPP) for construction will also be developed prior to the onset of construction activities.

2.1 On-Land Construction

A brief description of the on-land Project construction activities is provided in this subsection.

2.1.1 Infrastructure – Existing and Proposed

Apart from some smaller facilities that remain, such as the old pump house, much of the infrastructure put in place during previous mine operations has been demolished. However, at the mill site a number of buildings remain.

2.1.1.1 Existing Infrastructure

Mill Site

- Process building
- Administration building
- Assay laboratory
- Warehouse
- Electrical sub-station
- Ore storage silo

Tarefare Mine Site

- Mine shaft

Blue Beach North Mine Site

- Maintenance warehouse/office
- Compressor building

Existing infrastructure will either be upgraded or replaced as part of the mine reactivation activities.

2.1.1.2 Proposed Infrastructure

In addition, several support buildings and structures will be constructed on site. Buildings and structures to be constructed or renovated include:

Process Mill Site

- Administration building
- Assay laboratory

- Ore crushing facility
- Ore storage facility
- Mill building will be upgraded, including a new fluorspar filter cake storage building.
- Cut-off wall (Clarkes Pond outflow) & diversion pipeline (Clarkes Pond outflow to Shoal Cove Pond outflow).
- Tailings pipeline
- Tailings management facility
- TMF access road

Blue Beach North Mine Site

- Administration offices
- Mine dry facility
- Service bays
- Electrical sub-station
- Maintenance/storage warehouse
- Sedimentation ponds

Tarefare Mine Site

- Headframe building
- Mine dry facility
- Hoist/compressor building
- Electrical sub-station
- Maintenance/storage warehouse
- Sanitary sewer disposal facility

Other infrastructure includes the deepwater marine terminal and associated access road, and some additional small buildings as required. The location of these small buildings will be determined during the detailed design process. Additional detail on proposed buildings can be found in the EPR (CFI 2009).

2.1.2 Mine Infrastructure

The Blue Beach North (BBN) site has two shafts, with the No. 2 and No. 3 shafts reaching depths of 65 metres below ground surface (mbgs) and 100 mbgs, respectively. At the east end of the BBN deposit there is also an existing ramp which covers a vertical extent of approximately 130 m.

The Tarefare (TF) mine has two shafts, with No. 1 and No. 2 shafts reaching depths of 168 mbgs and 450 mbgs, respectively. Shaft stations spaced at 60 m intervals were cut during the sinking of the No. 2 shaft. The existing station spacing was used as the basis for the 60 m level spacing in the mine design.

Pre-production development at the TF site will include ramp development between 382 m and 492 m levels, a ventilation raise from the 382 m level, a transfer drift, an ore pass, a waste pass, main water sump, and general level development on the 382 m and 492 m levels. The ramp will also provide a breakthrough access to the shaft bottom at 445 m for mucking of the shaft bottom. The approximate pre-production construction duration for TF No. 2 shaft is 18 to 24 months (CFI 2009).

At the BBN site, pre-production development will include driving a ramp from the existing ramp face, which is approximately 130 m below the ramp portal elevation. The ramp will be extended to the 340 m level to provide access to the complete vertical extent of the deposit. Pre-production development in both ore and waste will be completed on the two lowest levels first, along with Alimak raising to prepare the initial stopes for production. The ventilation raise will also be completed to allow for a ventilated air supply and emergency egress in case of an underground emergency. The approximate pre-production construction duration for BBN is 18 to 24 months (CFI 2009).

2.1.2.1 Headframe

A 36 m high headframe and a 2.4 m diameter double drum hoist will be installed at the TF mine. A hoist room, compressor room, shafthouse and office/dry/garage/warehouse complex will be required. The backleg and shafthouse foundations will need to be constructed. It is anticipated that a portable headframe and pumping installation can be set up to initiate the dewatering and potentially save time in the pre-production phase.

2.1.2.2 Hoist Room

A hoist room measuring 15 m wide x 18 m long x 9 m high will be required to house the hoist and required electronics. An overhead crane with 9 tonne capacity will be installed to service the double drum hoist.

2.1.2.3 Maintenance Facilities

The main maintenance facilities will be located on the surface at both mine sites. However, at the TF mine, an underground service garage will be necessary as the haul trucks and LHD's (Load Haul Dump) will be captive on the lower level. Smaller service areas will be cut for the LHD's located on the other levels. A small service building will also be provided for equipment and tool repairs on the surface. For the BBN mine, a service garage area for the north and south sectors will be cut to provide sufficient equipment maintenance and servicing. Any required major overhauls of equipment will be completed on the surface.

2.1.3 Tailings Management Facility

Throughout their estimated 20 year project life, the mines will produce an estimated total of 2.04 million tonnes of acid grade concentrate and 1.5 million tonnes of high quality construction aggregate from 5.73 million tonnes of ore. An estimated 2.19 million tonnes of flotation tailings would be generated during this period.

Newspar proposes to construct an engineered Tailings Management Facility (TMF) within Shoal Cove Pond, a body of water whose poor quality reflects historic mining activity. From the mid-1930s until 1957, the St. Lawrence Corporation used this pond as a lagoon for its tailings, and at one point, the tailings occupied most of the pond's area. In the mid-1980s, Minworth Limited constructed a hillside TMF at the head of Shoal Cove Pond, and filled it to capacity in less than

four years. Although the company never disposed of its tailings directly into pond, the effluent from this facility continues to flow directly into Shoal Cove Pond.

Analysis of the water within Shoal Cove Pond revealed that levels of fluoride (F) and lead (Pb) are elevated (i.e., above Canadian Environmental Quality Guidelines for the Protection of Freshwater Aquatic Life, 2009), and the predominantly silt substrate may give rise to elevated levels of suspended sediment in the water column (AMEC 2009). This water flows uncontrolled through Shoal Cove Brook and discharges into the receiving marine environment at Shoal Cove Beach.

A field survey conducted in the 1990s reported a higher than normal length to weight ratio for the fish in Shoal Cove Pond, suggesting that the aquatic ecosystem is currently in a stressed state relative to other freshwater bodies within the area. The extent of the contribution of the old tailings to elevated concentrations of F and Pb in the pond water is unknown, given the natural outcropping veins of fluorspar with trace levels of associated sulphides within the Shoal Cove Pond watershed and their potential F and Pb contributions. Recent surveys by CFI (AMEC 2009) confirmed the above.

To help address these environmental issues, the current design of the TMF will include two cells separated by two retaining structures. Cell 1 will be retained by a Separator Berm and Cell 2 will be retained by a starter Tailings Dam. Cell 1 will act as the initial receiver for tailings for the first 3.5 yrs of operation and Cell 2 will act as a polishing pond during the first 3.5 yrs of operation. Flotation tailings may be flocculated and possibly adjusted for pH. The Separator Berm will be a pervious rockfill structure and will retain the tailings solids but allow the surface and pore water to report to Cell 2. The Tailings Dam will be constructed as a low permeability structure. All runoff will be discharged through a concrete spillway at the abutment of the Tailings Dam. After 3.5 years tailings will report to Cell 2 and a second tailings dam will be constructed at the outflow of Shoal Cove Pond, this new cell will then act as the polishing pond. Runoff will again be discharged through a concrete spillway at the abutment of the new tailings dam. When Cell 2 becomes full, lifts will then be placed on the separator berm and starter tailings dam and tailings deposition will then begin within Cell 1 again, this cycle will continue for the life of the Project.

Water quality monitoring stations, directly downstream of the TMF are included in the EEM Program and will be utilized for baseline sampling as well as regular sampling at the onset of construction. Water quality treatment stations may be required depending on the results of the water quality monitoring program. The engineered TMF will introduce a new level of environmental control to ensure that all effluent discharging to the receiving environment is of acceptable quality.

To accommodate tailings deposition into the TMF, a gravel road to the east of Shoal Cove Pond will be re-routed because the water level in the pond will rise and inundate the current road.

Aspects of these on-land construction activities could include (1) siltation/erosion/dust generation; (2) fish and avian habitat loss; (3) blasting/noise; (4) land clearing; (5) air emissions; (6) artificial lighting, and (7) accidental events. Accidental events are not being considered during the design of the EEMP so they will not be considered any further in this document.

2.1.4 Potential Environmental Effects of On-Land Construction Activities

The EPR identified the potential environmental effects of on-land construction activities on the freshwater component of the Fish and Fish Habitat VEC. They are as follows:

- Increased turbidity and suspended solids,
- Sedimentation,
- Loss of and/or damage to fish habitat and habitat replacement, and
- Fish injury/death.

The EPR identified the potential environmental effects of on-land construction activities on the marine component of the Fish and Fish Habitat VEC. They are as follows:

- Increased turbidity and suspended solids, and
- Sedimentation.

The EPR identified the potential environmental effects of on-land construction activities on the Migratory Bird VEC. They are as follows:

- Habitat damage;

- Disturbance;
- Attraction to artificial lighting; and
- Health effects due to air emissions.

2.1.5 Possible Mitigations for On-Land Construction Activities

Possible mitigations proposed in the EPR to minimize the effects of on-land construction activities on the Fish and Fish Habitat and Migratory Bird VECs are as follow:

- Use of silt curtains;
- Use of settling ponds;
- Dust suppression with water spray;
- Minimization of material stockpiling;
- Appropriate level of equipment maintenance.

Other possible mitigation measures can include:

- Water intakes to include appropriate fish screens as per DFO's *"Freshwater Intake End-of-Pipe Fish Screen Guidelines"*;
- Develop a *Fish Recovery and Relocation Plan* to mitigate against any fish stranding during construction;
- Use of bank stabilization techniques;
- Any blasting associated with the project will be done in accordance with accepted practice and guidelines such as DFO's 1998 "*Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters"*; and
- Use of noise reduction techniques, such as bubble curtains, where appropriate.

2.2 Marine Construction

Specifics of the marine construction activities (i.e., construction of deepwater marine terminal and associated infrastructure) include the following:

- Blasting activities in a rock quarry within the vicinity of the shoreline for the construction of the causeway and access road;
- Placement of the rockfill in the water for the construction of the causeway and wharf backfilling.

If the sheet pile option is selected for wharf construction, the following activities apply:

- Installation of the driving template (this will involve pile driving in the water, likely with a vibratory hammer);
- Installation of the sheet piling (this will also involve pile driving, likely with a vibratory hammer);
- Removal of the template;
- Backfilling of the cells;
- Backfilling of the wharf area;
- Placement of shoreline armour stone;
- Installation of wharf hardware (bollards, fenders etc);
- Marine plant (e.g., barges, cranes, etc) will be required.

If the concrete caisson option is selected for wharf construction, the following activities apply:

- Construction of a slipway on shore may be required;
- Import of concrete aggregates and cement;
- On-site production of concrete;
- Slip forming of the caissons;
- Launching the caissons;
- Installation of the caissons;
- Ballasting of the caissons;
- Backfilling of the wharf area;
- Placement of shoreline armour stone;
- Installation of wharf hardware (bollards, fenders etc); and

- Marine plant (e.g., barges, cranes, etc.) may be required.

Onshore work will require an assortment of heavy equipment such as trucks, front end loaders, cranes, drills, etc.

Aspects of these marine construction activities, other than the wharf footprint, could include (1) siltation; (2) blasting/noise; (3) air emissions; (3) generation of solid waste/debris; (4) artificial lighting; and (5) accidental events. Accidental events are not being considered during the design of the EEMP so they will not be considered any further in this document.

2.2.1 Potential Environmental Effects of Marine Construction Activities

The EPR identified the potential environmental effects of marine construction activities on the marine component of the Fish and Fish Habitat VEC. They are as follow:

- Loss of and/or damage to fish habitat and habitat replacement;
- Increased turbidity and suspended solids;
- Sedimentation;
- Habitat damage;
- Disturbance; and
- *Changes to surficial sediment and seawater chemistries.*

The EPR identified the potential environmental effects of marine construction activities on the commercial fishery component of the Fish and Fish Habitat VEC. They are as follow:

- Loss of fishing area;
- Temporary decrease in catch rate;
- Gear damage; and
- Lost fishing time.

The EPR identified the potential environmental effects of marine construction activities on the Migratory Bird VEC. They are as follow:

- Habitat damage;

- Disturbance;
- Attraction to artificial lighting; and
- Health effects due to air emissions.

2.2.2 Possible Mitigations for Marine Construction Activities

Possible mitigations proposed in the EPR to minimize the effects of marine construction activities on the Fish and Fish Habitat and Migratory Bird VECs are as follows:

- Use of silt curtains;
- Application of sufficient spatial buffer between blasting area and high water mark;
- Appropriate level of equipment maintenance;
- Use of bubble curtains;
- Use of 'clean' armour stone;
- Stabilization of shoreline;
- Open communication with fishers;
- Proper handling of wastes and materials;
- Compensation for damaged gear; and
- Minimization of noise.

3 PUBLIC AND STAKEHOLDER CONCERNS

Over the course of the environmental assessment process, including preparation of the EPR, consultations were conducted during February and October 2009 with the public. Meetings have also been held with government departments, municipal councils and community groups, and various other stakeholder groups. Relevant questions and inquiries are summarized in Table 3-1.

Other inquiries made outside of the formal consultation process included:

- Fish, Food and Allied Workers (FFAW) has made an inquiry with respect to the constituents of water leaving the polishing pond of the tailings management facility. Newspar will ensure that effluent leaving the TMF will be monitored and, if required, treated to comply with all regulatory effluent discharge requirements. In addition, water quality monitoring stations directly downstream of the TMF are included in the proposed design of the construction EEM Program; and
- Some inquiries have been raised regarding the impact of water level increases in Shoal Cove Pond on a nearby unpaved road. This road is used by some community residents for recreational purposes, such as walking. Newspar has reassured the public and the Town Council of St. Lawrence that the road will be rerouted to allow continued use by the public, as long as mine/mill related activities do not pose a risk to public safety.

All of these concerns have been analysed in the EPR (CFI 2009) and effects have been predicted to be not significant. With the exception of the concerns related to accidental release, these concerns will be addressed in the EEMP. As indicated above, this EEMP will monitor the routine construction activities only and not accidental releases and malfunctions. Therefore, the issue of accidental release of hydrocarbon products into the freshwater and/or marine environments will not be addressed here.

Refinement of these broad spectrum issues into scientifically testable hypotheses or questions follows consideration of the regulatory and scientific requirements.

Table 3-1: Summary of Public Consultations

Group	Date	Key Points and Issues
Canadian Environmental Assessment Agency	November 20, 2008	Project will be subject to both levels of environmental assessment.
Major Projects Management Office (MPMO)	November 20, 2008	Unsure if MPMO will be involved in this project (later determined in February 2009 that this project does not meet the criteria for MPMO involvement).
NL Dept. of Environment and Conservation, Environmental	November 20, 2008	Proper consideration to alternatives should be provided.

Group	Date	Key Points and Issues
Assessment Division		
Transport Canada	January 7, 2009	TC will likely be involved in EA (*Navigable Waters Protection Act* may be triggered).
Fisheries and Oceans Canada	January 7, 2009	HADD will apply to freshwater and marine fish habitat lost due to the Project. The existing freshwater HADD compensation agreement is still in effect, providing that no significant changes have occurred to the Project since the agreement was signed. Discussion of freshwater/marine fish habitat within the project footprint. Surveys for marine habitat will be initiated during spring 2009.
Environment Canada and Canadian Wildlife Services	January 7, 2009	No known species at risk found within project site. EC confirmed that Metal Mining Effluent Regulations (MMER) are not applicable to this Project.
NL Dept. of Environment and Conservation, Environmental Assessment Division	January 6, 2009	Discussed reasoning associated with need for new deepwater port (safety concerns at previous used wharf, needed deeper water). Schedules and expected timeline for registration.
NL Dept. of Environment and Conservation, Pollution Prevention Division	January 6, 2009	Discussion of proposed plans for processing and tailings management area.
NL Dept. of Environment and Conservation, Water Resources Management Division	January 6, 2009	Discussed possible sources of water for processing and clarified that no surface draining will be required.
Canadian Environmental Assessment Agency (CEAA)	January 15, 2009	Discussion of municipal amendments made by the Town of St. Lawrence and how this relates to the Federal EA process.
Fish, Food and Allied Workers (FFAW)	January 21, 2009	Number of shipments annually and size of vessels that can be expected. Discussion of where/what effluent would be released into the marine environment (no marine intake). Discussed possible use of Blue Beach area by local fish harvesters.
St. Lawrence Town	February 23,	Provided summary of proposed project,

Group	Date	Key Points and Issues
Council	2009	discussion of previous efforts to reactivate mine (in mid-1990s). Discussion of project schedule and past use of Shoal Cove Pond by previous mine operators. CFI reassured town council that many measures would be taken to improve working conditions for mine/mill employees. Town Council of St. Lawrence expressed their support for the proposed project.
Town of St. Lawrence – Open House #1	February 23, 2009	Questions asked: Inquiry regarding process by which the community can register public comments. Questioned the degree to which the water level in the Shoal Cove Pond will rise (impact on the road to Red Head). Detail requested regarding the response from potential fluorspar customers. Inquired about the involvement of the Provincial Department of Environment and Conservation. Questioned whether the company would ensure health/safety protection of workers (referencing past health issues). Inquiry regarding potential role for a union at the mine/mill. Further explanation of fish habitat compensation was requested. Inquiries regarding planned water supply for processing (Clarke's Pond?).
Schooner Regional Development Association	February 24, 2009	Proposed timeline was discussed. Schooner inquired about CFI's need for supporting infrastructure, labour analysis studies, etc.
NL Department of Natural Resources	March 18, 2009	Inquired about previously completed fish habitat work. Mine Plan progress and Project timelines were discussed. Alternatives should be given proper consideration, with focus on TMF.
Fisheries and Oceans Canada	March 19, 2009	Discussion of marine fish habitat within the Project footprint. Agreed that surveys for marine habitat will soon be initiated.
Fisheries and Oceans Canada	March 27, 2009	Discussion of freshwater fish habitat within the Project footprint and proposed plans for the tailings management facility. Reviewed previously approved HADD agreement.
Town of St. Lawrence –	October 22, 2009	Many participants expressed support for the

Group	Date	Key Points and Issues
Open House #2		Project and reported that they were pleased with the relationship CFI has developed with the community and local residents. Questions asked: Inquiries relating to health and safety in the mines, particularly in respect to history of health concerns. Inquiries relating to use of Shoal Cove Pond as a tailings facility and the associated water quality being released to the marine environment. Inquiries relating to local employment and business opportunities. Inquiries regarding types of mining methods to be used. Inquiries relating to use of local workforce and the opportunities for residents to receive training. More information requested on the Project's effect on tourism, i.e. Cape trail, Iron Springs, Shoal Cove Beach, Chamber Cove.

3.1 Identification of Regulatory Requirements

As part of the regulatory process, there is a requirement for the development of an EEMP which includes a description of a program established to monitor the effect on the natural environment of routine operations of mining activities. However, there are currently no regulatory guidelines for an EEMP. Environment Canada has also confirmed that Metal Mining Effluent regulations (MMER) are not applicable to this project as extraction of fluorspar does not qualify as metal mining. Until guidelines are in place, the critical elements monitored in an EEMP are determined specifically for each project.

The Project study team has been consulting with key government officials and regulators (municipal, provincial, and federal), both formally and informally. The objectives of these consultations are to provide information and updates on the Project and the environmental assessment, and to receive input and guidance as appropriate. Issues and concerns identified during these meetings were recorded in the issues tracking database.

At this time, the EPR process is complete and Conditions of Release or Approval have been provided to Newspar. Other regulatory permits (i.e., DFO Experimental License) will vary based

on the finalized EEMP and will be identified and applied for once the EEMP design is accepted and finalized.

There are also other environmental monitoring programs that will be conducted at the site that may complement the EEMP but are not directly related. One of these additional monitoring efforts is related to the *Fisheries Act*. Under the *Fisheries Act*, compensation areas for the TMF footprint, Clarke's Pond Brook, and the marine wharf footprint at Blue Beach Cove will also have to be monitored to determine the utilization of created fish habitat. The monitoring regimes for the compensation areas will be outlined in the Habitat Compensation Plans and are not addressed in this EEMP.

4 EXISTING ENVIRONMNETAL INFORMATION

This section provides some background information on the existing environment in the Project area, specifically freshwater fish and fish habitat, marine fish and fish habitat (including commercial fisheries), and birds. A higher level of detail of existing environment is provided in the EPR (CFI 2009).

4.1 Freshwater Fish and Fish Habitat

A number of site investigation surveys have been conducted at the proposed reactivation fluorspar mine site in St. Lawrence, Newfoundland and Labrador over the last 30 years. The following is a consolidation of the existing historical and current information on the fish and fish habitat characterization and surveys within the watersheds potentially affected by the Project. Information has been consolidated from several sources, including habitat characterization completed in 1985 by DFO as part of a site investigation, 1990 and 1995 surveys for previous EPRs, a DFO screening assessment conducted in 1997 regarding reactivation of the mine, and recent 2009 surveys related to the current assessment. The 2009 field investigations were presented in a report titled "*Water Quality and Fish Habitat Program in St. Lawrence; Proposed Re-activation of Fluorspar Mine"* by AMEC Earth and Environmental (2009). Results of these surveys are summarized below.

4.1.1 Shoal Cove Brook Watershed

The following ponds and streams are within the proposed Project footprint or within the general Project area. The Shoal Cove Brook watershed encompasses two ponds (Shoal Cove Pond and Clarke's Pond), as well as the stream itself. The main stem is divided into three separate sections, from farthest downstream to upstream (Figure 1-2):

- Shoal Cove Brook flows from Shoal Cove Pond to Shoal Cove;
- Clarke's Pond Brook flows between Clarke's Pond and Shoal Cove Pond; and
- Clarke's Pond Inlet drains from the north into Clarke's Pond.

Shoal Cove Pond also has two small tributaries which drain from the east (named T1) and southeast (named T2).

The Shoal Cove Brook watershed is relatively short with an overall length of 3.3 km (Nolan, Davis and Associates 1990). The watershed originates in a fen just north of Clarke's Pond. The primary source of water is from groundwater and precipitation. Clarke's Pond is the farthest upstream water body which discharges into Clarke's Pond Brook to the south. Clarke's Pond Brook flows south to Shoal Cove Pond (Nolan Davis and Associates 1990; ADI Nolan Davis 1995). Water is discharged from the southwest corner of Shoal Cove Pond into Shoal Cove Brook which flows south before discharging into the ocean at Shoal Cove (Nolan Davis and Associates 1990) (Figure 1-2).

Nolan Davis and Associates (1990) and ADI Nolan Davis (1995) identified brook trout (*Salvelinus fontinalis*) and American eel (*Anguilla rostrata*) as species which occur within the Shoal Cove Brook watershed. These species were distributed throughout the system and were captured during electrofishing surveys conducted within Shoal Cove Brook and Clarke's Pond Brook, as well as during fyke netting and gill netting activities at Shoal Cove Pond and Clarke's Pond.

During 2009 index electrofishing (August) within Clarke's Pond Brook and Shoal Cove Brook, AMEC reported that brook trout appeared to be more abundant in Clarke's Pond Brook

compared to Shoal Cove Brook. This trend for higher catches from Clarke's Pond Brook was also observed during previous surveys conducted in 1985, 1990 and 1995.

Although benthic invertebrates were not sampled during the field work, it was noted by visual observation that they were extremely scarce at all stream and pond survey locations (Nolan Davis and Associates 1990).

The habitat type in Clarke's Pond Inlet was identified as Type IIa (i.e., 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). There is also evidence of prior impact by human activity (ADI Nolan Davis 1995). Clarke's Pond Brook connecting Clarke's Pond and Shoal Cove Pond is also characterized by Type IIa habitat (Nolan Davis and Associates 1990). Shoal Cove Brook running from Shoal Cove Pond to the marine environment at Shoal Cove Beach is also characterized by primarily Type IIa habitat with small areas of Type III habitat (poor rearing habitat with no spawning capabilities, and used for migratory purposes) (ADI Nolan Davis 1995). There is evidence of prior impact by human activity throughout this system (ADI Nolan Davis 1995).

4.1.2 Salt Cove Brook Watershed

The Salt Cove Brook watershed includes the main channel of Salt Cove Brook from its mouth at Salt Cove, extending 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 re-direct water from the Director Mine area. The section of Salt Cove Brook which was diverted as a result of the diversion channel is also included in this summary as the Freshwater Fish Compensation Plan includes re-establishing fish habitat in this area.

The Salt Cove Brook main channel extends 4.6 km from Salt Cove to Haypook Pond and contains a mixture of spawning, rearing and migratory salmonid habitat. The brook contains good fish habitat over much of its length except for the section of man-made diversion channel located in its upper reaches. The man-made channel is straight and used to divert water from the natural channel. The lower reaches follow the natural river channel and are characterized by good channel development, with several pools and good substrate for salmonid species. The lower reaches contain several pools but the habitat is primarily riffle (ADI Nolan Davis

1996). The diverted former stream section, including the diversion section, is 1,251.8 m long and contains a substantial amount of habitat which is suitable for salmonid spawning.

Index and quantitative electrofishing conducted by ADI Nolan Davis (1996) identified brook trout, Atlantic salmon and American eel as species which inhabit the Salt Cove Brook system. Brook trout were the most common species found and were found throughout the system (ADI Nolan Davis 1996).

A previous assessment of the fish habitat within Salt Cove Brook was completed by ADI Nolan Davis (1996). The assessment covered the habitat within Salt Cove Brook from its mouth in Salt Cove to Haypook Pond including a section of diverted, former streambed as outlined above. The ADI Nolan Davis (1996) report identified a mixture of salmonid spawning and rearing habitat.

4.2 Marine Fish and Fish Habitat

Marine fish habitat baseline conditions at Blue Beach Cove (Figures 1-1 and 1-2) are based on comprehensive underwater surveys conducted in June 2009 (CFI 2010).

Marine macroinvertebrate and fish baseline conditions are based on information collected from various sources, including peer reviewed scientific literature, grey literature (e.g., DFO documents, consultant's reports), and local ecological knowledge (LEK) (e.g., discussion with local fishers, DFO's Community-based Coastal Resource Inventory [CCRI]).

For the purposes of this document, marine fish habitat includes habitat for both marine invertebrates and finfishes. Historically, there has been limited available information concerning fish habitat in Blue Beach Cove. However, some habitat information was collected in June 2009 during surveys associated with the proposed construction of a marine terminal in the cove. DFO determined that the footprint of the marine terminal would result in the harmful alteration, disruption or destruction (HADD) of marine fish habitat in the Blue Beach Cove area, making it necessary to quantify the existing habitat in the area. Surveys were conducted over two areas, i.e., the north and south options for the marine terminal. The habitat surveys used drop camera (videography) and SCUBA diving (photography, videography, diver observation) approaches for data collection.

4.2.1 Northern Blue Beach

The area surveyed in the northern portion of Blue Beach Cove had water depths ranging from 3 to 20 m. The depth and substrate of this area were very consistent over large areas with limited surface irregularity or complexity observed. Large portions of the survey area were characterized by coarse sand substrate which appeared to be underlain by bedrock. The northern side of the area was bounded by an exposed bedrock ridge extending from the shoreline. The inshore, shallow waters of the area were characterized by a rock and cobble substrate which extended from the beach.

Three types of marine vegetation were observed at the northern area. Coralline algae encrusted hard substrates such as cobbles and small rocks, fragments of coralline algae had accumulated in seabed depressions, and filamentous red algae and sea colander (*Agarum cribosum*) were associated with harder substrates. The sandy areas were largely devoid of vegetation. No eelgrass (*Zostera marina*) was observed.

A variety of finfishes and invertebrates were also observed during the habitat survey of the northern area, including sand dollars (*Echinarachnius parma*), green sea urchins (*Strongylocentrotus droebachiensis*), sea stars, purple sunstars, sea anemones, rock crab (*Cancer irroratus*), flatfishes, sculpins, and ocean pout (*Zoarces americanus*). Numerous holes, possibly due to the presence of polychaetes and/or clams, were also observed in sandy substrate. Sand dollars were very abundant on the sandy substrate, while urchins were most numerous on shallow water, rocky bedrock bottoms and on some sandy areas. Flatfishes, likely winter flounder (*Pleuronectes americanus*) were occasionally observed despite being camouflaged by a layer of sand.

4.2.2 Southern Blue Beach

Water depths in the southern Blue Beach Cove survey area ranged from 3 to 20 m. The site was characterized by bedrock and boulders with relatively limited sandy substrate. Occasional patches of sand were observed in bedrock depressions. Small gravel material was noted near the eastern edge of the southern survey area. Divers noted that the many crevices between boulders provided potential cover for macroinvertebrate species such as lobster and crab.

Compared to the northern survey area, marine vegetation was relatively abundant at the southern survey area. Several types of vegetation were observed, including kelp (edible kelp *Alaria* spp., horsetail kelp *Laminaria digitata* and sea colander), knotted wrack (*Ascophyllum nodosum*), rock weed (*Fucus* spp.), filamentous red algae, and filamentous green algae. The coverage of kelp, knotted wrack, and rock weed was limited to the inshore shallow waters except for the outermost eastern boundary of the survey area where kelp was also noted. No eelgrass was observed in the southern survey area.

Green sea urchins were the predominant faunal species observed in the southern survey area. Sea urchins numbered in the thousands and were most dense in locations closest to the shoreline. Other fauna observed included anemones, seastars, rock crab, spider (toad) crabs (*Hyas* sp.), flatfishes, sculpins, and cunner (*Tautogolabrus adspersus*). Lobsters (*Homarus americanus*) were not observed during the drop camera.

4.2.3 Shoal Cove

The substrate at Shoal Cove is characterized primarily by sand of which 10 to 15% is natural magnetite (N. Wilson, CFI, pers. comm.). Drop camera surveys are proposed for Shoal Cove during the EEM Program so more data related to physical and biological characteristics of the cove will be collected.

4.2.4 Fisheries

The two primary sources of information on fisheries in the vicinity of Great St. Lawrence Harbour include (1) DFO Newfoundland and Labrador (NL) commercial landings database, and (2) local ecological knowledge (LEK).

Local ecological knowledge was used to determine potential active fisheries occurring in the Blue Beach Cove area. One source of LEK used was the Community-Based Coastal Resource Inventory (CCRI) project. The Burin Peninsula portion of this LEK database was completed by DFO, Newfoundland Region, during fall and winter, 1998-1999. The CCRI project area for the Burin Peninsula covered coastal areas between Friar Head (Fortune Bay) and Davis Cove (Placentia Bay). Information concerning coastal fisheries resources and other data types was collected for the CCRI through interviews with knowledgeable individuals and stakeholders, most notably retired and active fishermen. Those being interviewed were asked to identify

areas where specific resources (e.g., groundfish, pelagics, shellfish, marine mammals, marine vegetation, etc.) were known to occur. The identified areas were mapped after the information was verified by at least three independent sources. Because the mapped data are qualitative, the information must be interpreted with caution and used only as a general guide.

The CCRI information for the Great St. Lawrence Harbour area was accessed online using the public DFO GeoBrowser v5.0. The arbitrarily chosen area assessed for CCRI extended from Shoal Cove to Bight Cove and included marine areas 1.5 to 3.0 km from shore. The LEK collected for the CCRI indicated fisheries for groundfish (lumpfish – *Cyclopterus lumpus*, Atlantic cod, flounder), pelagic fishes (capelin, Atlantic herring – *Clupea harengus harengus*, Atlantic mackerel – *Scomber scombrus*), and invertebrates (American lobster, squid and crab) occur or have occurred within or near Great St. Lawrence Harbour. These fisheries are summarized in Table 4-1.

A discussion with a St. Lawrence fisherman (E. Jarvis, pers. comm. 2009) indicated that commercial fishing within Great St. Lawrence 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 Great St. Lawrence 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 Great St. Lawrence Harbour when the opportunity arises. Mr. Jarvis (pers. comm.) indicated that most of the commercial fishery in the area is prosecuted outside of Great St. Lawrence Harbour. He said that both Atlantic cod and American plaice are fished primarily to the south and west of the harbour.

4.3 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.

Based on a 2002 wind farm study (JWEL 2003), the St. Lawrence area is expected to support from 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). Shorebird observations in the Shoal Cove Pond-Shoal Cove Beach area in 2002 are presented

in Table 4-2. 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 2 are marine/coastal (Table 4-3).

Table 4-1: Fisheries Resources Located within Great St. Lawrence Harbour Based on the Burin Peninsula Community-Based Coastal Resource Inventory and Consultation with Fishermen.

Target Species	Fishery Type	Timing	Depths Fished (m)	Gear Type	Location
Atlantic mackerel	Bait	Aug-Sep	18	Mackerel nets	GSLH
Atlantic herring	Bait	Jan-Apr	9-36	Seine nets, gillnets	GSLH
Capelin	Recreational	June	9-27	Seine nets, dip nets	GSLH, incl. Blue Beach Cove
Atlantic cod	Commercial	June-Oct	27-90	Gillnets, cod trap, hook and line, trawl	South of GSLH
Lumpfish	Commercial	May-June	11-45	Lumpfish nets	Outside of GSLH
Flounder	Commercial	May-Oct	90-108	Gillnets, hook and line	South of Lawn Point, east to Ferryland Head
Squid	Recreational	Aug-Sep	4-18	Hook and line	GSLH
Snow crab	Commercial	May-Sep	99-180	Crab pots	3-5 km outside of GSLH
American lobster	Commercial	Apr-June	4-36	Lobster pots	West shore of GSLH, incl. Blue Beach Cove

GSLH: Great St. Lawrence Harbour

Table 4-2: Shorebird Observations in the Shoal Cove Pond – Shoal Cove Beach Area in 2002.

Species	Date	Shoal Cove Beach	Shoal Cove Pond	Hares Ears	Blue Beach Cove
Black-bellied Plover	27 Sep-2 Oct	3			
American Golden Plover	18 Sep		1		
	19 Sep			3	
	21 Sep		17	1	
	25 Sep			4	
	30 Sep			6	
	3 Oct			2	
Whimbrel	19 Sep			1	
Dunlin	21 Sep	7			
	30 Sep-2 Oct	3			
Pectoral Sandpiper	30 Sep	2			
	2 Oct	4			
Baird's Sandpiper	21 Sep		1		
Sanderling	18 Sep	7			
	21 Sep	33			
	28 Sep	11			
	30 Sep	2			
	2 Oct	7			
Greater Yellowlegs	30 Sep-2 Oct	Grps < 20	Grps < 20		
Semipalmated Plover	18 Sep	4			
	19 Sep				1
	25 Sep			1	
	28 Sep			4	
	30 Sep	1			
	2 Oct	6			
Common Snipe	18 Sept		1		

Source: JWEL 2003

Table 4-3: List of Birds Observed in the St. Lawrence Area for 2003 to 2009.

Species	Category	J	F	M	A	M	J	J	A	S	O	N	D
Common Loon	R		x	x	x	x	x	x	x	x	x		x
American Coot	V					x							
Manx Shearwater	MB						x	x	x	x	x		
Northern Fulmar	MB					x	x			x			
Northern Gannet	MB	x	x	x	x	x	x	x	x	x	x	x	
Great Cormorant	R		x		x		x				x		x
Double-crested Cormorant	MB	x	x	x	x	x	x	x	x	x	x	x	x
Parasitic Jaeger	V						x						
Leaches Storm Petrel	V									x			
Great Blue Heron	M					x			x				
Little Blue Heron	V					x	x						
Yellow-crowned Night Heron	V								x				
American Bittern	MB						x	x					
Canada Goose	MB				x	x	x	x	x	x	x	x	
Mallard	MB/R				x	x	x						
Green-winged Teal	MB					x	x	x	x				
White-winged Scoter	M								x				
American Black Duck	MB/R				x	x	x			x		x	
Northern Pintail	MB					x	x						
Greater Scaup	MB/R					x	x						
White-winged Scoter	M												
Oldsquaw	M				x	x						x	
Red-breasted Merganser	R					x							
Northern Goshawk	R		x				x						
Sharp-shinned Hawk	R	x	x	x	x	x	x	x	x	x	x	x	x
Rough-legged Hawk	R			x			x		x				
Northern Harrier	MB				x	x	x	x	x				
Osprey	MB					x	x	x	x	x			
Peregrine Falcon	M					x					x		
Bald Eagle	R	x	x	x	x	x	x	x	x	x	x	x	x
American Kestrel	MB			x			x						
Merlin	MB					x	x	x					
Great Horned Owl	R	x	x	x	x	x	x	x	x	x	x	x	x
Short-eared Owl	R					x	x	x					
Willow Ptarmigan	R	x	x	x	x	x	x	x	x	x	x	x	x
Ruffed Grouse	R		x	x	x	x	x						
Black-bellied Plover	M					x			x	x	x		
American Golden Plover	M								x				
Semipalmated Plover	MB							x	x	x	x		
Ruddy Turnstone	M								x	x	x		
Semipalmated Sandpiper	MB								x	x	x		
Least Sandpiper	MB								x				
Greater Yellowlegs	MB				x	x	x	x	x	x	x	x	

Species	Category	J	F	M	A	M	J	J	A	S	O	N	D
Spotted Sandpiper	MB					x	x	x	x	x	x	x	
Sanderling	M					x		x	x	x	x		
Common Snipe	MB				x	x	x	x	x	x			
Whimbrel	M								x				
White-rumped Sandpiper	M								x				
Piping Plover	MB									x			
Northern Lapwing	V											x	x
Great Black-backed Gull	R	x	x	x	x	x	x	x	x	x	x	x	x
Herring Gull	R	x	x	x	x	x	x	x	x	x	x	x	x
Ring-billed Gull	MB	x	x	x	x	x	x	x	x	x	x	x	x
Black-legged Kittiwake	MB/R								x				
Iceland Gull	M	x	x	x	x	x							x
Glaucous Gull	M	x											
Black-headed Gull	V		x								x		
Franklin's Gull	V						x						
Caspian Tern	MB					x	x	x	x	x			
Common Tern	MB					x	x	x	x				
Arctic Tern	MB							x					
Dovekie	M	x	x								x	x	x
Common Murre	MB/R						x						
Black Guillemot	R	x	x	x	x	x	x	x	x	x	x	x	x
Rock Dove	R					x			x				
Mourning Dove	M	x	x	x	x	x	x	x	x	x	x	x	x
Belted Kingfisher	MB	x	x			x	x	x	x	x	x	x	
Northern Flicker	R				x	x	x	x	x	x	x	x	
Eastern Kingbird	M					x	x						
Yellow-bellied Flycatcher	M						x	x	x	x			
Alder Flycatcher	M						x						
Tree Swallow	MB						x	x	x	x	x	x	
Barn Swallow	M				x	x	x		x		x	x	
Chimney Swift	M				x						x	x	
Grey Jay	R	x	x	x	x	x	x	x	x	x	x	x	x
Blue Jay	R	x	x	x	x	x	x	x	x	x	x	x	x
Common Raven	R	x	x	x	x	x	x	x	x	x	x	x	x
American Crow	R	x	x	x	x	x	x	x	x	x	x	x	x
Black-capped Chickadee	R	x	x	x	x	x	x	x	x	x	x	x	x
Boreal Chickadee	R					x	x						x
Red-breasted Nuthatch	MB				x	x	x					x	
Golden-crowned Kinglet	R										x		
Ruby-crowned Kinglet	MB					x	x	x	x				
Grey Catbird	M					x	x						
American Robin	R	x	x	x	x	x	x	x	x	x	x	x	x
Hermit Thrush	MB					x	x	x	x	x			
Swainson's Thrush	MB						x						
Horned Lark	MB				x	x	x	x	x				

Species	Category	J	F	M	A	M	J	J	A	S	O	N	D
Northern Shrike	MB	x											
Water Pipit	MB					x	x	x	x	x	x		
Cedar Waxwing	M							x					
Bohemian Waxwing	V		x										
Starling	R	x	x	x	x	x	x	x	x	x	x	x	x
Yellow Warbler	MB					x	x	x	x	x	x	x	
Magnolia Warbler	M						x						
Yellow-rumped Warbler	MB			x	x	x	x	x	x	x	x	x	
Black-throated Green Warbler	M						x				x		
Palm Warbler	M					x				x			
Blackpoll Warbler	MB				x	x	x	x	x	x	x		
Black & White Warbler	MB					x	x	x	x				
Northern Waterthrush	MB					x	x	x	x				
Mourning Warbler	MB					x	x	x					
Common Yellowthroat	MB					x	x	x	x	x			
Philadelphia Vireo	V						x			x			
Red-winged Blackbird	M	x	x	x	x							x	x
Brown-headed Cowbird	V							x					
Wilson's Warbler	MB					x	x	x	x	x			
Scarlet Tanager	V					x							
American Redstart	M						x						
American Tree Sparrow	M	x	x	x	x	x	x	x					
Chipping Sparrow	V				x								
Savannah Sparrow	MB	x	x	x	x	x	x	x	x	x	x		
Fox Sparrow	MB	x	x	x	x	x	x	x	x	x	x	x	x
Song Sparrow	MB	x	x	x	x	x	x	x	x	x	x	x	x
Swamp Sparrow	MB					x	x	x	x	x	x	x	
White-throated Sparrow	MB	x	x	x	x	x	x	x	x	x	x	x	
Dark-eyed Junco	R	x	x	x	x	x	x	x	x	x	x	x	x
Snow Bunting	M										x	x	
White-winged Crossbill	R	x	x	x									
Rose-breasted Grosbeak	M				x	x							
Indigo Bunting	M				x		x						
Purple Finch	R	x	x	x	x	x	x	x	x	x	x		
Rusty Blackbird	MB	x	x		x	x	x	x			x		
Common Grackle	R		x	x	x	x	x	x	x	x	x	x	
Pine Grosbeak	R	x	x	x	x	x	x	x	x	x	x	x	x
Blue Grosbeak	V										x		
Common Redpoll	M		x	x	x	x	x	x	x				
Hoary Redpoll	M				x								
Pine Siskin	R	x	x	x	x	x	x	x	x	x	x		
American Goldfinch	R	x	x	x	x	x	x	x	x	x	x	x	x
House Sparrow	R	x	x	x	x	x	x	x	x	x	x	x	x
Dickcissel	M	x	x	x									x

Source: N. Wilson, CFI, pers. comm.; Category: M – Migratory; MB – Migratory Breeder; R – Resident; V - Vagrant

Of the birds that occur within the Project area, the migratory shorebirds are of most concern with respect to potential effects of construction activities. Therefore, only migratory shorebirds are considered in the design of the EEMP.

5 MONITORING DESIGN METHOLODGY

As indicated in Section 5.9.4 of the EPR (CFI 2009), "the Proponent will develop a comprehensive Environmental Monitoring Plan at an early stage of the Project implementation. It will start with baseline monitoring of existing conditions. The program has already started and will continue for some time during construction. Then a long term monitoring program will be implemented as needed by permits and certificate of approval".

"The Environmental Monitoring Plan will include Environmental Effects and Compliance Monitoring. The Plan will be developed in consultation with regulators. The Plan will detail the methods and procedures to be used by contractors on-site when conducting their activities. The Plan will allow Vendors/Contractors to ensure that all the activities carried out under their direction or by their subcontractors/suppliers are in compliance with the permit, approval and authorization requirements, the Proponent's site EPP and the Emergency Preparedness Plan. The Proponent's HS&E On-site Supervisor (or designate) and/or Company Representative has the right to monitor and/or audit any work in progress, or completed, at any time to ensure compliance with the EPP".

The EEMP presented in this document addresses the measurement of variables associated with candidate parameters that may be affected by mine reactivation construction activities. Historical data, as well as data collected during the pre-construction baseline surveys, will help to identify the candidate environmental parameters, and spatial and temporal design aspects of the EEMP. Furthermore, baseline data serves as a benchmark against which the future environmental data will be evaluated. The strategy of the EEMP is not to exhaustively study every aspect of the environment surrounding the Project area, but to focus upon those attributes which have been used in the assessment to predict environmental effects, particularly those where an important effect may occur and/or where predictions are uncertain. This approach will allow effective environmental monitoring of the Project.

5.1 Framework

The first step in designing an EEM program is to define the expectations and goals, based upon input from regulators, permitting requirements, public concerns, and the scientific community. This information was obtained from the EPR (CFI 2009) as well as from previous studies of similar nature within the area.

The second step in designing an EEM program is to develop the pre-construction monitoring strategy with the aid of a baseline survey. This task required the evaluation of the environmental components at risk and the sources of potential effects from the Project. Some baseline data were collected in 2009 as part of the Water Quality and Fish Habitat Program in St. Lawrence; Proposed Re-Activation of Fluorspar Mine (AMEC 2009), and the marine habitat characterization survey conducted by LGL Limited for the Marine Fish Habitat Compensation Strategy for Marine Terminal Footprint St. Lawrence, NL (CFI 2010). Much of the bird data for the Project area were collected in 2002 (JWEL 2003) and since 2003 by Gail and Norman Wilson of St. Lawrence.

As the EEM program uses the adaptive management philosophy, the stations and variables may be adjusted depending upon results obtained from baseline and ongoing monitoring or changes in construction design. However, it has been designed to ensure that a core group of study components, locations and parameters are available that will enable temporal comparisons between the different phases of the Project (i.e. baseline, construction, operation, decommissioning and post-decommissioning).

The results of initial steps were used to determine the environmental data to be measured and the spatial distribution of the data sampling. Scientific knowledge and professional judgment were also used to select the measurements, the sampling distribution, and frequency of sampling.

5.2 Monitoring Goals and Exclusions

The baseline survey has been designed to characterize existing conditions of the environment in and around the Project area. From this information, and the interactions the construction activities of the Project will have with the environment identified within the EPR, a program can be developed to confirm effects predictions and to monitor environmental responses to the

Project. It is important to note, however, that the EEM sampling is an adaptive process and certain components may be modified, added, or discontinued from one sampling period to the next depended upon the findings. However, the importance of maintaining the EEM Program's scientific defensibility and integrity is recognized and the utmost effort will be made to maintain its consistency and repeatability. The pre-construction monitoring plan considers the following areas of interest:

- freshwater and seawater quality;
- freshwater and marine fish and fish habitat;
- freshwater benthic macroinvertebrate community; and
- migratory shorebirds and associated habitats.

5.3 Detectable Change Concept and Maximum Acceptable Effects Levels

An EEMP should be able to detect specific changes to environmental components. Parameters are chosen based on their relevance to issues important to the public, stakeholders and/or regulators. The biological, chemical and physical measurements identified for the baseline survey associated with the EEMP were carefully chosen as the candidate parameters with these considerations in mind.

Where a monitoring program can measure an effect directly (e.g., chemistry), test results can be compared to Maximum Acceptable Effects Levels (MAEL). Where indirect links in cause and effect relationships are being measured, determination of a MAEL is more difficult. Often regulatory standards identify acceptable exposure levels. These levels are often taken as MAEL. Some parameters, such as turbidity, are governed by specific regulations (Canadian Council of Ministers of the Environment (CCME)) which prescribe guidelines for increases in TSS due to an activity/project. In the absence of regulated values, a typical MAEL may be determined by a statistically significant change in a measurement compared to values obtained by the baseline survey and/or by comparison to reference stations outside the area of predicted effects. The EEM measures baseline variability and then monitors for changes outside of baseline variability or for exceedances of some MAEL or a regulatory guideline.

5.4 Design and Review Process

Parameters and baseline sampling design from previous EEMP related studies concerning the construction activities of mining projects were reviewed to evaluate the technical aspects and relevance to the proposed EEMP design. This review aided in ensuring that the proposed studies are scientifically sound, the relevant Valued Ecosystem Components (VECs) have been addressed, and that Newspar fulfils its social role and environmental policy by mitigating and minimizing predicted project effects.

The EPR (CFI 2009) has laid the groundwork for the development of the baseline survey design associated with the EEMP by detailing project-environment interactions and making impact predictions.

5.5 Statistical Analysis

Data will be interpreted using scientifically defensible techniques (i.e., comparisons to reference and baseline data); however, statistically significant results are not necessarily environmentally significant results. Therefore, appropriate effects based benchmarks may be utilized in data interpretation. Due to the unique conditions at the site (brownfield site), there may be some value in developing site specific benchmarks for some of the parameters.

5.6 Baseline Sampling (Pre-construction)

The EEMP baseline survey will provide information on conditions in both the near-field (potentially impacted areas during construction activities) and far-field areas (areas at the limits of the zone of influence) prior to the onset of the construction activities, and assess baseline spatial variability in the absence of Project related effects. To ensure clear reporting of the variability, the data will be reported using various summary statistics including mean, median, standard deviation, standard error, and minimum and maximum values. As the construction phase of the Project is scheduled to start in the third quarter of 2012, the time to conduct seasonal baseline measurements is limited. Therefore, data collected at reference stations both before and during construction will be used to assess the magnitude of seasonal and year-to-year variation.

The statistical models or tools used to assess whether significant environmental effects are occurring or have occurred as a consequence of Project activities are typically based on Analysis of Variance (ANOVA) or regression techniques. These methods allow for the natural variability of a parameter to be described such that significant changes can be detected.

Following the principle that simplicity and clarity in statistical analysis are preferred, the following approach is suggested. The baseline EEMP data set can be used to determine the typical range of natural, pre-Project variability for each of the measured environmental variables. This variability will be assessed using standard exploratory data analysis techniques, such as ANOVA or regression.

5.7 Sampling After Onset of Construction

Data collected during sampling events scheduled during and after construction will be compared to the typical range of conditions determined during baseline sampling. It is assumed that near-field and far-field/reference stations are affected in the same way by seasonal and long-term trends. Data identified as outliers in either the near-field or the far-field sampling stations will be subject to investigation.

5.8 Overview of General Monitoring Designs

There are several study designs that can be used in an EEMP. Brief descriptions of the potential sampling designs proposed in this program are given below. If data quality allows it, the combined Before-After/Reference-Impact (BARI) design with two-way ANOVA comparisons will be used.

5.8.1 Before-After (BA)

The Before-After design includes sampling prior to the onset of any construction activities (i.e., baseline survey) as well as sampling during and/or after construction. This design typically utilizes one-way ANOVA comparisons between sampling times.

5.8.2 Reference-Impact (RI)

Reference-Impact design includes sampling within and outside of the potentially impacted area. The sampling stations within and outside of the potentially impacted area should have similar

characteristics. This design typically utilizes one-way ANOVA comparisons between sampling areas.

5.8.3 Before-After/Reference-Impact (BARI)

Another design approach is to use a combined Before-After/Reference-Impact (BARI) design for assessing environmental effects. The design requires estimates for the response variable of interest (e.g., turbidity of seawater) in the four BARI cells—BR, BI, AR, and AI. This information allows the determination of whether the relationship between the reference and impact sites changed following the onset of marine construction activities. In other words, it allows the determination of whether the relationship between the before and after period differed between the reference and impact sites. The classic statistical test for data that fit this design and conform to the required parametric assumptions would be a two-way ANOVA; the two factors (categorical variables) would be (1) time period (levels=before and after) and (2) study site (levels=reference and impact). A statistically significant interaction between the two factors would suggest that a measurable impact occurred. The reference-impact site component will help remove confounding influences through time while the before-after component will help remove confounding influences through space.

5.8.4 Gradient-to-Background

The fundamental premise behind the gradient-to-background approach is that there is a well-defined, localized potential source of impact and that selected effects can be monitored at increasing distances from that source. This approach will be used in the marine construction EEM Program, particularly at Blue Beach Cove, where three sampling stations will be established on a transect oriented towards the potential source of impact. By monitoring at progressively distant intervals from the potential source of impact, one is effectively passing along a gradient and at some theoretical distance from the potential source of impact, background or ambient conditions should be observed. The stations at Shoal Cove and Salt Cove can also be considered as part of the design, although they are located around a headland and not along the more obvious linear transect in Blue Beach Cove.

5.9 Determining Suitable Components of an EEMP

Historical data and data collected during pre-construction baseline surveys provide a foundation upon which construction EEMPs can be developed. A baseline survey is intended to be broad-based and could possibly include parameters and sampling stations that may not be carried into the final EEMP.

5.10 Potential Project Construction Activity- Environment Interactions Identified in the EPR

The proposed EEM program concerns the interactions of Project construction activities with the freshwater fish and fish habitat, marine fish and fish habitat and birds, specifically migratory shorebirds. The EPR laid the groundwork for the development of the baseline survey design by detailing on-land and marine construction activities (with their potential Project-environment interactions). These activities have been summarized earlier in this document.

This EEM program will focus on potential discharges and emissions (including noise) into the freshwater and marine environments during construction activities. A Waste Management Plan and an Environmental Protection Plan will be implemented and will state mitigation measures for runoff and siltation events. All discharges and emissions are diffuse in nature and mostly relate to episodic events throughout construction activities.

5.11 Monitoring Objectives

Objectives of the development and application of the EEMP include:

- To test whether effects on the environment are within the bounds predicted by the EPR and associated component studies;
- To address public concerns;
- To fulfill regulatory requirements in terms of permitting requirements and commitments made in the EPR; and
- To provide an early warning of a potential environmental impact.

The baseline survey is not designed to cover effects from accidental releases, malfunctions, and unplanned events identified in the EPR. Rather, mitigation planning for these events will be discussed with regulators and addressed in the Environmental Protection Plan and the Emergency Preparedness and Response Plan.

6 DESIGN OF PROJECT CONSTRUCTION EEMP

The proposed design of the Project Construction EEM program is presented below as three separate components: (1) the freshwater fish and fish habitat, (2) the marine fish and fish habitat (including commercial fisheries), and (3) birds, most notably migratory shorebirds.

6.1 Freshwater Fish and Fish Habitat

After conducting a review of previous studies within the area, reviewing the potential effects identified in the EPR, and addressing concerns raised by the public and regulatory requirements, the following list of sampling components has been compiled to be incorporated in the freshwater Fish and Fish Habitat component of the EEMP:

- Freshwater quality
- Freshwater fish
- Freshwater benthic macroinvertebrate community.

The basic strategy of the monitoring design is to measure variables that can be affected by the Project and can reasonably interact with the freshwater system components listed above to cause a detectable change from baseline conditions. Spatial coverage is designed to be able to determine the geographical extent of any changes noted during monitoring for the freshwater Fish and Fish Habitat component of the EEMP.

The overall design of this EEMP component is provided in the following sections and includes the proposed sample station locations, sampling frequencies, laboratory analyses, and morphological and statistical analyses.

All measurements identified are related to diffuse discharges mostly caused by episodic events throughout construction activities. These types of discharges and emissions will be measured using the Before-After/Reference-Impact approach.

- Freshwater quality – water quality sampling (Before-After/Reference-Impact);
- Freshwater fish and fish habitat – index electrofishing (Before-After/Reference-Impact); and
- Freshwater benthic macroinvertebrate community – benthic surveys (Before-After/Reference-Impact).

6.1.1 Sample Frequency, Locations and Timing

6.1.1.1 Freshwater Quality

Water quality was identified as an important aspect of the freshwater component of the Fish and Fish Habitat VEC in the EPR, primarily because of the potentially damaging effects of suspended solids to freshwater aquatic species, and the potential of release of contaminants (e.g., cement fines) into the water. The EPR has identified mitigation measures to reduce sediment loading during construction. The EPP will also address and identify mitigation measures to reduce runoff and siltation events.

The recommended frequency for freshwater quality monitoring is four times per year to capture both low and high flow conditions, the interval between each sampling event being at least 30 days (Table 6-1). This frequency is recommended because of the seasonal variability in brook flows (discharge) and requirements from the Department of Environment and Conservation.

Freshwater quality sampling will be conducted at a total of ten stations (Figure 6-1): one north of Clarke's Pond (WS-1 located upstream from the intended location of discharge input from the Blue Beach North mine water settling ponds and initial dewatering activities, two (WS-14, WS-1a) are located in a small tributary of Shoal Cove Pond upstream from the Tailings Management Facility and impoundment area, one within Clarke's Pond Brook (WS-2), two within in Shoal Cove Brook (WS-4 and WS-6), one in Salt Cove Brook below the old canal (WS-9), and one in the western most tributary of Salt Cove Brook (WS-11). Water samples will also be taken from two boreholes (BH-1 and BH-8), as shown in Figure 6-1. WS-1a, WS-11 will be used as

reference sites because they are located away from construction areas (WS-11) or upstream of activities (WS-1). WS-2, WS-4, and WS-6 will be used as impact site locations because they are located within the Shoal Cove Brook watershed downstream of areas of construction. WS-9 will be used to evaluate any impacts associated with construction of the freshwater fish compensation channel and to measure any effects associated with the additional remedial measures given in the 1997 Fish Habitat Compensation Agreement – Shoal Cove Pond Tailings Project. The water samples taken from the boreholes will give an indication of groundwater changes or impacts due to construction activities. Flow can be measured in both the inflow stream and outflow stream of Clarke's Pond and flow within Shoal Cove Brook can be monitored as well. A staff gauge can be installed in Clarke's Pond to measure variations in the water level and the timing of water quality sampling will be such that it adequately captures the seasonal variability in hydrological conditions.

Table 6-1: Specifics of Freshwater Fish and Fish Habitat EEM Sampling

EEM Component	Survey Type	EEM Approach	Baseline Sampling	Frequency and Timing of Sampling		
				Baseline	2013	2014
Freshwater Quality	Water sampling; *In situ* Physical / chemical analysis	Before-After/ Reference-Impact	Yes	4x Spring Mid- to late-summer Fall Winter	4x Spring Mid- to late-summer Fall Winter	4x Spring Mid- to late-summer Fall Winter
Freshwater Fish and Fish Habitat	Quantitative electrofishing	Before-After/ Reference-Impact	Yes	1x Mid- to late-summer	1x Mid- to late-summer	1x Mid- to late-summer
Freshwater Benthic Macroinvertebrate Community	Invertebrate sampling	Before-After/ Reference-Impact	Yes	1x Mid- to late-summer	1x Mid- to late-summer	1x Mid- to late-summer

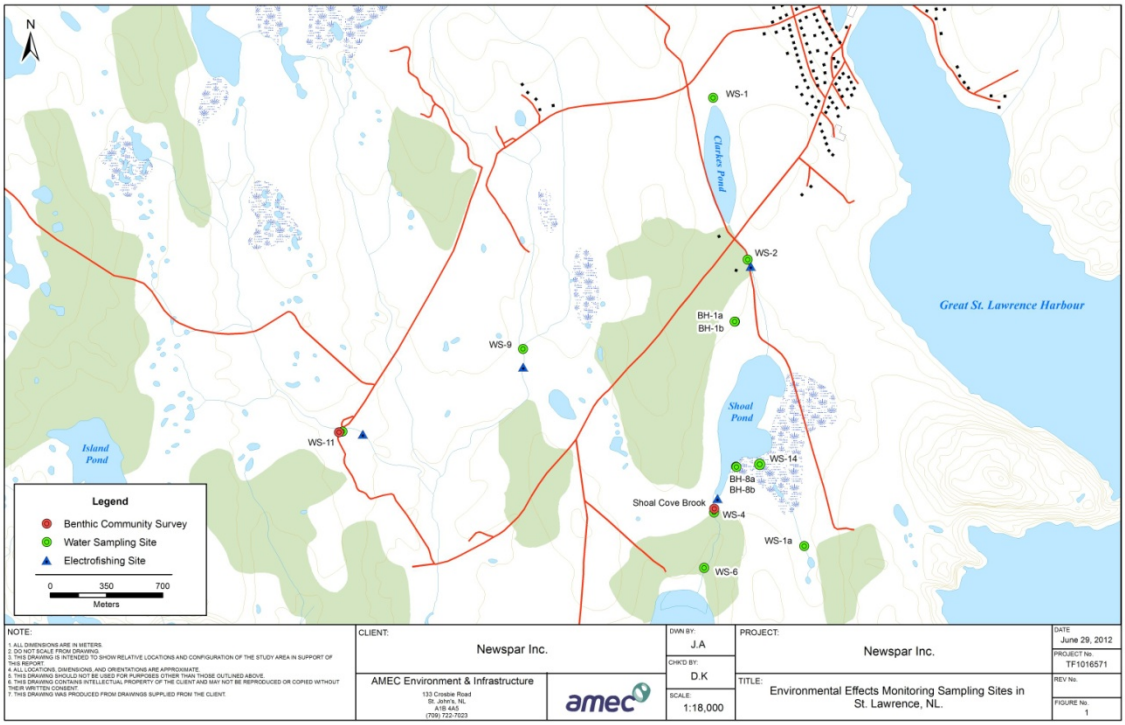


Figure 6-1: Proposed Freshwater Fish and Fish Habitat Sampling Stations

6.1.1.2 Freshwater Fish and Fish Habitat – Fish Population Survey

Major construction activities are proposed to start in the third quarter of 2012 and continue to the start of production in the fourth quarter of 2014. Because of this, it is recommended that full quantitative electrofishing be conducted during construction (mid- to late summer 2013 and 2014) (Table 6-1) and baseline electrofishing is scheduled for late summer 2012. Index electrofishing data collected in August 2009 can also serve as pre-construction data and can be directly compared to the initial sweep at an adjacent quantitative site (as a minimum a quantitative site will have four sweeps).

Quantitative electrofishing will be conducted in Shoal Cove Brook and Clarkes Pond Brook, where fish could reasonably be expected to be exposed to construction activity influences. These surveys give species composition utilizing the habitat within the streams as well as the size/age distribution of each species. The timing of electrofishing may be integrated with the fish habitat compensation activities also associated with the use of Shoal Cove Pond as a tailings pond. Quantitative electrofishing will also be conducted at two sites in the Salt Cove

Brook watershed as indicated in Figure 6.1. The quantitative electrofishing site located near WS-11 in Salt Cove Brook watershed will be used as the reference site.

6.1.1.3 Freshwater Benthic Macroinvertebrate Community Survey

Benthic macroinvertebrate communities can serve as sensitive biomonitors. Benthic community surveys will be conducted downstream of Shoal Cove Pond around the same location of the electrofishing site. A survey will also be conducted near WS-11 and will be used as a reference site. Baseline benthic macroinvertebrate data will be collected before the onset of construction in 2012, preferably in the late summer/early fall. It is recommended that subsequent freshwater benthic macroinvertebrate sampling be conducted in mid-to late summer 2013, and mid- to late-summer 2014 (Table 6-1). The benthic macroinvertebrate communities should be relatively stable in mid- to late summer since emergence will have already occurred, organisms are larger than at earlier points in the year, and flow rates do not prohibit effective sampling.

6.1.1.4 Sample/Data Collection Methods

Freshwater Quality

In situ physicochemical attributes will be recorded at each selected survey location (including quantitative electrofishing and benthic invertebrate community survey locations) using a Hydrolab Surveyor 4a water sensor. *In situ* parameters such as water temperature (^{o}C), dissolved oxygen (mg/L and percent saturation), pH, turbidity (NTU), salinity (‰) and specific conductivity (µS/cm) will be recorded. Water sample sub-sets will also be collected and sent for analysis for standard water quality parameters such as general chemistry and metals. Water quality data will be collected by grab techniques using standard collection methods. Specifically, water samples will be collected just below the surface upstream of any influence of the individual taking the sample and directly into the appropriate sample bottles. Multiple samples will be collected. Water samples will always be collected prior to any disturbance associated with the collection of other types of samples. Borehole samples for metal analysis will be filtered in the field prior to being preserved for shipment to the lab.

Freshwater Fish and Fish Habitat – Fish Population Survey

Quantitative electrofishing will be conducted with a backpack electrofisher as per Scruton and Gibson (1995), for species presence and composition. These surveys give species composition

utilizing the habitat within the streams as well as the size/age distribution and general condition of each species. An experienced operator and at least one net person will conduct the electrofishing. All team members will be fully equipped with protective equipment to eliminate any risk associated with using electrical current in water. Stream characterization data (as per Sooley *et al*., 1998 and Scruton *et al*., 1992) will also be collected at this time. Measurements will include channel dimensions (e.g., channel width, wetted width, ice scour height), substrate composition (e.g., percent streambed cover by substrate each size), stream slope, instream features (transects for water depth, velocity and discharge), riparian vegetation (e.g., dominant species, percent cover, instream woody debris) as well as appropriate photos. The general habitat description will also be determined (i.e., pool, riffle, run habitat quantities).

Freshwater Benthic Macroinvertebrate Community Survey

Benthic samples from Shoal Cove Brook will be collected using a Surber sampler (0.1 m^2). The Surber sampler will be placed on representative erosional substrate (cobble) and all material falling within the boundaries of the sampler will be carefully handwashed free of any debris. Loosened debris will then be transported by the current into the mesh bag attached to the sampler. After washing is complete, the entire procedure will be repeated at two more proximal locations to produce a three-grab composite. After completion of the procedure for the third time, the sampler will be carefully washed to ensure all organisms are within the mesh bag. The bag will then be removed and its contents will be carefully transferred to labelled, wide-mouth plastic jars using a wash bottle while working over a plastic tub to avoid the potential loss of sample. All samples will be preserved within 6 hours with buffered formalin solution to achieve an overall preservative concentration of 10%. Since the benthic community survey will be in the same location as electrofishing activities, all supporting measures will have already been taken (i.e., depth, substrate, velocity, etc.). The identification of fauna in the benthic invertebrate samples will be conducted by a qualified aquatic invertebrate biologist.

6.1.1.5 Sample Analysis

An accredited laboratory under either the Canadian Association for Laboratory Accreditation (CALA) or Standards Council of Canada (SCC) will be subcontracted to analyze the freshwater samples. Samples collected at all stations will be analyzed for general water chemistry, metals, Total Suspended Solids (TSS), and hydrocarbons (TPH as measured by the Atlantic PIRI

method). All analyses will conform to the NL ENVC *Accredited Laboratory Policy PD:PP2001-01.02*. Specific analyses and methods associated with freshwater analyses are indicated in Table 6.2.

Table 6-2: Specifics of Freshwater and Groundwater Physical/Chemical Analyses

Matrix Sampled	Parameter	Method Reference
Groundwater	General Chemistry	Various methods
	Dissolved Metals	ICP-MS
Surface Water	General Chemistry	Various methods
	Total Metals	ICP-MS
Water	TSS	EPA 160.2
	BTEX/TPH	Atlantic PIRI
	Salinity	Hydrolab
	pH	Hydrolab
	Temperature	Hydrolab
	Dissolved Oxygen	Hydrolab
	Conductivity	Hydrolab

Source: Maxxam Analytics Quotation, 20 June 2012

6.1.1.6 Data Analysis

Appropriate statistical analyses will be conducted on data collected during the freshwater component of the EEMP. As already indicated, two-way ANOVA will be conducted when data are suitable to investigate spatial and temporal comparisons. Data from the benthic invertebrate survey will be used to calculate various community indices, such as diversity (richness, Shannon-Weiner, H_{max}, and evenness), as another means of spatial and temporal comparison.

6.2 Marine Fish and Fish Habitat

After conducting a review of existing studies within the area, reviewing the potential effects identified in the EPR, and addressing concerns raised by the public and regulatory requirements, the following list of sampling components have been compiled to be incorporated in the EEM Program:

- Seawater quality
- Surficial sediment quality

- Marine macroinvertebrates and fishes.

The basic strategy of the monitoring design is to measure marine variables that can be affected by the Project and can reasonably interact with the marine environmental components listed above to cause a detectable change from baseline conditions. Spatial coverage is designed to be sufficient to determine the geographical extent of change during EEM monitoring.

The overall design of the marine Fish and Fish Habitat component of the EEMP is provided in the following sections and presents the sample station locations, sampling frequencies, laboratory analyses, morphological analyses, and statistical comparisons utilized in the EEM. Timing and frequency of sampling for this EEM component are based on the projected duration of wharf construction activities (i.e., 365 days).

All measurements identified are related to diffuse discharges/emissions mostly relating to episodic events throughout construction activities. These types of discharges and emissions will be measured using a before-after/reference-impact approach.

6.2.1 Sample Frequency, Locations and Timing

6.2.1.1 Seawater Quality

Water quality was identified as an important aspect of the marine component of the Fish and Fish Habitat VEC in the EPR, primarily because of the potentially damaging effects of suspended solids to marine macroinvertebrate and fish species. The EPR has identified mitigation measures to reduce sediment loading during construction. The EPP will also address and identify mitigation measures to reduce runoff and siltation events.

The recommended frequency for seawater quality monitoring during the marine construction EEM Program is once before the onset of marine construction activities, two times during marine construction activities, and once after completion of marine construction activities (Table 6-3). Seawater quality sampling will be conducted at five stations, three in northern part of Blue Beach Cove (NBB-1, NBB-2 and NBB-3), one at Shoal Cove (ShC-1) and one at the marine reference station, Salt Cove (SaC-1) (Figure 6-2). The timing of seawater quality sampling will be such that it adequately captures the seasonal variability in water column stratification.

Table 6-3: Specifics of Marine Fish and Fish Habitat EEM Sampling

EEM Component	Survey Type	EEM Approach	Baseline Sampling	No. of Stations	Frequency and Timing of Sampling		
					Baseline	During Construction	After Construction
Seawater Quality	Water sampling *In situ* physical/chemical measurement	Before-After/ Reference-Impact	Yes	5	1x before onset of wharf construction activities	2x	1x
Surficial sediment quality	Grab sampling	Before-After/ Reference-Impact	Yes	5	1x before onset of wharf construction activities	2x	1x
Marine macro invertebrates and fishes	Drop camera survey Underwater sound pressure and particle motion measurement	Before-After/ Reference-Impact	Yes	Survey transects in Blue Beach Cove, Shoal Cove and Salt Cove (reference station) 4 stations for sound measurement (3 at Blue Beach Cove and 1 at Salt Cove)	2009 marine benthic habitat survey will serve as baseline for drop camera survey at Blue Beach Cove. Baseline drop camera surveying will be needed for Shoal Cove and Salt Cove, the reference station. Underwater sound measurement 1x before onset of wharf construction activities	Drop camera survey 1x during blasting at all three coves Underwater sound measurement 1x during blasting)	Drop camera survey 1x at all three coves
Commercial fisheries	Interview	Before-After	Yes	n/a	As in EPR (CFI 2009)	1x	1x

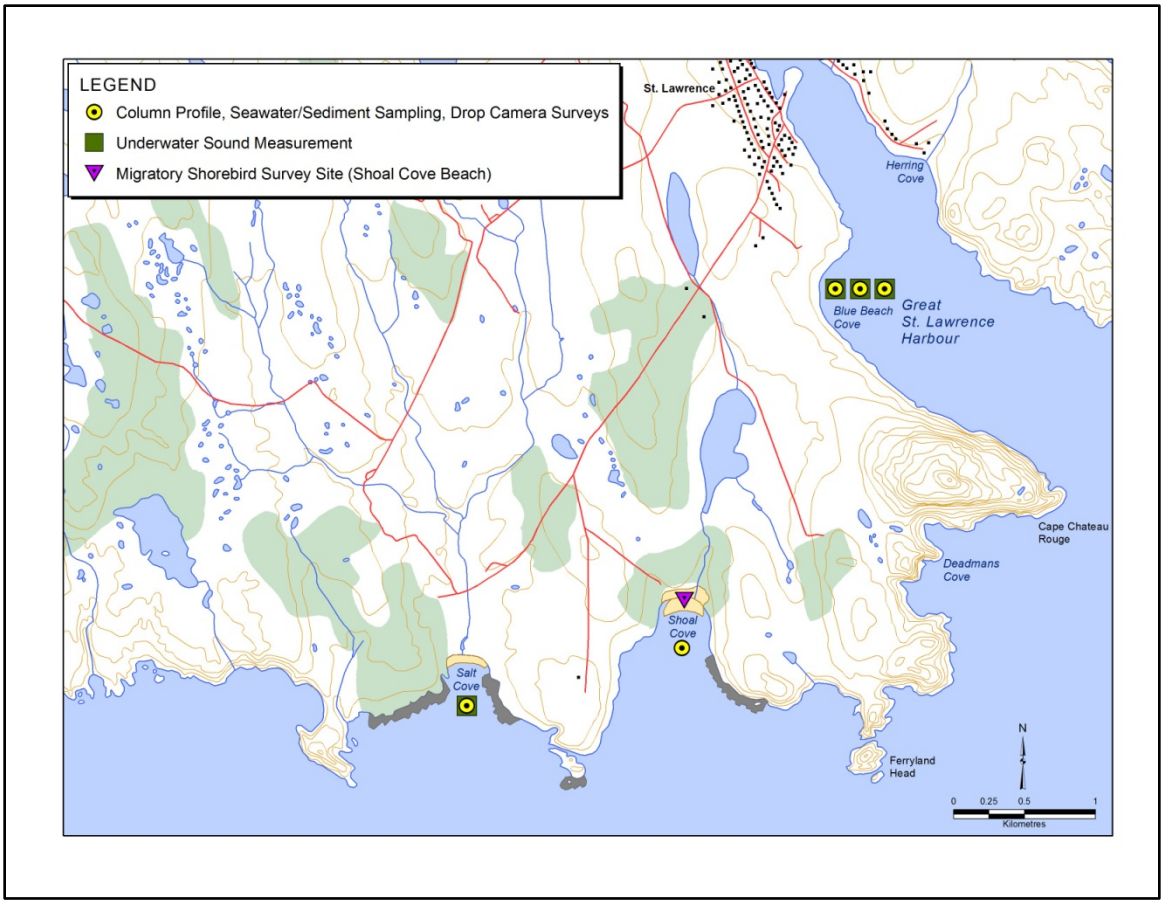


Figure 6-2: Proposed Marine Fish and Fish Habitat and Migratory Shorebird Sampling Stations

6.2.1.2 Surficial Sediment Quality

Surficial sediment quality was identified as an important aspect of the marine component of the Fish and Fish Habitat VEC in the EPR, primarily because of the potential of introduced suspended solids to settle on the existing substrate and possibly affect marine macroinvertebrate and fish species. The EPR has identified mitigation measures to reduce sediment loading during construction. The EPP will also address and identify mitigation measures to reduce runoff and siltation events.

The recommended frequency for surficial sediment sampling is once before the onset of marine construction activities, twice during marine construction activities, and once after completion of marine construction activities (Table 6-2). Surficial sediment sampling will be conducted at the same five stations used for seawater sampling (Figure 6-2).

6.2.1.3 Macroinvertebrates and Fishes

Macroinvertebrates and fishes may ultimately be affected by physical and chemical changes to the seawater and surficial sediment. Therefore, the marine fish and fish habitat component of the EEMP will include drop camera surveying of these animals. Some of the survey transects established during the 2009 marine habitat baseline survey conducted by LGL Limited in Blue Beach Cove will be used for the EEMP drop camera marine habitat surveys. Results of the 2009 marine habitat survey will be used as marine construction EEM Program baseline data for the northern part of Blue Beach Cove. Drop camera surveying will be conducted at both Shoal Cove and Salt Cove during the EEMP baseline sampling event. The drop camera surveying will be conducted at all three coves twice after the baseline sampling event; once during the blasting phase of the marine construction, and once after completion of the marine construction activities.

Since it is likely that some blasting near the shoreline will occur during construction of the marine infrastructure, underwater sound measurements should be made once before blasting to establish baseline levels, and during blasting to determine received sound pressure levels at varying distances from the source within Blue Beach Cove. Sound measurements will be made immediately above the bottom substrate at three locations in Blue Beach Cove: (1) just below the low water mark; (2) at 10 m depth; and (3) at 20 m depth. These locations may be the same as those used for seawater and surficial sediment sampling (Figure 6-2). Underwater sound measurements will also be conducted at the reference station, Salt Cove, during baseline sampling and during blasting operations.

6.2.1.4 Fisheries

Commercial fisheries were identified as an important component of the Fish and Fish Habitat VEC in the EPR (CFI 2009). The baseline condition of commercial fisheries in the vicinity of Great St. Lawrence Harbour has already been established and presented in the EPR (CFI 2009). Additional interviews with local fishers would be conducted during wharf construction and after completion of wharf construction to collect anecdotal information regarding the fisheries. If any relevant DFO commercial fishery statistics are available, they will also be used as part of the EEM.

6.2.2 Sample/Data Collection Methods

6.2.2.1 Seawater

A YSI 6600 Sonde meter will be used to profile the water column at each station during each sampling event. Parameters that will be measured *in situ* include water temperature, salinity, pH, dissolved oxygen, and turbidity. Water column profiling will establish the location of the thermocline during summer sampling, which will in turn determine where seawater samples are to be collected in the column.

Three seawater samples will be collected at each station during each sampling event using a Niskin sampler. During summer sampling when the water column is stratified, samples will be collected 1 m below surface, immediately above the thermocline, and below the thermocline. During winter sampling when there is no column stratification, seawater samples will be collected 1 m below surface, mid-column, and immediately above the bottom substrate. Samples will be contained in bottles supplied by the analytical laboratory and stored in coolers at 4°C.

6.2.2.2 Surficial Sediment

A Ponar sediment grab sampler will be used to collect surficial sediment samples at each station during each sampling event. The Ponar sampler is designed to prohibit sample disturbance during retrieval. The upper 2 to 3 cm of the sediment in the sampler will be removed with a stainless steel spoon, put into bottles supplied by the analytical laboratory and stored in coolers at 4°C. The Ponar will be washed down after sampling is completed at each station.

6.2.2.3 Macroinvertebrates and Fishes

Using an underwater video camera and GPS system, a series of transects in the northern portion of Blue Beach Cove will be surveyed to provide a representative ‘snapshot’ of the bottom habitat. The same type of survey was conducted in Blue Beach Cove in June 2009 by LGL Limited and Narwhal Environmental so the systematic approach to be used is a proven one.

Underwater sound will be measured using specialized electronic devices, specifically hydrophones and geophones. They will be used to measure sound pressure and particle

motion, respectively. LGL Limited has considerable experience with studies/surveys that have included the measurement of underwater sound.

6.2.2.4 Fisheries

As already indicated, the collection of data related to the commercial fisheries in the immediate vicinity of Great St. Lawrence Harbour will be through interviews with local fishers and examination of available DFO commercial fishery landings data.

6.2.3 Sample/Data Analyses

An accredited laboratory under either the Canadian Association for Laboratory Accreditation (CALA) or Standards Council of Canada (SCC (SCC) will be subcontracted to analyze the seawater and surficial sediment samples. Seawater and surficial sediment samples will be analyzed for a variety of parameters (e.g., TSS [water], particle size [sediment], metals and hydrocarbons). All analyses will conform to the NL ENVC *Accredited Laboratory Policy PD:PP2001-01.02*. Specific analyses and methods associated with seawater and surficial sediment analyses are indicated in Table 6.4.

Table 6-4: Specifics of Seawater and Surficial Sediment Physical/Chemical Laboratory Analyses

Matrix Sampled	Parameter	Method Reference
Seawater	Total metals	Maxxam-Burnaby
	Mercury	Based on EPA 245.1
	BTEX/TPH	Atlantic PIRI
	TSS	Based on EPA 160.2
	Turbidity	Based on EPA 180.1
	Major ions/hardness	Based on EPA 6020A
Marine Surficial Sediment	Particle size	Sieve and pipette
	TIC/TOC/TC	LECO
	Sulphate	Colourimetric
	TEH Analysis ($>C_{10}$-C_{32})	Atlantic PIRI
	Available metals (incl. mercury)	Based on EPA 6020A

Source: Maxxam Analytics Quotation, 22 June 2012

Analysis of the drop camera habitat survey videos will be conducted by marine biologists who are experienced with interpreting underwater video footage.

Analysis of sound pressure and particle motion measurements will be conducted by expert acousticians.

Commercial fisheries data will be presented in summary tables.

Analysis of empirical data collected during the marine fish and fish habitat will be focused on spatial and temporal comparisons of baseline conditions with conditions during construction. Depending on data characteristics, a mixture of parametric, non-parametric and summary statistical methods will be used.

6.3 Migratory Shorebirds

After conducting a review of existing bird studies within the area, reviewing the potential effects identified in the EPR, and addressing concerns raised by the public and regulatory requirements, it is clear that migratory shorebirds constitute the component of the Migratory Bird VEC that is most relevant to the Project Construction Phase EEM Program.

The overall design of the migratory shorebird component of the EEMP, as per the Atlantic Canada Shorebird Survey (ACSS), is provided below.

6.3.1 Protocol for Monitoring Piping Plover

The Atlantic Canada Shorebird Survey (ACSS) is applied as the Newfoundland and Labrador Shorebird Survey (NLSS) for shorebirds, and has been established to collect data through monitoring protocols. It is a tool used to fill the current data gap that exists in Atlantic Canada with respect to shorebirds. Newspar is committed to playing an essential role in the collection of data through conducting the standardized surveys in spring and fall following the Atlantic Canada Shorebird Survey (ACSS) provided to the proponent by the Canadian Wildlife Service (CWS). From this, Newspar will contribute to the developing database on shorebird species in Newfoundland and Labrador. These data will build the knowledge base, aid in determining the status of Atlantic Canada shorebirds, particularly the Piping Plover (*Charadrius melodus melodus*) and facilitate an adaptive approach toward sound decisions for shorebird conservation. The *SARA* status of the Piping Plover *melodus* subspecies is endangered on Schedule 1. This species has also been designated by COSEWIC as an endangered species in Canada.

Newspar commits to conducting shorebird surveys at Shoal Cove Beach as part of the EEMP, including recording sightings of Piping Plover. The construction EEM Program baseline surveys commenced in 2010 and will continue until the fall of 2012, at which point the construction monitoring surveys will begin. The surveys will include a number of monitoring events in the

spring and summer/fall of each year. This period is intended to at least span the construction phases of the Project. Standard operating procedures (SOP) approved by CWS will ensure minimal disturbance of the birds. However, given that Shoal Cove Beach is promoted by the Town of St Lawrence as a recreational area and has been used as such for many years, it is expected that this monitoring program will reveal infrequent use of the beach by Species at Risk, such as the Piping Plover. At the end of this monitoring period, Newspar will meet with the Canadian Wildlife Service with the view of discussing and agreeing upon any future monitoring that may be required.

Newspar proposed survey will have the following elements:

6.3.1.1 Spring Migration and Breeding

Of prime interest is the potential use of the Shoal Cove Beach by the Piping Plover. The spring surveys will be able to detect the presence of prospecting and/or breeding adults. This will provide a good understanding of the numbers of each species that remain or pass through the site in spring season. A single survey will be conducted in each of the following ten day periods: 20-30 April, 1-10 May, 11–20 May, 21–30 May, and 31 May – 9 June, that is, five spring surveys each year (Table 6-5). A total of 15 spring surveys have been conducted during the 2010-2012 spring survey period. Ten more spring surveys will be conducted during the 2013-2014 period. In general, surveys of spring migration in Newfoundland and Labrador are expected to produce fewer birds (of shorebirds other than Piping Plovers) compared to the Maritime Provinces because of the nature of the northward migration of shorebirds in spring.

Newspar will provide all records to the Canadian Wildlife Service in order to enhance understanding of shorebird numbers in the area.

6.3.1.2 Summer/Fall Migration Sites with Fewer than Three Years of Consecutive Surveying

For summer/autumn NLSS surveys, the Shoal Cove Beach area will be surveyed once in each third of the month (about every ten days), from late July through October (July 20 – October 31) achieving a total of ten fall surveys per year (Table 6-5). A total of 30 summer/fall surveys will be conducted during the construction EEM period. A total of 30 fall surveys will have been conducted during the 2010-2012 spring survey period. Twenty more fall surveys will be conducted during the 2013-2014 period.

Newspar will provide all records to the Canadian Wildlife Service in order to enhance understanding of shorebird numbers in the area.

Table 6-5: Specifics of the Migratory Shorebird EEMP Surveys

Season	Time Period	Year				
		Baseline			Monitoring	
		2010	2011	2012	2013	2014
Spring	20-30 April	√	√	√	√	√
	1-10 May	√	√	√	√	√
	11-20 May	√	√	√	√	√
	21-30 May	√	√	√	√	√
	31 May-9 June	√	√	√	√	√
	Total surveys	**5**	**5**	**5**	**5**	**5**
Summer/Fall	21-31 July	√	√	√	√	√
	1-10 August	√	√	√	√	√
	11-20 August	√	√	√	√	√
	21-31 August	√	√	√	√	√
	1-10 September	√	√	√	√	√
	11-20 September	√	√	√	√	√
	21-30 September	√	√	√	√	√
	1-10 October	√	√	√	√	√
	11-20 October	√	√	√	√	√
	21-31 October	√	√	√	√	√
	Total surveys	**10**	**10**	**10**	**10**	**10**

6.3.1.3 Key Points

- The spring survey period April 20 to June 9 will include a total of five surveys per year;
- The summer/fall survey period July 20 to October 31 will include a total of ten surveys per year;
- The time between surveys is necessary to allow new birds to arrive and old birds to continue on their migration, thus avoiding counting the same birds twice;
- All incidental wildlife observations will be recorded;
- Notes on potential disturbance, especially related to habitat (e.g., ATV use, dogs, etc.), will be recorded;

- If Piping Plover are found on site, the sightings will be immediately reported to EC-CWS, specifically Krista Baker, Species at Risk biologist. Her contact information are as follow:
- Email: Krista.Baker@ec.gc.ca, Tel: 709-772-3739
- All data will be forwarded in standard protocol to:

  Newfoundland and Labrador
  Atlantic Canada Shorebird Survey
  c/o Canadian Wildlife Service
  17 Waterfowl Lane
  Sackville, NB
  E4L 1G6

6.4 EEM Quality Assurance and Quality Control (QA/QC)

Quality assurance can be defined as a "set of operating principles that, if strictly followed during sample collection and analysis, will produce data of known and defensible quality whose analytical accuracy can be stated with a high level of accuracy" (APHA 1992). Quality assurance comprises two separate but interrelated activities; quality control and quality assessment (NRC 1990).

Quality control ensures that the data collected are of adequate quality, given the study objectives and the specific hypothesis to be tested. Quality control activities would include standardized protocols for sample collection and processing. The goals of quality are to ensure that sampling, processing, and analysis techniques are consistent; uncollected samples are minimized; data are comparable with similar data collected elsewhere; and study results can be reproduced (NRC 1990).

Quality assessment uses external and internal quality measures to determine the quality of the data produced by a given laboratory. Quality assessment activities are undertaken to ensure the effectiveness of quality procedures. Quality assessment consists of activities such as repetitive measurements, internal test samples, exchange of samples among laboratories, and use of reference samples (NRC 1990). 10% duplicate water and sediment sampling will be conducted in the field.

6.4.1 Quality Assurance Plan

To ensure that environmental data collected during the St. Lawrence Fluorspar Mine Reactivation Construction Phase EEMP are accurate and defensible, a Quality Assurance (QA)

Plan will be developed prior to sampling. QA planning ensures that high quality data are produced and substantiated. An effective QA plan includes organization, record keeping, and standard operating procedures (SOPs) for such tasks as field surveys, sample handling, laboratory analyses, and data management.

The following is considered for inclusion in the QA Plan:

- Identification of field teams and the responsibilities of each member;
- Statement and prioritization of study objectives;
- Description of survey area, including sampling station locations, samples, and sample station identifiers;
- Complete identification of variables to be measured and corresponding containers and preservatives;
- Identification of all QA/QC samples to be submitted with the samples;
- Description of the sampling methods, including sampling station positioning, sampling devices, replication and other special considerations;
- Detailed program schedule including time, date and georeferenced location of sampling stations and field teams;
- Storage and shipping procedures;
- Identification of laboratories to which samples will be shipped;
- Field team requirements;
- Location and availability of alternate equipment;
- Equipment necessary to undertake the program; and
- Equipment checklists and manifests prepared to ensure all required sampling equipment, supplies, spare parts, and alternative equipment are available to the sampling program.

6.4.2 Sample Collection

The following are specific QA/QC methods to be used for the all data collection surveys. Note that 10% duplicate water and sediment sampling will be conducted in the field.

6.4.2.1 Sampling Locations

Accurate positioning is essential to ensuring that sampling stations can be plotted and reoccupied with a high degree of certainty. All locations should be fixed by Geographical Positioning System (GPS). All personnel using such devices must be trained in their proper use, care, and limitations.

6.4.2.2 Sample Handling

All stages of sample handling must be carefully documented to ensure sample handling requirements are sustained to minimize errors in collection, shipping, and analyses of the samples. The use of SOPs is required to ensure all field personnel activities are conducted in the same manner regardless of the individual conducting the activity.

Sampling programs must maintain integrity of sample from time of collection to data reporting. Chain of custody procedures will ensure that all the possession and handling of samples can be traced from collection to final disposal.

Sample labels should be waterproof and securely fastened and contain the following information.

- Sample identification (identifier)
- Preservation technique
- Date/time of collection
- Location (depth and by identifier)
- Collectors ID
- Sample analysis required.

Chain of custody forms will be filled out with information from the sample label and accompany every sample shipped to a laboratory or consultant for analysis. Each person who has had custody signs off to ensure sample traceability. Shipment manifests will accompany every sample shipped to a laboratory or consultant for analysis, with the consigner and consignee signing off on the shipment.

6.4.2.3 Sample Shipment

All samples must be shipped in such a manner to ensure that the samples are received at the appropriate destination within an acceptable holding time. Shipping containers must be in good condition and capable of surviving rough treatment. Samples must be tightly and, if necessary, individually packed. Dividers must separate glass containers and empty spaces must be filled so jars are secure. Leak proof containers must be used wherever appropriate.

Sample request form and/or chain of custody forms will accompany all samples. A chain of custody form should be filled out for each shipment. The original chain of custody should be placed inside the shipping container in such a manner that it is protected and can serve as a sample request form. A copy of the chain of custody form is to be retained by shipper.

Shipping containers must be either hand delivered or sent by a courier that will provide a delivery slip. All shipping charges are to be prepaid to avoid rejection of shipment by consigner.

6.4.3 Laboratory Analysis

Any laboratory utilized to perform an analysis must conform to the NL ENVC *Accredited Laboratory Policy PD:PP2001-01.02*., and have an acceptable QA/QC program in place and must also have in place corporate Safety and Environmental Protection Policies and Procedures. The laboratory must be suitably equipped to meet the analytical requirements for the analyses to be undertaken.

All laboratories used must assign a specific staff member who will be responsible for the project and will act as liaison person with the client in terms of delivery of results, quality reference of results, and overall activities of the laboratory. This person shall be responsible for:

- Sample reception;
- Maintenance of chain of custody;
- Maintenance of sample tracking logs;
- Distribution of samples for laboratory analyzes;
- Subcontracting samples to other facilities;
- Supervision of labelling, log keeping, data reduction, and data transcription;
- Storage and security of all samples, data and documents; and

- Reports of results from all lab analyses

The laboratory will provide all necessary forms and documentation required for sample submission. The laboratory will notify the client in writing of inconsistencies between labels and sample request forms (Chain of Custody Forms) and hold time violations. Prior to initiation of testing, all parameters and specific Levels of Quantification (LOQs) of each parameter will be confirmed with the client.

Data transfer shall be submitted by electronic copy, hard copy in mail, and, where available, by facsimile.

Originals of the following documents shall be sent to the proponent or their representative:

- Chain of custody forms
- Data report sheets
- QA/QC reference records and reports.

The chosen analytical laboratory will be required to analyze samples on a 10% replicate (duplicate) basis or one replicate (duplicate) per batch, whichever is more frequent.

Where available, Certified Reference Materials (CRMs) will be run in conjunction with each batch of samples. The laboratory shall provide appropriate QA/QC reports or data for each set of samples analyzed. The reported data will include results of laboratory duplicates, reference samples, method blanks, and spike recovery. The laboratory will provide validation of these QA/QC data to demonstrate their acceptability. The laboratory shall provide full references for all methods used.

6.4.4 Data Management

Data management involves a number of systematic processes and protocols that are designed to provide a framework for quality environmental data with a high degree of credibility. The major components for a data management system used for environmental programs should include or consider items such as:

- Data documentation (computer programs, and statistical, normalization, and error reference procedures);

- Data recording (laboratory reports, field notebooks, field maps, and auxiliary data records);
- Data custody and transfer (chain of custody records, QA/QC procedures for authorizing changes to data, QA/QC documentation of transfer formats, data recording forms, and data verification and validation);
- Data validation (data identification, transmittal errors, flagged or rejected data, data comparability, and data review and evaluation);
- Data verification (sample results reported and checked for transmission errors, sample labels verified, cross-referencing field data sheets and laboratory results, data review, flagging and screening); and
- Data presentation (tables, graphs, and figures).

6.4.5 Reporting

A full report of the Construction Phase EEM Program will be submitted to the Newfoundland and Labrador Department of Environment and Conservation within two months of completion of the field work and receipt of all laboratory results. Some field data, such as any observations of the Piping Plover, can be directly forwarded to the relevant agency (e.g., Wildlife Division) immediately after that sampling event.

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Personal Communications

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