6 ENVIRONMENT (BASELINE DESCRIPTION & ASSESMENT)

This Environmental Preview Report and Federal Assessment Screening Report provide a description of the existing environment and examination of the potential effects of the project on the environment (both bio-physical and socio-economic) of Reactivating the St. Lawrence Fluorspar Mines and constructing a new marine terminal nearby. The EA Guidelines, developed and provided by the project's appointed Environmental Assessment Committee, specified particular aspects of the project to be assessed in greater detail.

This Chapter provides a description of the existing environment (baseline conditions) and assessment of project effects on the receiving environment, both bio-physical and socio-economic, as related to project activities. The previous Chapter, Section 5.10 provided a list of Project Activities and Environment Interactions matrices. The focus of this Chapter is on those environmental components which were identified in the EA Guidelines. Project activities are those related to Construction; Operations and Maintenance; Decommissioning & Closure. Accidental Events & Malfunctions were also assessed.

The Guidelines specifically listed the following components or VEC's that will require detailed assessment:

1. Fish and Fish Habitat (both freshwater and marine, including fisheries);
2. Marine Traffic – This is not a VEC but rather an activity. The VEC's that are affected by this activity are Marine Mammals, Seabirds, Fisheries, Species at Risk, and Human Receptors which are addressed under their respective areas;
3. Migratory Birds (including seabirds, shorebirds, waterfowl, songbirds and other land birds within the footprint of the Project, with emphasis on species at risk);
4. Species at Risk; and
5. Human Receptors (including socio-economic parameters)

The assessment covers both Bio-Physical Assessment and Socio-Economic Assessment; which includes: human health, employment, job creation and training, community and business opportunities, infrastructure and services, quality of life, commercial fisheries and aquaculture, tourism, and historical resources.

Additional environmental, heath and safety concerns are addressed, such as the Occupational Health and Safety Management, Environmental Management, Environmental Protection Plan, Emergency Response Plan, and Environmental Monitoring, as described in detail in Chapter 5, Sections 5.7 to 5.9.

6.1 FISH AND FISH HABITAT

6.1.1 Surface Water and Groundwater Hydrology

6.1.1.1 Topography, Rainfall and Hydrology

St. Lawrence lies on the southern tip of the Burin Peninsula, Newfoundland to the south west of St. Lawrence as shown on Figure 6.1-1.

The area has been shaped by glaciation into three broad but elongate southward sloping upland valley troughs separated by rounded ridges that form the main watersheds. The direction of these features follows the structure of the geology. The land drops from an altitude of 300m-500m in the north to about 50m-100m at the cliff bound coast.

The western valleys combine and form the Salt Cove Brook catchment. The topographic catchment of Salt Cove Brook to the sea is around 24.7 km^2. Tarefare Vein and the previously mined Director Vein are within this catchment. The eastern catchment is the Shoal Cove Brook catchment with an area of around 5.1 km^2, (see Figure 6.1-1). The existing mill building and the former tailings facility are located in the Shoal Cove catchment.

Flow measurements are not available so a hydrological assessment was carried out to determine flow duration curves for Salt Cove and Shoal Cove Brooks as shown in Figures 6.1-2 and 6.1-3, respectively.

In places, gradients are low and many reportedly shallow ponds of various sizes have formed (Newfoundland Fluorspar Ltd, 1967). Flat areas between ponds are often occupied by heavily saturated upland bogs. The largest of the ponds is Long Pond to the west which, with Hay Pook

Pond, has formed in the Salt Cove catchment. A canal was constructed before 1967 to divert water from Director Mine to the lower reaches of Salt Cove Brook, which reduced flows into the upper reaches of this brook and Director Mine.

Clarkes Pond and Shoal Cove Pond are in the Shoal Cove catchment. There has been some human intervention in the area during previous mining episodes including the use of Shoal Cove Pond for tailings deposition. Clarkes Pond up gradient is believed to be in hydraulic continuity with, and partially fed by, groundwater. Historically it was used for mine water supply.

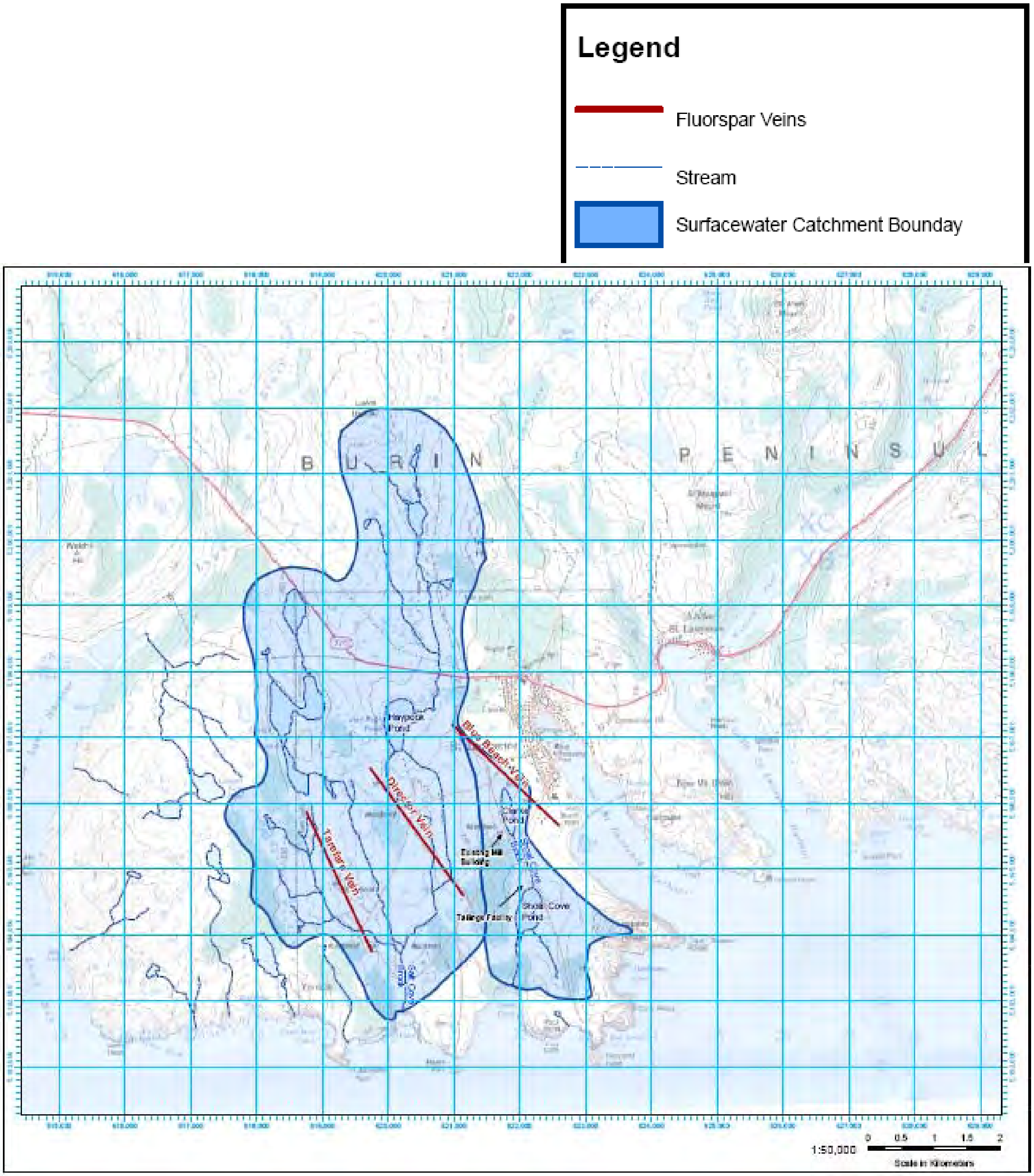

Figure 6.1-1: Surface Water Catchment Boundary – Location Map

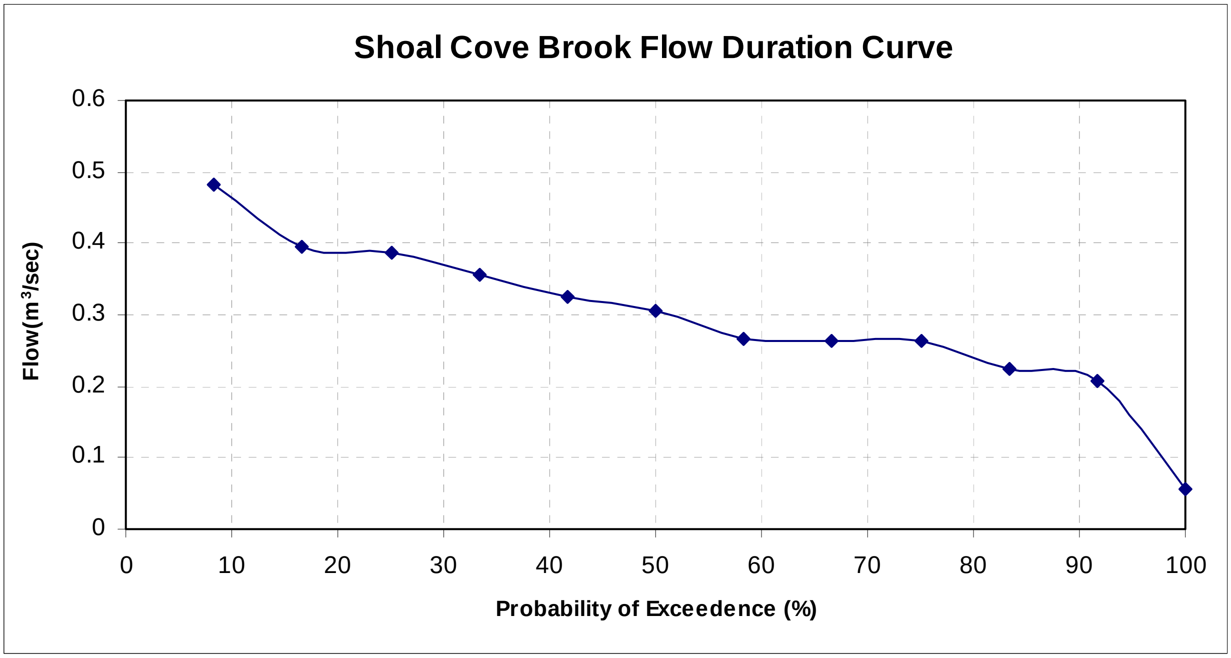

Figure 6.1-2: Shoal Cove Brook Flow Duration Curve

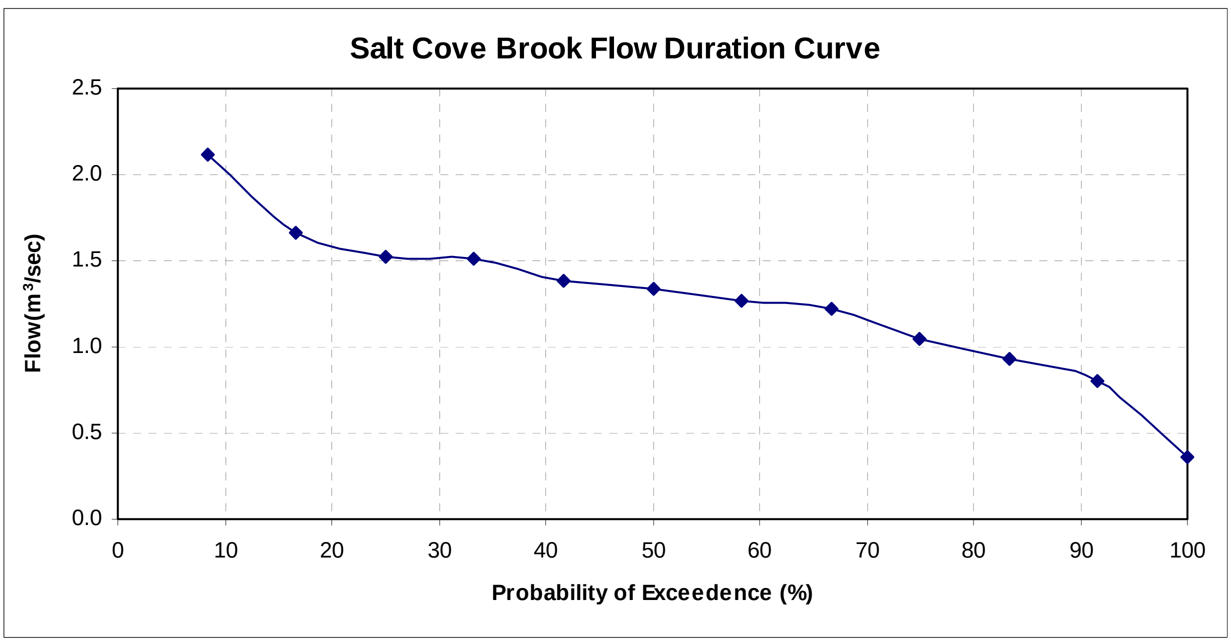

Figure 6.1-3: Salt Cove Brook Flow Duration Curve

Precipitation occurs all year round as rain with some snow in winter. The long term average rainfall (1971-2000) over the area was 1564.1 mm ranging between 1000mm and 1650mm per year (Environment Canada, Atlantic Region, Atlantic Climate Centre).

6.1.1.2 Geology

The geology of the area is described in detail by the Mineral Development Division of Newfoundland and Labrador's Department of Mines and Energy. (Strong DF, O'Brien SJF et al, 1978) and key features are shown on Figure 6.1-4.

Superficial Geology

Most of the area is underlain by a thin layer of undifferentiated glacial till up to 5m in thickness (ADI Nolan Davis,1995). The till is absent in places and there are also areas of exposed bedrock, for example south east of Shoal Cove from Red Head through to Chapeau Rouge. Another area of exposed bedrock lies south of Hay Pook Pond and south east of Long Pond from the approximate location of Hookey Vein in the north-east to the Blakes Brook vein (Figure 6.1-4).

In the area to the north and west of the bedrock contact between granite and the Inlet Group (including part of the northern Tarefare vein) there is a thin layer of sandy till and peat bogs.

Bedrock Geology

Bedrock geology can be subdivided into three geological areas as summarised below and illustrated in Figure 6.1-4. The geological cross sections along N-S and NE-SW directions are presented in Figure 6.1-5.

The area is predominantly underlain by granitic rocks of the intrusive St Lawrence batholith which forms a generally northeast trending 3–4km wide belt. The granite is flanked by rocks of the Inlet Group to the west and the Burin Group to the east.

Table 6.1-1 summarises the bedrock geology.

Table 6.1-1: Geological Succession

Age	Group/ Formation	Lithology
Carboniferous Intrusive	St Lawrence Granite	Fine to medium grained porphyritic to equiangular leucocratic pink to red granitic rock comprised of red alkali feldspar and quartz with low ferromagnesian minerals.. The granite is characterised by mineralised veins.
Cambrian	Undifferentiated Inlet Group	Fine grained sandstone siltstone and shale with interbedded limestone
Pre-Cambrian	Burin Group/ Sculpin Point Formation	Thick bedded siltstone, sandstone, conglomerate, shale, argillite with subordinate massive mafic flows and silts .

The St. Lawrence batholith is comprised of leucocratic granites. The margins of the granite are controlled by normal N-S faults from earlier deformation. The granite is a pink coloured granitoid rock which appears to be composed exclusively of feldspar and quartz. It is characterised by strong faulting and fracturing. The fractures are filled with mineralised veins and pegmatites. Fluorspar occurs as a hydrothermic deposit in the fissures in the granite. The veins were reported to persist for many hundreds of metres with lengths ranging from less than 100m to over 2,100m and thicknesses of several metres, averaging 11m (Harris A, et all, 1999). The St. Lawrence granite in the area was deeply scoured by glaciers so that the bedrock formations are exposed or lie under a thin layer of glacial till.

The Inlet Group consists of sedimentary rocks of Cambrian age lying west of the granite contact. The contact with the granite stretches approximately north-northeast from Chambers Point towards Hay Pook Pond. The group is comprised of fine grained sandstone, siltstone and shale with interbedded limestone (Howse A, et all, 1983). In part of the area the group is underlain by the St Lawrence granite but in the greater part of the area it conformably overlies the rhyolite, basalt and associated sedimentary rocks of the Marystown Group. Siltstone of the Inlet Group was observed at shallow depth at Tarefare (Harris A, et all, 1999). The Inlet group was folded prior to intrusion of the granite.

The Pre-Cambrian Burin Group is comprised of sedimentary and meta-sedimentary rocks and subordinate volcanic flows consisting of pillowed and massive basaltic and andesitic flows and aquagene tuffs (Howse A, et all,1983). In the study area the Burin Group outcrop stretches northwards from Ferryland Head to Great St Lawrence Harbour incorporating Red Head, Ferryland Head, Cape Rose, Deadmans Cove and Chapeau Rouge and then across the Great St Lawrence Harbour through Herring Cove and St Margaret Mount north of Little St Lawrence Harbour (ADI Nolan Davis,1995).

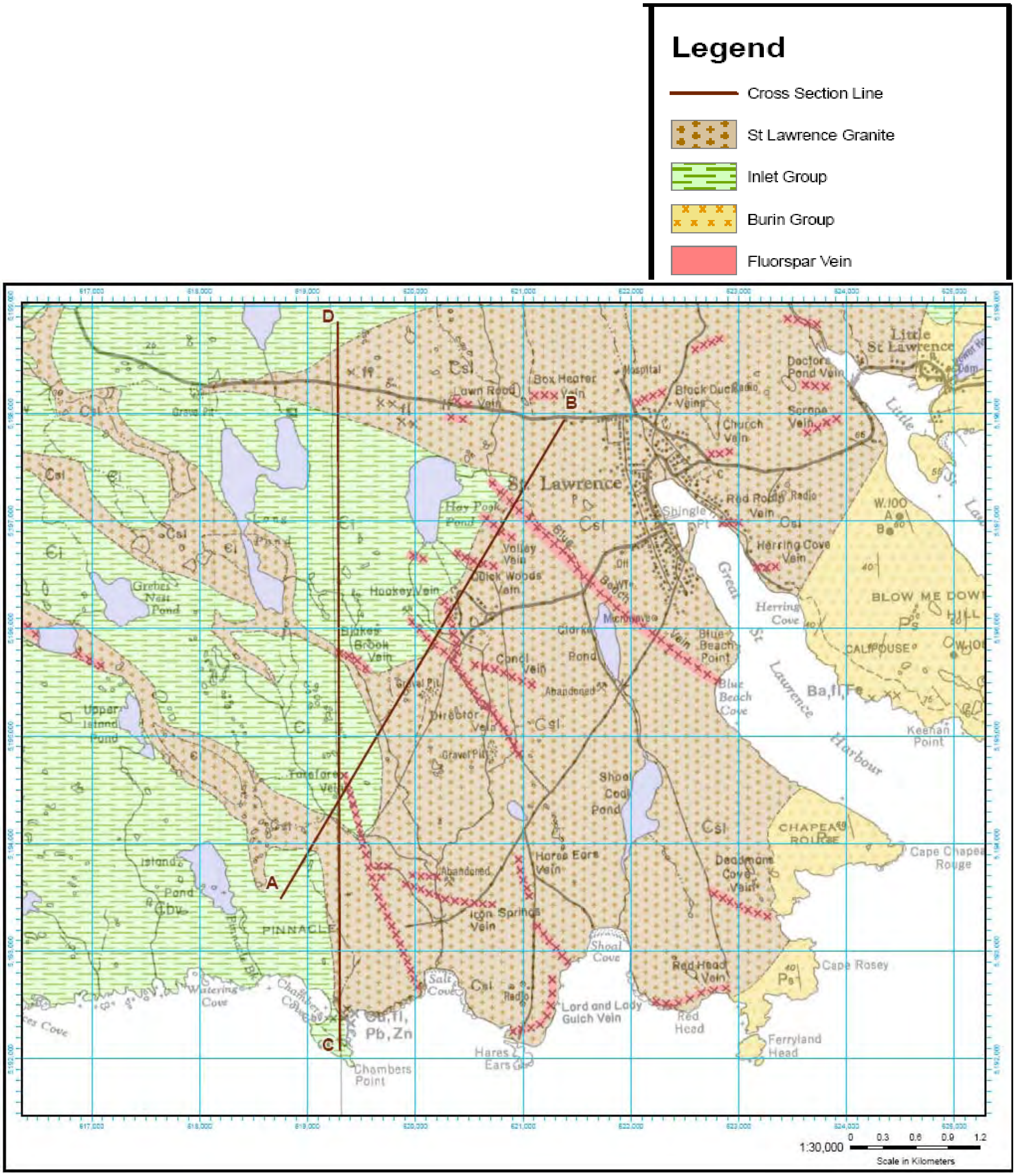

Figure 6.1-4: Geological Map of the Study Area

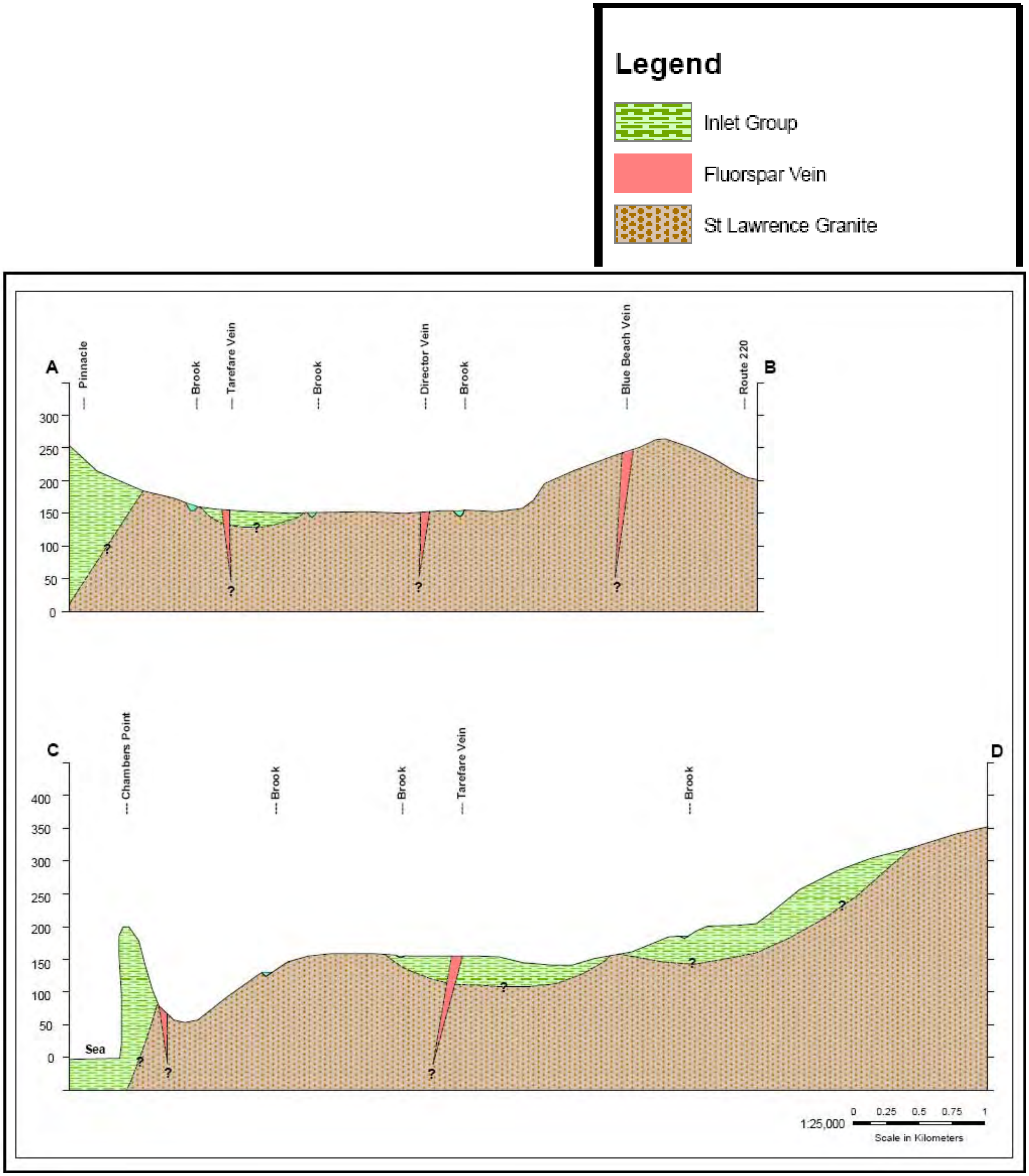

Figure 6.1-5: Geological Cross Sections

6.1.1.3 Hydrogeology

The granite has little or no intrinsic permeability and therefore does not naturally constitute an aquifer. However it does contain significant fracture zones associated with tension faulting. Although many of the faults are infilled with pegmatites and other mineralization, they remain sufficiently open and interconnected to give the granite secondary permeability. The overlying glacial till can act as a shallow aquifer.

Aquifer Parameters

The occurrence and movement of groundwater in the St Lawrence granite is controlled by the frequency and degree of interconnectivity of the faults. Thus groundwater will tend to occur in those areas where mineralisation also occurs, that is in discrete secondary aquifers. Such aquifers will also tend to be linear in conformity with the principal direction of faulting. The hydraulic conductivity of igneous rocks such as granite lies in the range 10^{-11} m/s to 10^{-3} m/s (unfractured to fractured), (Freeze Cherry, 1979). In the absence of test pumping data, the hydraulic conductivity of these St Lawrence aquifers is conservatively assumed to be within the range 10^{-6} m/s to 10^{-8} m/s and the veins 10^{-1} m/s to 10^{-5} m/s. BLM Bharti Engineering estimated a range of 10^{-4} m/s to 10^{-8} m/s (BLM Bharti Engineering Inc., 1998).

Whilst the faults in the granite provide transmission paths and storage for groundwater, the storage of the granite itself will be low.

Where Glacial Till is present, this will also provide some storage. The overlying Glacial Till constitutes a shallow aquifer whose lateral extent is limited to the surface catchment in which it lies. The hydraulic conductivity of the Till was estimated at 10^{-4} m/s to 10^{-5} m/s (BLM Bharti Engineering Inc., 1998).

Groundwater Flow and Piezometry

Groundwater level data is not available to define groundwater levels and flows with certainty. However groundwater levels are expected to be close to ground surface and the water levels of the ponds probably represent groundwater levels to a certain extent. The groundwater flow direction is expected to be towards the coast although this has yet to be confirmed by monitoring.

Natural & Dewatered Condition

Under natural conditions groundwater levels in the St Lawrence granite, the Inlet Group and overlying till are expected to coincide where there is hydraulic continuity. Under dewatering conditions associated with mining, groundwater levels in the St Lawrence granite will be lowered which in turn will affect water levels in overlying formations. The extent to which water levels will fall in the Inlet Group and Till will depend on the relative permeability and the rate at which water can be drawn from the base of the formation compared with the rate of replenishment from rainfall and snow melt at the top.

The possible effect of dewatering was explored further by means of a model and is described in later in this Section. It should be noted that the results of the model are indicative only and the available data does not allow a fully calibrated model to be developed at this stage.

6.1.1.4 Water Quality

Water quality data is available from recent and historical sampling. The quality of water was assessed so that its potential for use as well as potential locations for discharge could be determined.

Water Quality Standards

The standards used to benchmark water quality analyses include the Canadian Drinking Water Quality Limits, the Environmental Control Water and Sewage Regulations, 2003 (Amendment in 2009), and the Canadian Environmental Quality Guidelines (2007) for Freshwater Aquatic Life.

Discharges of mine effluents are controlled by the Newfoundland and Labrador Regulation 23/09 under the Water Resources Act (O.C. 2009-091). Under this Regulation the 2009 amendment of the Environmental Control Water and Sewage Regulations, 2003 refers to Schedule C which, for metal mines, requires compliance with the Metal Mining Effluent Regulations (Canada) SOR/2002-222, known as MMER. (Note that CFI's Fluorspar Mine Reactivation Project is not defined as a "metal" mine, and Environment Canada has indicated that MMER do not apply to this Project.)

The MMER prescribe authorised concentration limits for deleterious substances in mine effluents that discharge to waters frequented by fish. The regulated parameters are arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids (TSS), Radium 226, and pH.

Schedule 4 of the MMER specifies the maximum prescribed limits under which these substances may be discharged in mine effluent. The maximum allowable concentrations of these substances at the final discharge points are presented in Table 6.1-2.

Table 6.1-2: Authorized Levels Prescribed in the MMER

Deleterious Substance	Units	Maximum Authorized Monthly Mean Concentration	Maximum Authorized Concentration in a Composite Sample	Maximum Authorized Concentration in a Grab Sample
Arsenic (As)	mg/L	0.5	0.75	1.0
Copper (Cu)	mg/L	0.3	0.45	0.6
Cyanide (CN)	mg/L	1.0	1.5	2.0
Lead (Pb)	mg/L	0.2	0.3	0.4
Nickel (Ni)	mg/L	0.5	0.75	1.0
Zinc (Zn)	mg/L	0.5	0.75	1.0
Radium 226	Bq/L	0.37	0.74	1.11
Total suspended solids (TSS)	mg/L	15	22.5	30
Percentage of non-acutely lethal effluent[(2)]	100%			
pH range	6.0 - 9.5			

Notes: (1) All concentrations are total values.
(2) For the purposes of the MMER, non-acutely lethal means survival of at least 50% of rainbow trout subjected to 100% concentration effluent for a period of 96 hours.

Water Quality Sampling

The surface water and groundwater sampling locations are presented in Figure 6.1-6.

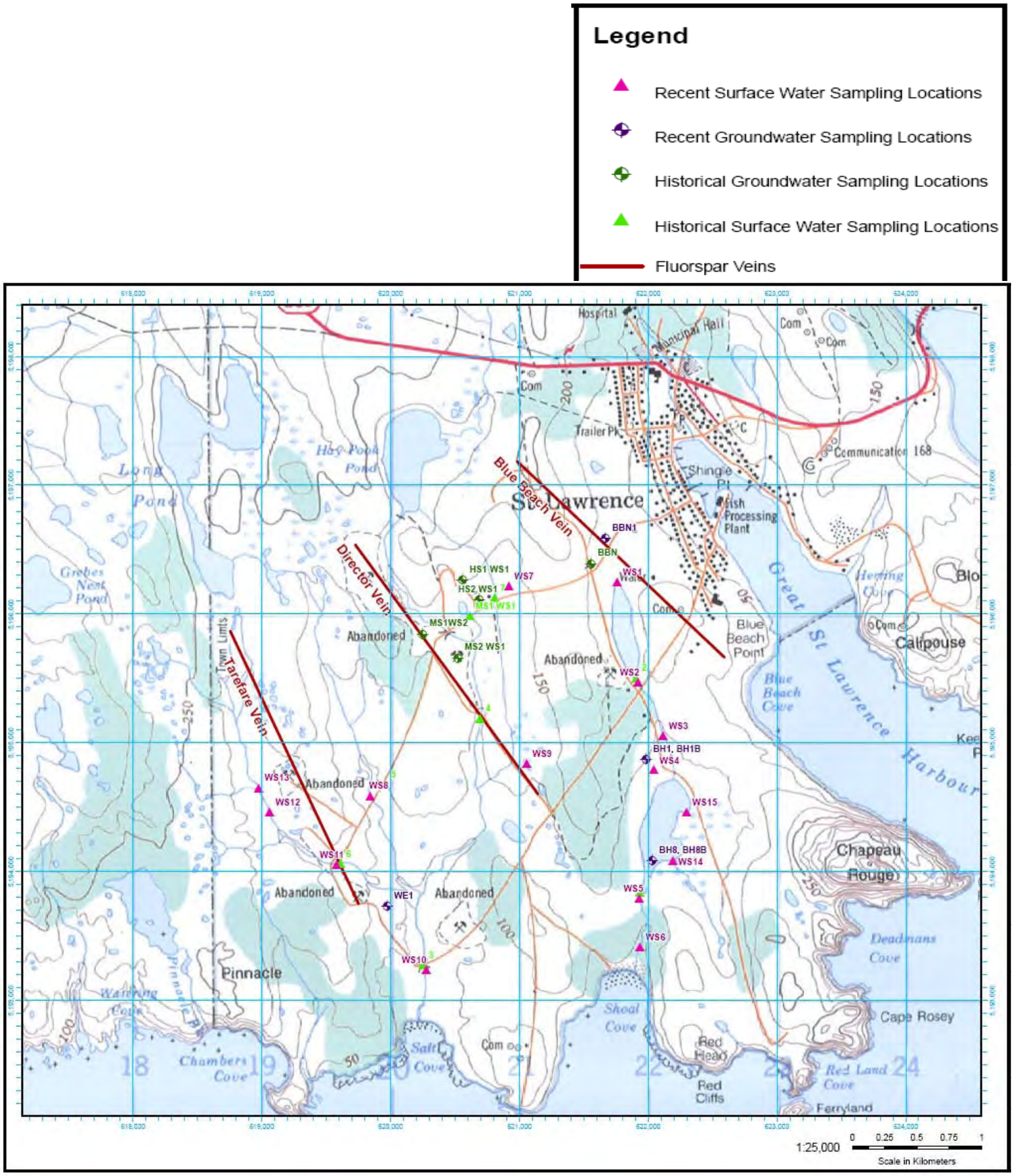

Figure 6.1-6: Surface Water and Groundwater Sampling Location Map

Surface and groundwater samples from the mines and elsewhere have been collected over the years as summarised in Table 6.1-3 and Table 6.1-4.

Most recently (2009) samples were collected as part of baseline sampling. The samples WE1 and BBN1 are considered to be representative of mine water at Tarefare and Blue Beach North respectively. The recent ‘BH’ series of boreholes were drilled close to the old tailings facility. Four samples were taken from piezometers installed in these boreholes. The results are discussed as part of the tailings evaluation and for the purposes of this section are not considered to be representative of groundwater or mine water in the general area.

Table 6.1-3: Summary of Groundwater Samples

Sampling Locations	Sampling Date
HS1 WS1 (Fabian Aylward's Well)	April 1997
HS2 WS1 (Ronald Way's Well)	November 1995 April 1997
MS1 WS2 (Director Mine Shaft)	April 1997
MS2 WS1 (Canal Vein Raise No 4)	April 1997
BBN (Blue Beach North Mine)	May 1995
Director Mine	1941
Blue Beach Mine Discharge	1987
BH1B Minworth's Tailings Facility Piezometer at 22 feet	2009
BH1 Minworth's Tailings Facility Piezometer at 55 feet	2009
BH8 Outlet of Shoal Cove Pond Piezometer at 92 feet	2009
BH8B Outlet of Shoal Cove Pond Piezometer at 26 feet	2009
WE1 Spring	2009
BBN1 Mine shaft of Blue Beach North Mine	2009

Table 6.1-4: Summary of Surface Water Samples

Sampling Locations	Description	Sampling Date	
MS1 WS1	Canal Dam	April 1997	
1	Outlet of Shoal Cove Pond	July 1984	June 1985
2	Outlet of Clarke's Pond	July 1984	June 1985
3	Downstream of Salt Cove Brook	July 1984	June 1985
4	Upstream of Salt Cove Brook	July 1984	June 1985
5	Upstream of Salt Cove Brook	July 1984	June 1985
6	Salt Cove Brook to the west of Tarefare Mine	July 1984	June 1985
7	Salt Cove Brook to the east of Tarefare Mine	July 1984	June 1985
Clarke's Pond	-	October 1984	
Clarke's Pond Inlet	Small stream entering pond from the north. Sample taken at entrance to pond. Clarified BBN mine water entered this stream (above sampling point) after passing through three small lagoons.	From November 1986 to September 1987 & From February 1989 to August 1990	
Clarke's Pond Outlet	Outlet from south end of pond but upstream of road culvert.		
Tailings Pond Inlet	Sampled at discharge end of pipe into settling pond (mill tailings stream)	From February 1989 to August 1990	
Decant Final Holding Dam	Water from end of polishing pond prior to discharge into Shoal Cove Pond.		
Shoal Cove Pond Inlet	Water from the polishing pond entered a small stream running parallel and to the west of the roadway. The sampling point was half way between the polishing pond outlet and where the stream entered Shoal Cove Pond.		
Shoal Cove Pond Outlet	Upstream of where stream enters the ocean.		
WS1	Clarke's Pond	April 2009	
WS4	Minworth's Polishing Pond	April 2009	
WS8	Upstream of Salt Cove Brook	April 2009	
WS10	Downstream of Salt Cove Brook	April 2009	
WS11	Salt Cove Brook to the east of Tarefare Mine	April 2009	
WS12	Salt Cove Brook to the west of Tarefare	April 2009	
WS13	Salt Cove Brook to the west of Tarefare Mine	April 2009	
WS2	Outlet of Clarke's Pond	April 2009	
WS3	Outlet of Clarke's Pond Brook	April 2009	
WS5	Outlet of Shoal Cove Pond	April 2009	
WS6	Downstream of Shoal Cove Pond Brook	April 2009	
WS7	Outlet of Hay Pook Pond	April 2009	
WS9	Upstream of Salt Cove Brook	April 2009	
WS14	East of Shoal Cove Pond	April 2009	
WS15	East of Shoal Cove Pond	April 2009	

Water Quality Assessment

Recent and historical data shows that, when compared with various water quality standards such as the Canadian Drinking Water Quality Limits and the Canadian Environmental Quality Guidelines (2007) for Freshwater Aquatic Life, mine water has elevated concentrations of fluoride, manganese, iron, cadmium and zinc. These are also elevated in surface water but to a lesser extent.

Stream water samples taken from the study area were tested using in situ field methods as well as laboratory analysis. The results from the laboratory analysis showed that every sample site, from the April and August 2009 sampling trips, exceeded CCME FAL guidelines in at least one parameter. Every site sampled exceeded CCME FAL guidelines for Cadmium, thirteen surface water sites exceeded Aluminum, nine exceeded Iron, two exceeded Copper and one exceeded Zinc (AMEC 2009).

6.1.1.5 Water Resources

A hydrological study of the Salt Cove and Shoal Cove catchments was undertaken which provided estimates of stream flows and the flow duration curves presented above. In Shoal Cove Brook it was estimated that flows are greater than 0.05 m^3/s (100 % probability of exceedance); are greater than 0.31 m^3/s 50% of the time and greater than 0.48 m^3/s 8% of the time. Salt Cove Brook being a larger catchment has estimated flows of 0.36 m^3/s (100 % probability of exceedance) 1.33 m^3/s and 2.11 m^3/s.

A groundwater catchment study was used to assess dewatering rates and the radius of influence of dewatering. The Salt Cove and Shoal Cove catchment areas were estimated as 24.7 km^2 and 5.1 km^2 respectively. The groundwater catchment area is considered to be larger at 58.7 km^2; covering the area illustrated in Figure 6.1-7.

As part of the hydrological study it was estimated that the average runoff coefficient was 0.88, leaving 12% of annual precipitation available for recharge and evapotranspiration. During groundwater model development, recharge was adjusted within the range of 5% to 7 % of the total annual precipitation (1564.1 mm) which is equivalent to around 14,300 m^3/d (0.17 m^3/s) of recharge over the groundwater catchment area. Although the groundwater catchment is greater, the estimated recharge to groundwater is less than stream runoff for most of the year.

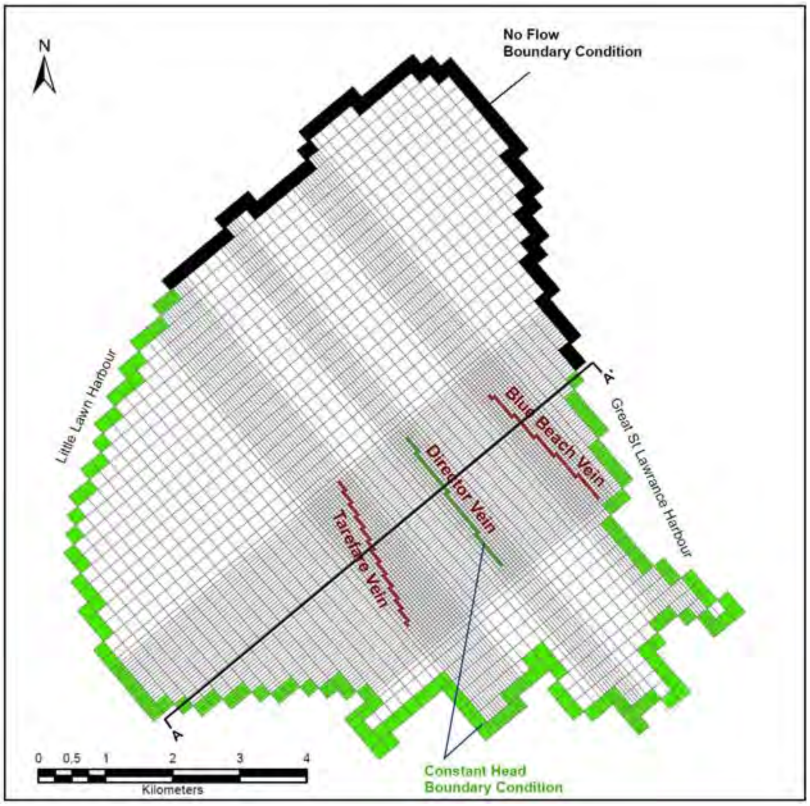

Figure 6.1-7: Groundwater Catchment Area

6.1.1.6 Water Use

Groundwater from the St Lawrence area was historically used for water supply. In recent years it is understood that water is obtained from a water supply further east. There are no known abstractions of groundwater or surface water in the vicinity of the mine, with the exception of two drilled wells servicing single family residences located between Blue Beach and Clarkes Pond.

6.1.1.7 Catchment Water Balance

Under natural (non-dewatered) conditions the majority of rainfall would appear to discharge from the catchment as surface water. Recharge to groundwater is limited by the relatively low permeability, a high water table and low flow through the bedrock.

When mining starts, the workings would be kept dry by pumping from deep shafts. Groundwater levels would be lowered and the situation arises where more recharge could take place. This in turn may reduce the amount of water available for surface water runoff, resulting in reduced stream flows. The effect of this would be mitigated by discharge of pumped water back to the streams.

When the mine first starts to be dewatered, water will be drawn from storage as water levels fall and the cone of depression widens. Large inflows which decrease with time have been observed and may be indicative of this condition. The other potential consequences of dewatering are the increased infiltration from surface water bodies such as ponds and the drawing in of sea water.

The rate at which water may infiltrate from the base of a pond when groundwater levels are lowered, will depend on the permeability of the base layers. For a base hydraulic conductivity of 10^{-7} m/s the fall in level would be around 10 mm/d. This could also be mitigated by returning pumped mine water back to the environment either upstream or into the ponds. The feasibility of mine discharge to the environment in terms of quantity and quality is discussed in subsequent sections.

Saline intrusion was indicated as a possibility from the groundwater modelling exercise and from a high chloride concentration recorded at the mine historically. It remains a possibility but the rate of flow from the coast towards the mine would mean that this takes some time to manifest. It is also noted that an increase in infiltration will lessen the possibility of saline intrusion as shown by the reduction in modelled flow derived from sea water as recharge is increased as part of the model sensitivity analysis.

To overcome potentially adverse impacts as a result of dewatering, the following are included in the pre-feasibility design:

- Recirculation of pumped water (from dewatering the mine) back to the environment to streams and ponds (subject to quality being acceptable);
- Contingency for treatment of pumped water; and
- Monitoring of groundwater levels, groundwater quality and mine discharge water quality.

6.1.1.8 Dewatering

Dewatering is required to keep the underground workings dry during the operation of Tarefare and Blue Beach North mine since the underground operations will be conducted below the water table. A groundwater model was developed by Scott Wilson for the project area. The model was run under steady state conditions using the 3-D finite difference code, MODFLOW to estimate the amount of the groundwater inflow into the underground workings during the operational period.

The model was calibrated according to a historical groundwater inflow of 3000 gpm (16,350 m^3/day) into the Director Mine. The calibrated model was used to simulate the dewatering of Tarefare Vein and Blue Beach Vein. The simulations indicate that water inflow into Tarefare Vein and Blue Beach Vein would be around 2,770 gpm (15,100 m3/day) and 2,710 gpm (14,800 m^3/day), respectively. The amount of water to be dewatered during the operation of Tarefare Vein and Blue Beach North Vein is estimated to be about 8 % and 10 % less than during the dewatering of the Director Vein, respectively.

The mine dewatering rates are significant when compared with the estimated recharge to the groundwater catchment of 14,300 m^3/d (0.17 m^3/s). This implies that water will be drawn from other sources such as ponds, stream baseflow and possibly the sea, as discussed above.

Based on the groundwater model results, the cone of depression extends to the sea (under a steady state condition) and constitutes up to 25% of the total modelled inflow to the underground workings for Tarefare Mine and up to 47% of total inflow for Blue Beach North Mine. Steady state conditions will take some time to develop and the possibility of saline water intrusion will be monitored by regular mine water quality analysis.

Mine dewatering and subsequent assessments are reliant on the accuracy of flow measurements during dewatering of Director Mine (Cooper, 1971).

6.1.1.9 Mine Water Balance

Water Balance diagrams for Tarefare and Blue Beach Mines are presented in Figure 6.1-8 and Figure 6.1-9, respectively.

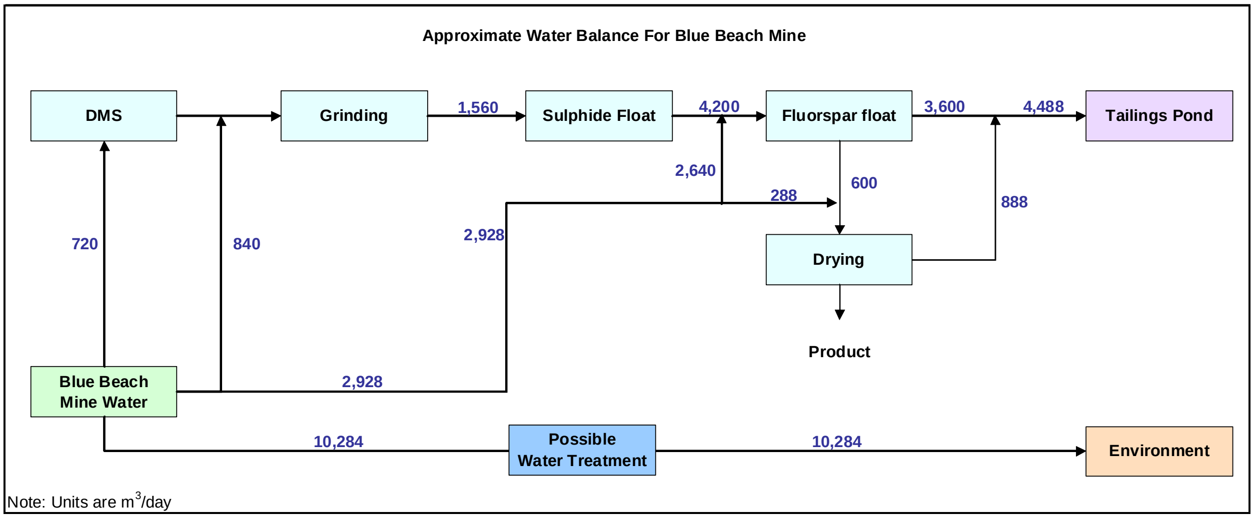

Figure 6.1-8: Water Balance for Blue Beach Mine

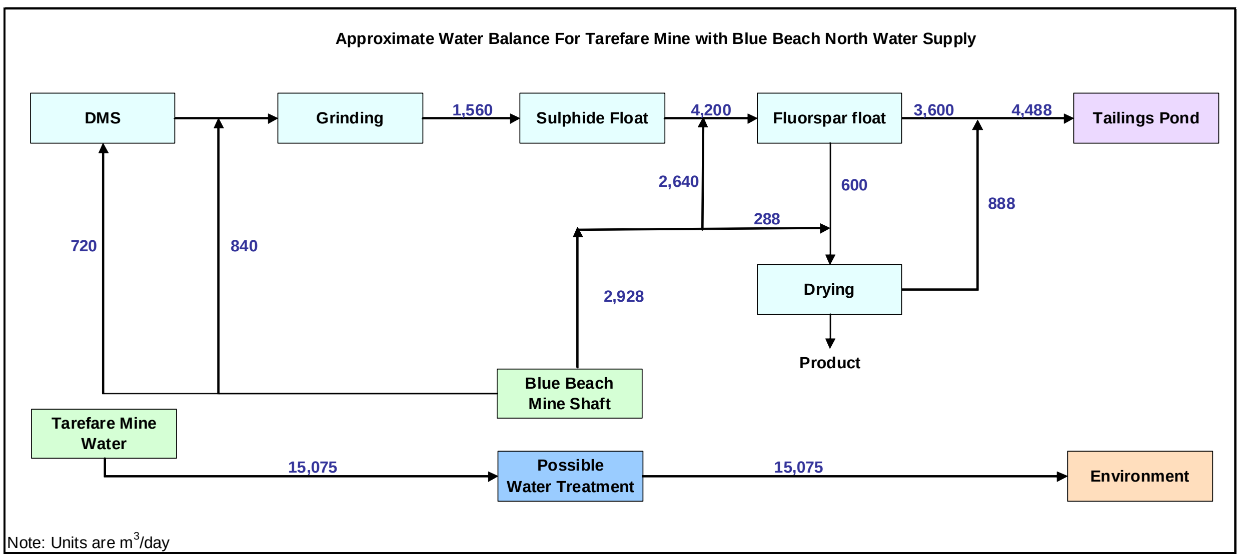

Figure 6.1-9: Water Balance for Tarefare Mine with Blue Beach North Water Supply

In summary, a total of 4,488 m^3/day will be needed for the milling process. The anticipated quantity of water obtained from the dewatering of Tarefare Mine and Blue Beach Mine would be 15,100 m^3/day and 14,800 m^3/day, respectively. The mine outflow rate for both mines is sufficient to meet the required demands for process. However, the quality of the mine water will be an important factor in determining its suitability for process use.

The water required for DMS and the grinding components of mill process is not sensitive to water quality. Therefore, the water demand of 1,560 m^3/day for DMS and grinding could be met by mine dewatering for both Tarefare and Blue Beach North Mine. The distance from Tarefare to the process plant will however limit its use for water supply.

As regards the water demand for fluorspar flotation, based on the historical water quality data, mine water from Blue Beach North Mine could be used for the flotation process but water from Tarefare Mine is most likely not suitable for flotation since the hardness and calcium concentration are expected to be higher. The distance from Tarefare Mine to the process plant also limits the use of this water.

During the operation of Blue Beach North mine, the required water demand for fluorspar flotation would be met by water pumped from the mine as illustrated in the flow balance. The excess water, 10,300 m^3/day, would be diverted to the discharge location in Shoal Cove Brook.

During the operation of Tarefare it is proposed to take all the process water from Blue Beach North as indicated in Figure 6.1-9. The existing shaft at Blue Beach North can be used for this purpose. Tarefare mine water will be discharged to the Salt Cove Brook.

6.1.1.10 Water Disposal

It is intended to discharge excess pumped mine water to nearby streams if flow and quality impacts on the environment are acceptable. This would be beneficial to Habitat Compensation in providing additional water volume during typical low-flow summer conditions.

The discharge rates for Tarefare and Blue Beach North mines have been estimated as 13,500 m^3/day and 10,300 m^3/day, respectively. The potential location for discharge from Tarefare is Salt Cove Brook and, for Blue Beach Mine, Shoal Cove Brook. The hydrological study generated monthly flow and the flow duration curves which were used to assess the feasibility of discharging the pumped mine water into these streams.

Calculations were based on a Shoal Cove catchment area of 5.1 km^2. Monthly flows are presented in Table 6.1-5. The anticipated discharge for Blue Beach North mine is 0.12 m^3/sec (10,300 m^3/day). If this is discharged to the brook there will be an increase in flow of between 25% and 200%, the greater increase during the summer months.

Table 6.1-5: Estimated Monthly Flows for Shoal Cove Brook and Percentage Increase in Flow Diagram Discharge of 0.12m^3/s

Month	Flow (m^3/sec)	Increase (%)
January	0.31	39%
February	0.39	31%
March	0.39	31%
April	0.48	25%
May	0.26	46%
June	0.27	44%
July	0.21	57%
August	0.06	200%
September	0.22	55%
October	0.32	38%
November	0.36	33%
December	0.26	46%

A similar assessment was carried out for the Tarefare discharge, estimated as 0.16 m^3/sec (13,500 m^3/day). The flows in Salt Cove Brook were generated using a catchment area of 24.7 km^2. The monthly flows are presented in Table 6.1-6. The estimated increase in flow ranges from 8% to 44%.

Table 6.1-6: Estimated Monthly Flows for Salt Cove Brook and Percentage Increase in Flow from Discharge of 0.16 m^3/s

Month	Flow (m^3/sec)	Increase (%)
January	1.33	12%
February	1.52	11%
March	1.66	10%
April	2.11	8%
May	1.22	13%
June	1.05	15%
July	0.80	20%
August	0.36	44%
September	0.93	17%
October	1.38	12%
November	1.51	11%
December	1.27	13%

These assessments assume that dewatering will not affect flows in the Brooks indirectly by a decrease in base flow. There is however a possibility of this occurring and therefore the net increase in flow and the impact may be less. On the basis of the calculations above, the discharge of excess water to the Brooks is considered to be feasible. An assessment of the streams that might be affected by this operation has been made as part of the freshwater fish & fish habitat assessment, where the capacity of the Brooks has been made to confirm that increases in flow of around 25% and 8% of maximum flows will not exceed the capacity of the channels.

The MMER prescribe authorised concentration limits for deleterious substances in mine effluents that discharge to waters frequented by fish. The regulated parameters include arsenic, copper, cyanide, lead, nickel, zinc, total suspended solids (TSS), and pH. Using the concentrations specified, recent and historical analyses indicate that the quality of mine water is likely to be suitable for discharging directly into the environment.

There is a possibility of sea water intrusion as a result of dewatering which could increase the salinity of mine water, making it unsuitable for discharge. Monitoring of mine water quality will therefore form part of the Environmental Management Plan. A water management plan will be required which will define where mine water is to be discharged at the surface. The resulting recharge of the underlying aquifer may prevent salt water intrusion into mine openings.

6.1.2 Freshwater Fish and Fish Habitat

The following is a consolidation of the existing historical and current information on the fish and fish habitat characterization and surveys within the two watersheds potentially affected by the Project; Shoal Cove Brook and Salt Cove Brook. 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 Environmental Preview Reports (EPRs); fish habitat investigation of Salt Cove Brook conducted in 1996; a DFO screening assessment conducted in 1997 regarding reactivation of the mine and the recent 2009 surveys related to the current assessment. The 2009 field investigations have been presented in a report entitled "*Water Quality and Fish Habitat Program; St. Lawrence Proposed Re-Activation of Fluorspar Mine*" by AMEC Earth and Environment (2009, in preparation). The results of these surveys are summarized below.

6.1.2.1 Existing Baseline Description

The following ponds and streams are within the proposed project footprint or within the general project area. Figure 6.1-10 presents an overview of the watershed, see also Figure 6.1-10a for the water and fish sampling location map.

Shoal Cove Brook Watershed

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:

- 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 sub-tributaries which drain from the east (named T1) and south east (named T2).

The Shoal Cove Brook watershed is relatively short with an overall length of 3.3km (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 most-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 south west corner of Shoal Cove Pond into Shoal Cove Brook which flows south before discharging into Shoal Cove (Nolan Davis and Associates 1990).

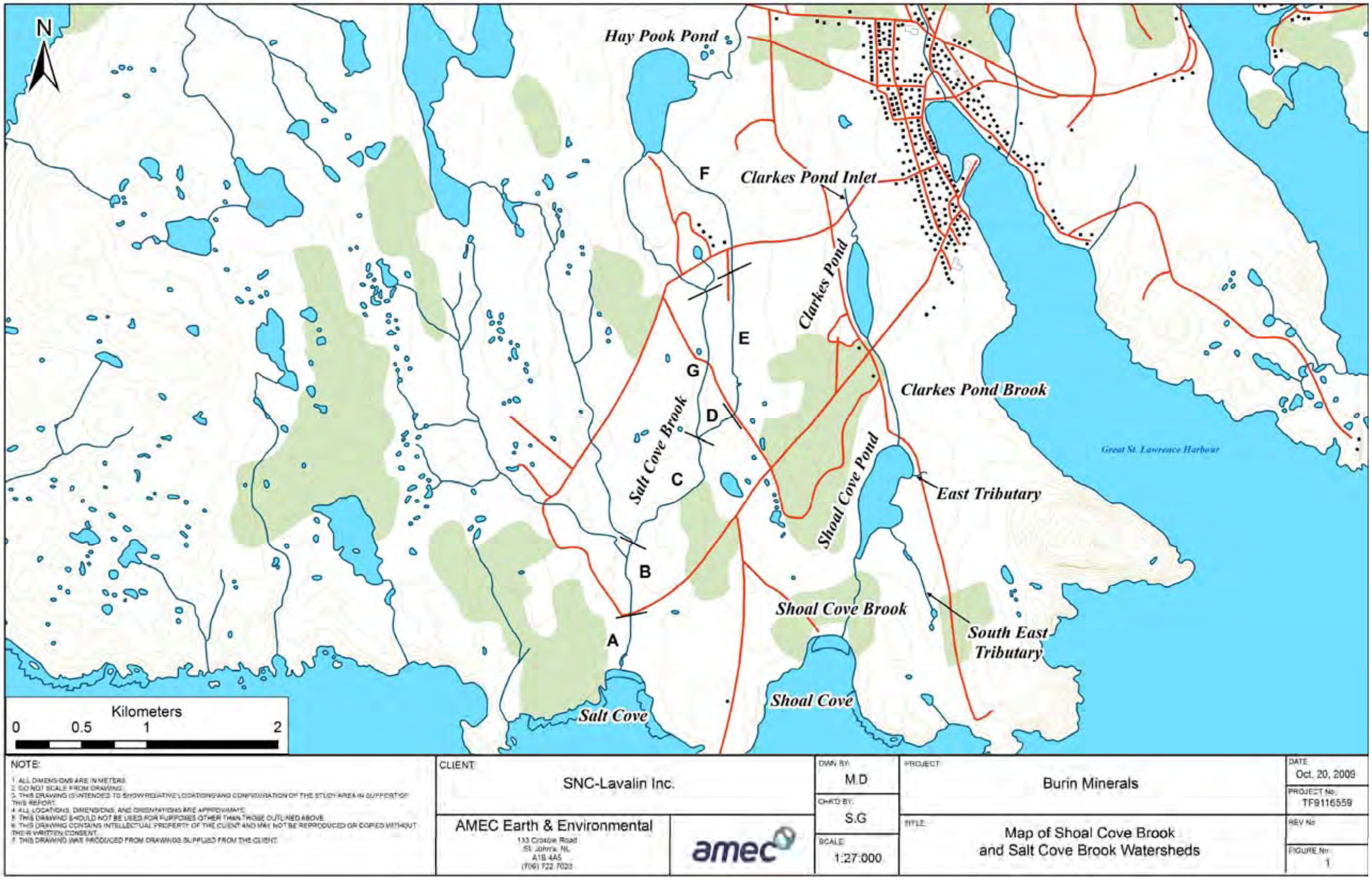

Figure 6.1-10: Fish Habitat Located Within the Project Area

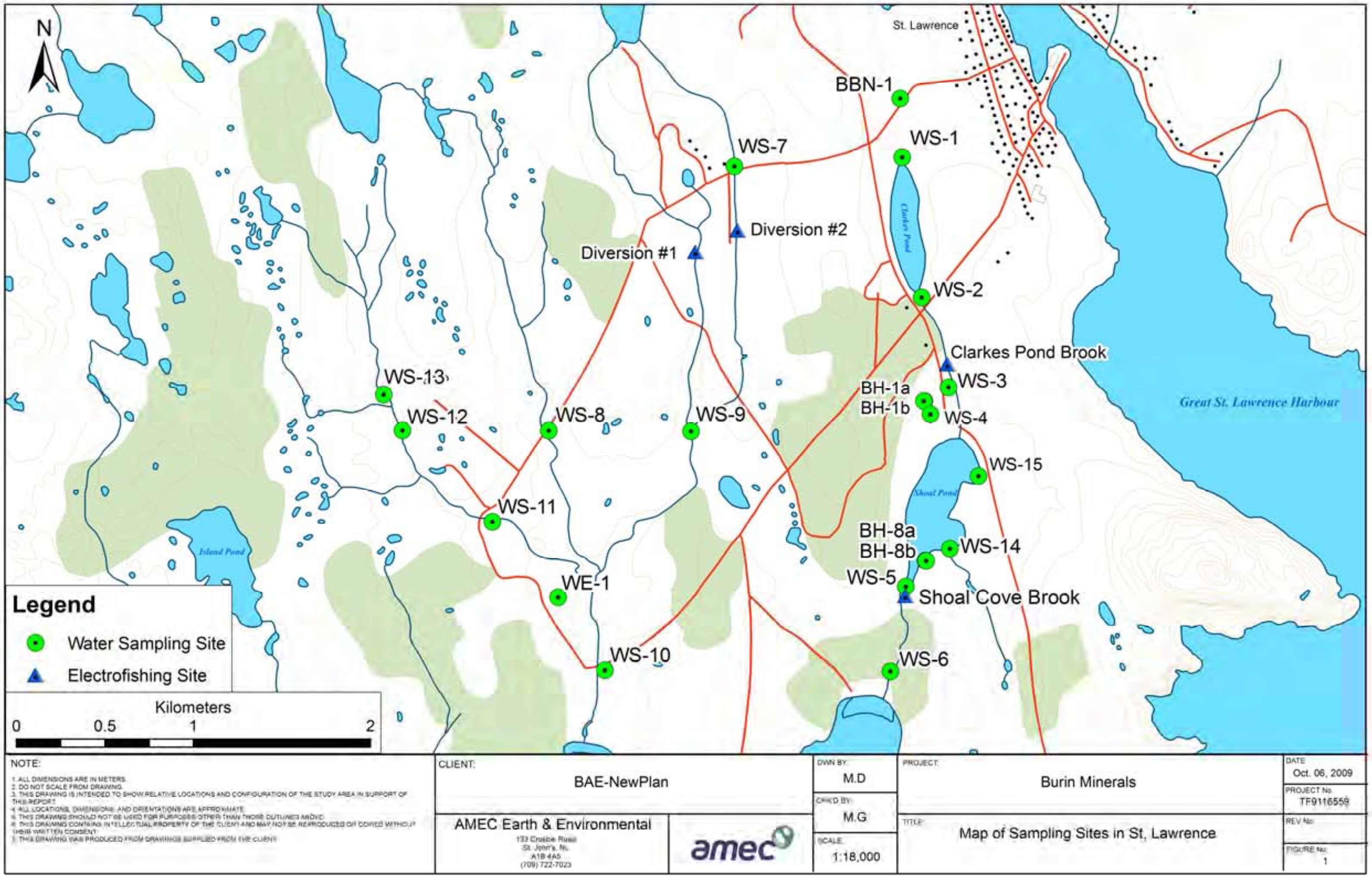

Figure 6.1-10a: Water Quality and Fish Sampling Location Map

Fish Species in Shoal Cove Brook Watershed

Nolan Davis and Associates (1990) and ADI Nolan Davis (1995) both 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 of 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. Age class 1+ and 2+ brook trout were caught during fyke netting in both Shoal Cove Pond and Clarke's Pond. Fish from Clarke's Pond were of better condition than fish captured in Shoal Cove Pond (ADI Nolan Davis 1995). In particular, Shoal Cove Pond brook trout exhibited a trend of being shorter at a particular age than Clarke's Pond fish.

Fish weight for a given length was also lower in Shoal Cove Pond (ADI Nolan Davis 1995). In addition, all fish captured in Shoal Cove Pond during field investigations in 1995 were heavily infested with black spot suggesting that fish residing there are of lower fitness. Due to the difference in morphometrics and difference in condition (lack of black spot in Clarke's Pond fish) it was suggested that each waterbody may have distinct populations of the species (ADI Nolan Davis 1995) although stream surveys in 2009 did not indicate any physical barrier to migration. It is most likely a reflection of poorer quality habitat downstream of Clarke's Pond.

Previous electrofishing studies conducted on Shoal Cove Brook and Clarke's Pond Brook also indicate a general trend of reduced abundance (based on CPUE and biomass) of brook trout in both brooks between 1986 and 1995 (Table 6.1-7). From Table 6.1-8 it is also evident that there is a general trend of reduced average length and weight of stream dwelling fish from 1990 to 1995 whereas average weight increased for pond dwelling fish.

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 as shown by a CPUE of 0.10 and 0.01 fish/second in Clarke's Pond Brook and Shoal Cove Brook respectively. This trend for higher catches from Clarke's Pond Brook was also observed during previous surveys conducted in 1986, 1990 and 1995 (Table 6.1-8). The thirty fish captured in Clarke's Pond Brook in 2009 ranged from 0.1 to 54.2g with an average weight of 11.2g while the three fish captured in Shoal Cove Brook ranged from 19.2 to 54.2g with an average weight of 36.8g (AMEC 2009) (Table 6.1-8).

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

Fish Habitat in Shoal Cove Brook Watershed

Fish habitat within the Shoal Cove Brook watershed is presented below from most-upstream to downstream.

Clarke's Pond Inlet

The inlet to Clarke's Pond is a small stream which winds its way through a fen for approximately 300m (Nolan, Davis and Associates 1990). The primary source of water for the stream was formerly from mine drainage prior to the mine closing (Nolan, Davis and Associates 1990). With input from the mine discharge, average width of the stream was 1.2m with depths averaging 0.19m. Its annual flow rate was 0.113m^3/s (Nolan, Davis and Associates, 1990). The substrate within the stream is primarily cobble covered by a layer of fine silt. The habitat type within this stream has been identified as Type IIa fish habitat (Table 6.1-9), (Nolan Davis and Associates 1990).

Table 6.1-7: Previous Historic Electrofishing Conducted on the Shoal Cove River Watershed (Recreated from (ADI Nolan Davis, 1995))

Station	Water Temp.			# Sweeps			Effort (seconds)			# Trout			CPUE (fish/second)			Area (m^2)			Biomass (g/m^2)		
Year	**1986**	**1990**	**1995**	**1986**	**1990**	**1995**	**1986**	**1990**	**1995**	**1986**	**1990**	**1995**	**1986**	**1990**	**1995**	**1986**	**1990**	**1995**	**1986**	**1990**	**1995**
UB-1	-	19	10	1	3	2	161	640	877	12	3	3	0.075	0.005	0.003	75	110	125	-	0.2	0.1
UB-2	-	17	13	1	4	3	522	935	1232	46	9	6	0.088	0.010	0.005	63	110	112	-	0.8	0.5
LB-1	-	17	16	1	3	3	216	822	1143	5	1	1	0.023	0.001	0.001	45	150	75	-	0.7	0.3
LB-2	-	19	15	1	3	3	317	1000	1355	10	2	5	0.032	0.002	0.004	88	175	150	-	1.0	0.5
T-1	-	-	11	-	-	1	-	-	223	-	-	3	-	-	0.014	-	-	60	-	-	0.4
T-2	-	-	9	-	-	1	-	-	248	-	-	2	-	-	0.008	-	-	30	-	-	0.4

Legend:

CPUE Catch Per Unit Effort
UB-1 Upper Brook (Clarke's Pond Brook) near Shoal Cove Pond
UB-2 Upper Brook (Clarke's Pond Brook) near Clarke's Pond
LB-1 Lower Brook (Shoal Cove Brook) near Shoal Cove Pond
LB-2 Lower Brook (Shoal Cove Brook) near Shoal Cove
T-1 Inlet tributary of Shoal Cove Pond (south-eastern shoreline)
T-2 Inlet tributary of Shoal Cove Pond (eastern shoreline)

Table 6.1-8: Characteristics of Fish Caught Throughout Shoal Cove River Watershed During Previous Field Studies (Nolan, Davis and Associated 1990, ADI Nolan Davis 1995, AMEC 2009)

Year	1990		1995		2009	
Sampling Location	Average Length	Average Weight	Average Length	Average Weight	Average Length	Average Weight
Clarke's Pond	11.78	34.7	16.7	62.5	-	-
Shoal Cove Pond	15.7	59.1	16.6	62	-	-
Clarke's Pond Brook -1	8.2	7.3	7.6	5.8	82.5	11.2
Clarke's Pond Brook -2	8.03	9.9	9.6	9.6	-	-
Shoal Cove Brook-1	19.5	98.6	12.7	21.2	146.3	36.8
Shoal Cove Brook-2	19.7	90.9	10.62	16	-	-
T-1	-	-	8.1	7.4	-	-
T-2	-	-	7.6	5.8	-	-

Table 6.1-9: Description of Salmonid Riverine Habitat Type Classifications

Habitat Type	Description
I	Good salmonid rearing habitat, good spawning areas, often with pools for larger age classes. Flows – moderate riffle, current 0.1 to 0.3m/s. Depth – shallow, less than 1m. Substrate – gravel to small cobble size rock, may be interspersed with boulder.
II	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. Flows – riffle to light rapid, current 0.3 to 1.0m/s. Depth – variable, < 1.5m. Substrate – large cobble to boulder and bedrock, some gravel pockets interspersed.
III	Poor rearing habitat with no spawning capabilities, used for migratory purposed. Flows – fast, turbulent, heavy rapids, chutes, waterfalls, current >1m/s. Depth – variable. Substrate – boulder, bedrock.
IV	Poor juvenile salmonid rearing habitat, no spawning capability. Provides shelter and feeding habitat for larger, older salmonids. Flows – sluggish, currents 0.15m/s. Depth – variable, often >1m. Substrate – soft sediment or sand, large boulders or bedrock covered by sand or silt, aquatic macrophytes often present, especially along shore.
The letter designation a is added if habitat is impacted by human activity such as channelization, bank destabilization etc.	

Clarke's Pond

Clarke's Pond has a total surface area of 10ha, average depth of 1.5m and maximum depth of 2.7m at its southern end (Nolan, Davis and Associates 1990). Water is supplied to the pond through groundwater/underground springs (ADI Nolan Davis 1995; Burin Minerals Ltd. 2009; Department of Fisheries and Oceans 1997) and formerly from mine drainage from the inlet stream (Nolan Davis and Associates 1990). Aquatic vegetation is relatively thick within the pond and consists primarily of Pondweed (*Potamogeton* sp.) and yellow water lily (*Nuphar variegatum*) (Nolan, Davis and Associates 1990). Barnes (1985) indicated that in 1985, the northern three-quarters of the pond was choked with weeds at the time of his spring field survey. Barnes (1985) also indicated that the pond was known to become full of lily pads during the late summer months. It was also reported in Barnes (1985) that the upper three-quarters of the pond has a thick muddy bottom whereas the bottom quarter has rocky substrate. The shoreline banks of Clarke's Pond are stable and well vegetated with grass, alder spruce and fir (Nolan, Davis and Associates 1990; Department of Fisheries and Oceans 1997; Burin Minerals Ltd. 2009).

Clarke's Pond Brook

Clarke's Pond brook (Figure 6.1-11) has an approximate length of 1,000m and is considered Type IIa (Table 6.1-9) salmonid fish habitat throughout (ADI Nolan Davis 1995).

Figure 6.1-11: Clarke's Pond Brook (August 13, 2009). Clarke's Pond is Shown Upstream.

The width of the brook varies from three to four metres near Shoal Cove Pond to a braided section which flows through a wooded area with a width of less than 1m. During historic stream surveys, water depths were typically less than 0.20m with an annual discharge of 0.08m^3/s. The substrate within the brook consists of small boulders, cobbles and gravels (ADI Nolan Davis 1995). The lower sections of the stream have a boulder/cobble substrate whereas in the upper sections of the stream the boulder/cobble substrate shifts to a cobble/gravel substrate with gravels becoming increasingly common when approaching Clarke's Pond (Barnes 1985). Areas with substrate suitable for spawning were located in areas with no cover (ADI Nolan Davis 1995). Based on the information from ADI Nolan Davis (1995), the total area of fish habitat within the brook would be in the range of 1,000-4,000m^2. A stream survey completed by Barnes (1985) indicated that the lower two-fifths of Clarke's Pond Brook was quite heavily silted indicating previous tailings deposition within the system. Barnes (1985) also indicated that few invertebrates were encountered within the stream. The stream banks of Clarke's Pond Brook are variable, with some sections impacted by vegetation removal (the 60m section below Clarke's Pond is primarily composed of exposed soil, gravel, alder and grass) whereas some sections flow through natural wooded and fen areas (i.e. section of brook located below the road passing south of Clarke's Pond to 60m upstream of Shoal Cove Pond), (Nolan Davis and Associates 1990).

Stream surveys and transects were conducted in August 2009 over the upper 433.2m section of Clarke's Pond Brook by AMEC (2009). Stream characterization results were similar to that of previous stream surveys. Wetted widths ranged from 1.6-3.4m whereas channel width ranged from 6.4-11.8m. Survey transects also identified dominant substrates as a mixture of rubble, cobble and gravel with sand, silt and small boulder found as a minor proportion (Figure 6.1-12). Average water depths ranged from 0.07-0.12m whereas water velocities ranged from 0.18-0.53m/s (AMEC 2009). Discharge at the time of surveys was measured at 0.119 m^3/s. Habitat identified throughout the surveyed section of Clarke's Pond Brook was classified as riffle or riffle/run habitat (AMEC 2009).

<u>Shoal Cove Pond</u>

Shoal Cove Pond has a total surface area of 15.7 ha, a maximum depth of approximately 1.8m (Figure 6.1-13), and is shallow throughout especially towards its northern end (Nolan, Davis and Associates 1990). There are patches of emergent aquatic vegetation, primarily *Potamogeton* sp., on the east side, northeast corner and the southeast corner (Nolan, Davis and Associates 1990). Previous mining activity and associated tailings disposal has resulted in the deposition of tailings throughout a vast portion of the pond. Tailings from settling basins located upgradient of the pond have migrated and infilled a major portion of the pond (estimated at fifty percent), (ADI Nolan Davis 1995). The entire bottom of the pond is also covered with a thick layer of fine silt (Nolan, Davis and Associates 1990). Unlike Clarke's Pond, the water levels in Shoal Cove Pond fluctuate seasonally (ADI Nolan Davis 1995).

<u>Shoal Cove Pond Tributary Streams (T1 and T2)</u>

ADI Nolan Davis (1995) identified two small sub-tributaries which empty into Shoal Cove Pond; one from the east (Figure 6.1-14) and another from the southeast (Figure 6.1-15).

Figure 6.1-12: Clarke's Pond Brook Looking Downstream Towards Shoal Cove Brook (August 13, 2009)

Figure 6.1-13: Section of Shoal Cove Pond (April 2, 2009)

Figure 6.1-14: Shoal Cove Pond Eastern Tributary Stream (August 15, 2009)

Figure 6.1-15: Shoal Cove Pond South Eastern Tributary Stream (April 2, 2009)

Historic stream characterization or survey data was not reported on either. Although stream surveys were not conducted throughout, habitat near their confluences with Shoal Cove Pond were electrofished as part of the field work completed for the 1995 Environmental Preview Report (see Table 6.1-8). Water samples were also collected from these streams as part of the 2009 water sampling program completed by AMEC (2009).

Shoal Cove Brook

Shoal Cove Brook extends from the outflow of Shoal Cove Pond for approximately 600m with typical width and depth of 3.5m and 0.22m respectively with an annual discharge of $0.177m^3/s$ (Nolan, Davis and Associates 1990). This section is steeper than stream sections further north within the watershed (eg. Clarke's Pond Brook). Substrate consists of bedrock, boulder and cobble with sparse gravel (Nolan, Davis and Associates 1990). Similarly, the river banks are steep in places and well vegetated with grass, alder, blueberry, fir and spruce. Shoal Cove Brook was noted to contain more and deeper pools (0.30-0.40m) than Clarke's Pond Brook. The lower 70m of the stream, prior to reaching the beach of Shoal Cove, is located in a marshy area and is approximately 4m wide. Flow filters through boulders at the crest of the beach before meandering across the sandy beach in an unstable channel. It was noted that under these conditions there would be a barrier to migration for fish to move into or out of the system. However, during high flow periods, local residents have reported that fish may migrate between the stream and Shoal cove (ADI Nolan Davis 1995). Fish habitat within Shoal Cove Brook is primarily Type IIa (Table 6.1-9) with small areas (less than 1m long) of Type III (Table 6.1-9) habitat. In addition, the upper 100m of the brook has been diverted from its historical route, channelized and the banks have been stabilized with rock as a result of previous mine tailings management activities (ADI Nolan Davis 1995).

Stream surveys and transects were conducted in August 2009 over the upper 400m section of Shoal Cove Pond Brook by AMEC (2009). Stream characterization results were similar to that of previous stream surveys. Wetted widths ranged from 2.1-4.5m whereas channel width ranged from 5.6-9.2m. Survey transects also identified dominant substrates as a mixture of small boulder, rubble, cobble and gravel with sand, silt and large boulder found as a minor proportion (Figure 6.1.16). Average water depths ranged from 0.09-0.38m whereas water velocities ranged from 0.20-0.27m/s (AMEC 2009). Discharge at the time of surveys was measured at 0.202m^3/s. Habitat identified throughout the surveyed section of Shoal Cove Brook was classified as riffle or a combination of riffle and run (AMEC 2009).

Shoal Cove Brook Water Quality

The Nolan, Davis and Associates (1990) report indicated that the water within Shoal Cove Pond and Shoal Cove Brook was murky at the time of the field surveys. Water sampling within the inlet and outlet streams of Clarke's Pond and Shoal Cove Pond conducted by AMEC (2009) indicated little turbidity throughout the system in August (0-1 NTU) with no observations of excessive sedimentation indicated. April water sampling conducted by AMEC (2009) indicated greater turbidity throughout the system (8.9-38.5 NTU) with the highest levels (38.5 NTU) found in the upper reaches of Shoal Cove Brook suggesting that previously deposited sediment within Shoal Cove Pond may become re-suspended during high flow or adverse weather conditions. In addition, analysis of water samples collected by AMEC (2009) within the Shoal Cove Brook watershed indicated that all samples exceeded Canadian Council of Ministers of the Environment (CCME) guidelines for cadmium. Similarly, 14 of 16 water samples analyzed had aluminum concentrations which were above CCME guidelines as were 3 of 16 samples for copper and iron (AMEC 2009).

Figure 6.1-16: Shoal Cove Brook

Previous Impacts Due to Mining and Mine Site Development

The Shoal Cove Pond watershed has been impacted by previous mining activities within the area. Particularly, historical tailings deposition and mill process water discharge have resulted in sedimentation within the entire system (Figure 6.1-17). Specifically, Nolan, Davis and Associates (1990) noted that the substrate within the section of stream north of Clarke's Pond was cobble covered by a layer of fine silt likely from mine discharges. They also noted that in August of 1990 the water in Clarke's Pond was cloudy suggesting increased suspended sediment and sedimentation. Clarke's Pond Brook has also been impacted through the disturbance of riparian vegetation and earth moving activities along its length (ADI Nolan Davis 1995). Two sections of the brook have also been channelized; one extending from the outflow of Clarke's Pond downstream and the other extending from Shoal Cove Pond upstream (Nolan, Davis and Associates 1990). Shoal Cove Pond shows the greatest impact as a result of tailings deposition as its bottom substrate has been characterized as being covered by a thick layer of fine silt (Nolan, Davis and Associates 1990; ADI Nolan Davis 1995; Department of Fisheries and Oceans 1997 and the Burin Minerals Ltd. 2009). The northwest corner of the pond has also been infilled due to previous tailings deposition. Shoal Cove Brook was noted to have its upper 100m channelized away from its historical route and stabilized with rock (ADI Nolan Davis 1995).

Figure 6.1-17: Aerial Photograph of Shoal Cove Pond (1941), Highlighting Tailings Deposition within the System between Clarke's Pond and Shoal Cove

Salt Cove Brook Watershed

The Salt Cove Brook watershed covers Salt Cove Brook from its mouth at Salt Cove, northward to the outlet of Hay Pook Pond. The outflow of Hay Pook 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 the summary as the Compensation Plan includes re-establishing fish habitat in this area.

The Salt Cove Brook watershed encompasses two larger ponds outside the Project area in terms of potential interactions with the freshwater environment; Hay Pook and Long Pond. The main stem is divided into seven separate sections, from most-downstream to upstream (as described in ADI Nolan Davis 1996):

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

Salt Cove Brook also has two tributaries (T-1 and T-2) which drain from the west of the Project area. Figure 6.1-10 presents an overview of the watershed.

The Salt Cove Brook main channel extends 4.6km from Salt Cove to Hay Pook Pond and contains a mixture of Type Ia, IIa and III salmonid fish 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 to avoid potential mine flooding of the former Director Mine. 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 natural stream section, as a result of the diversion, is 1,251.8m long and contains a substantial amount of habitat which is suitable for salmonid spawning.

Fish Species in Salt Cove Brook System

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). Atlantic salmon were found within section B (as juveniles) and section F (as fry) whereas the only eel located was in section E (ADI Nolan Davis 1996). A comparison of fish from the Salt Cove Brook watershed and Shoal Cove Brook watershed indicated that trout are smaller in the Salt Cove Brook watershed (ADI Nolan Davis 1996). An index electrofishing survey conducted on Salt Cove Brook by AMEC in August of 2009 also identified brook trout, Atlantic salmon and American eel as species which occur within the watershed (AMEC 2009). It was not determined whether the Atlantic salmon were resident or anadromous. The survey conducted in 2009 included electrofishing a portion of Section G (diverted natural stream) which was not included in the original 1996 ADI Nolan Davis survey. The AMEC survey resulted in forty brook trout being captured within Section G (CPUE = 0.13) and only three (CPUE = 0.01) within the man-made diversion channel. (AMEC 2009). Brook trout captured in the diverted section ranged from 46-155mm long with an average of length of 109.1mm and weighed between 1.1g-42.8g with an average weight of 17.7g. These fish were holding in pooled water as shown in Figure 6.1-18. The brook trout captured in the man-made diversion ranged from 50-130mm long with an average length of 87.7mm and weighed between 1.2 and 22.9g with an average weight of 10.3g.

Figure 6.1-18: Diverted Section (G) of Salt Cove Brook (August 14, 2009)

<u>Fish Habitat in Salt Cove Brook Watershed</u>

A previous assessment of the fish habitat within Salt Cove Brook was completed by ADI Nolan Davis (1996). This assessment covered the habitat within Salt Cove Brook from its mouth in Salt Cove to Hay Pook Pond including a section of diverted, former stream bed as outlined above. The ADI Nolan Davis (1996) report identified stream sections as seven distinct sections (A-G outlined above) and identified a mixture of type Ia, IIa and II salmonid fish habitat (Table 6.1-10).

Table 6.1-10: Stream Characteristics of Salt Cove Stream Sections

Parameter	Stream Section						
	A	B	C	D	E	F	G
Average Wetted Width (m)	13.5	10.1	9.2	6.0	5.1	4.9	5.3
Length (m)	439.5	573.6	1043.1	311.6	899.4	1335	1251.8
Area (m^2)	5933	5793	9631	1870	4557	6542	6635
Habitat Type	II	II	II	IIa	IIa	Ia	Ia

Sections A, B and C are similar in character with widths between 13-15m and containing primarily riffle habitat (Sections B and C are 95% and 90% riffle habitat respectively). All habitat in these sections is classified as Type II fish habitat and contains primarily cobble, boulder and bedrock substrate (80% or greater of the substrate in each section once combined). Although sections A, B and C are similar they vary in overhanging vegetation and stream morphology (Figure 6.1-19). In particular, section A has a 60m x 150m pond on its southern end, contains only a single pool in the riverine portion, and has little overhanging vegetation or undercut banks. Section B is the only section which contains bedrock substrate which results in this section also having small sections of Type III fish habitat. In addition this section has a greater amount of pool habitat than Section A. Section C was considered by ADI Nolan Davis (1996) to be the most conducive salmonid habitat of the three stream sections. In particular, substrate diversity (substrates in this section were 55 % cobble, 25% boulder, 15% gravel and 5% sand); the presence of pools and back eddies; and the well developed channel morphology (stability, sinuosity and channel development) were utilized in classifying the habitat.

The upper reaches consist of straight man-made channel sections (Figure 6.1-20). These channel segments were designated as D, E and F. Similar to the lower river sections the upper river sections are dominated by riffle habitat (100%, 90%, 95% for Sections D, E, and F respectively) and larger substrates (cobble and boulder). Stream segments D, E and F are the same width (8m) and are bound by steep (3-4m high) banks. Sections D and E are also similar in that they have moderate to steep stream bed channels and are both classified as Type IIa fish habitat (0.61m/s and 0.45m/s respectively). Stream section F has a higher proportion of gravel substrate (35%), experiences slower water velocities (0.35m/s), has a lower slope than either section D or E and is classified as Type Ia fish habitat.

Section G is the historic, natural section of river bed. Even though the construction of the channel resulted in the diversion of the majority of flow away from the original stream bed, there still remains some flow and standing water through the river bed (AMEC 2009). Section G is approximately 14m wide and contains a mixture of riffle/run habitat (90%/10%).

It contains a substrate composition of 50% gravel, 25% cobble and 25% boulder (ADI Nolan Davis 1986). The riparian zone is well vegetated with trees on both banks and has a channel morphology which is much better than Sections D, E or F. Although there is an abundance of gravel substrate, they were heavily embedded due to reduced flow and sedimentation within the channel (ADI Nolan Davis 1996).

Figure 6.1-19: Section C, Salt Cove Brook (August 15, 2009)

Figure 6.1-20: Salt Cove Brook Man Made Diversion Channel (August 14, 2009)

At the mouth of Salt Cove brook there is a 60m x 150m pond which is created by an extensive gravel beach at Salt Cove (ADI Nolan Davis 1996). Water from Salt Cove Brook filters through the gravel beach to eventually reach the ocean (ADI Nolan Davis 1996). Information from local residents and Fisheries and Oceans personnel indicate that this is typical and serves as a barrier to the movement of fish in and out of the system (ADI Nolan Davis 1996). However, it was indicated that under certain conditions, the mouth of the brook is open (ADI Nolan Davis 1996).

Water Quality – Salt Cove Brook Watershed

During the spring and summer of 2009, water samples from the Salt Cove Brook watershed were collected and analyzed. In particular these samples were collected from the upper section (Section F - man-made diversion canal), lower section (Section A - natural steam section) and Section C (at the confluence of the dewatered section of stream and the diversion canal) (AMEC 2009). For all samples collected, the concentration of cadmium exceeded CCME guidelines. Similarly, five of the six samples collected had concentrations of aluminum which were above CCME guidelines. Samples collected in August also exceeded CCME guidelines for iron. Turbidity values for April ranged from 8.8-9.3NTU while all readings in August were 0.0NTU.

Previous Impacts due to Mining and Mine Site Development

Impacts to Salt Cove Brook are primarily due to the diversion of water away from the natural stream channel and into a linear man-made diversion channel which contains little instream structure conducive to productive fish habitat. In addition, a concrete dam constructed in one of the upper reaches is considered a barrier to fish passage.

6.1.2.2 Impact Assessment

Freshwater fish and fish habitat is included as a VEC as it will directly interact with the Project, particularly during the Operations phase. A description of the Tailings Management is provided in Section 5.1and 5.4. Fish species and the habitat located within both the Shoal Cove and Salt Cove Brook watersheds are provided in Section 6.1.2.1 above. In particular, brook trout is the most-abundant species within the watersheds with Atlantic salmon and American eel also utilizing Salt Cove Brook. The main potential for effects on these species and the freshwater environment in general arise from construction activities (Section 5.2.2), mine operation (Section 5.2.3) and accidents and malfunctions (Section 5.7).

Assessment Criteria

Assessment criteria, including boundaries, are described in Section 4.4. *Significant* environmental effects are those considered to be of sufficient magnitude, duration, frequency, geographic extent, and/or reversibility to cause a change in the freshwater fish and fish habitat VEC that will alter its status or integrity beyond an acceptable level. Establishment of the criteria is based on professional judgment, but is transparent and repeatable.

In this EPR/EA, a *significant* effect is defined as one having a medium or high magnitude, duration greater than one year, and geographic extent greater than 100 km^2. Reversibility of the effect as well as mitigations/compensation are also an important considerations.

Issues and Concerns

The potential issues identified are those interactions that have a reasonable probability of occurring within at least one of the three phases of the Project (Construction, Operation and Decommissioning).

The principle concerns would be related to:

- Loss and/or alteration of freshwater fish and fish habitat (during Operations);
- Increased total suspended solids (during all phases); and
- Characterization of effluent discharged from the Tailings Management Area (during Operations).

The effects of these and other routine activities on freshwater fish and fish habitat are assessed in the following sections.

Existing Knowledge

The following sections briefly summarize existing knowledge in regard to the focal species, freshwater habitat disturbance and chemical contamination. Within the Project area, three species of freshwater fish were identified; brook trout, Atlantic salmon and American eel.

Brook Trout (*Salvelinus fontinalis*)

As mentioned in previous section, within the Project area, brook trout are located throughout the Shoal Cove Brook and Salt Cove Brook watersheds.

Brook trout are known to have both landlocked and anadormous populations throughout Newfoundland and Labrador (Scott and Crossman 1964; 1998). Anadromous populations may spend 1 or 2 months feeding at sea in relatively shallow water, close to their natal stream, while others spend their entire life in freshwater (Scott and Crossman 1964; Morrow 1980; Power 1980; Ryan 1988; Scott and Scott 1988).

Within Newfoundland and Labrador, lakes and ponds are utilized for spawning, overwintering and feeding (Dempson and Green 1985; Cowan and Baggs 1988; McCarthy 1996). Raleigh (1982) characterized optimal brook trout riverine habitat as clear, cold spring-fed streams with a silt-free rocky substrate in riffle-run areas; an approximate 1:1 pool-riffle ratio with areas of slow, deep water; well vegetated stream banks; abundant instream cover; and relatively stable water flow, temperature regimes and stream banks. Brook trout spawning has been observed in a variety of habitats and substrates, including: lake shorelines (Wiseman 1971; Wurtsbaugh et al 1975; Fraser 1982; Dempson and Green 1985; Cowan and Baggs 1988; Ford et al. 1995), sandy and heavily silted substrates (Webster 1962; Carline 1980; Chisholm et al. 1987) and over aggregations of waterlogged sticks, woodchips and debris (Fraser 1982). This generalist spawning behaviour appears to be less dependent on substrate and more strongly correlated to the presence of groundwater upwelling (Morrow 1980), particularly for mainland populations. Groundwater upwelling is beneficial in that it protects from freezing and carries dissolved oxygen to and metabolic wastes away from, developing embryos (Reiser and Wesche 1977; Fraser 1982; 1985; Matthess 1982; Curry et al. 1995).

Alevins remain in the nest until the yolk sac is absorbed (Ryan 1988; Scott and Scott 1988) and upon emergence disperse over gravel/cobble substrates in the shallow (<2 m) littoral zone, usually residing within 0.5 m of the bottom (Wurtsbaugh et al. 1975; Pepper et al. 1985; Hosn and Downing 1994; Curry et al. 1995; Ford et al. 1995; Halvorsen et al. 1996). Wesche (1980) reported that young-of-year (YOY) and small juveniles (<15 cm in length) were associated more with instream cover (mostly rubble substrate) than overhead stream bank cover, and that an area of cover at least 15% of the total stream width is required. Boussu (1954) reported that aquatic vegetation is an important form of cover for young salmonids. Cunjak and Green (1983) observed in two Avalon Peninsula streams that YOY and juveniles showed a strong preference for cover (where available), but that the presence of competing species and/or lack of available cover can result in shifts of habitat utilization. In Newfoundland, juvenile brook trout typically move into lakes at 1-3 years of age (Ryan and Knoechel 1994; O'Connell and Dempson 1996) and move to deeper, cooler, waters during the warmer summer months (Venne and Magnan 1995).

Gibson (1993) stated that in an Avalon Peninsula stream, brook trout biomass had a negative relationship to maximum flood height, indicating that habitats with more stable flows had higher production. Adults are often associated with cover, which is sometimes considered a factor limiting to production (Boussu 1954; Lewis 1969; Hunt 1971; Fausch and White 1981; Cunjak and Power 1986; Lambert and Hanson 1989). Cover can be provided by overhanging vegetation, submerged vegetation, undercut banks, instream objects (woody debris, roots, and large boulders), rocky substrates, depth, and water surface turbidity (McPhail and Lindsey 1970; Giger 1973; Becker 1983; Raleigh 1982; Ford et al. 1995). Enk (1977) reported that in two Michigan streams, trout biomass and number of adults were significantly correlated with bank cover. Cunjak and Green (1983) reported that in two Avalon Peninsula streams, as brook trout increase in size they tend to move from shallow stream margins to deeper water (pools) with undercut banks and other forms of cover.

Atlantic Salmon (*Salmo salar*)

Atlantic salmon are distributed throughout the northern portion of the Atlantic Ocean from Portugal to Norway in the east, throughout southern Iceland and Greenland, and from Hudson Bay to the Connecticut River in the west. In Canada, the anadromous form is distributed throughout eastern Quebec, the Maritimes and Newfoundland and Labrador. Atlantic salmon are found throughout Newfoundland and southern Labrador (Scott and Crossman 1973; Scott and Scott 1988) and have been reported in coastal rivers as far north as the Fraser River (Black et al. 1986). Throughout Newfoundland and Labrador, Atlantic salmon occur in both anadromous and landlocked populations (Smith 1988). Anadromous salmon have been captured at sea up to the northern tip of Labrador (Power and Creesman 1975).

Landlocked salmon, commonly called Ouananiche, are the dominant species in some Newfoundland lakes where they may exist in either normal or dwarf forms (Smith 1988).

Ouananiche spawning typically occurs in October or November, depending on water temperature, with females ascending tributaries to prepare redds (nests). In Newfoundland, lake-spawning has been reported to occur over a gravel substrate (Leggett 1965) at depths of 0.5-1.3 m (Cowan and Baggs 1988). Lake-spawning has also been observed along shorelines (Leggett 1965) as well as near areas of moving water, usually above outlet streams and near the mouths of inlet streams (Leggett 1965; Harvey and Warner 1970; Einarsson et al. 1990). Milt and eggs (1,500 eggs per kg of female) are deposited in the redd and the female then covers the eggs, which range in size from 5 to 7 mm, with a layer of gravel. When spawning is complete, the adults return to the lake. Incubation lasts for about 110 days (depending on temperature), with hatching generally occurring in April. The larvae, or sac fry, remain in the redds until the yolk sac is absorbed, after which they emerge in May or June.

For the next 2 or 3 years, the parr remain in stream habitat, preferring rapid water (Scruton et al. 1997). They then move to a lacustarine habitat and continue to grow rapidly (Leggett 1965; Leggett and Power 1969; Wiseman 1971; Harvey and Warner 1970). Jorgensen et al. (1996) found that juveniles utilized the littoral zone throughout the entire ice-free season with smaller individuals occupying areas closer to the bottom than larger ones (Halvorsen et al. 1996). Ouananiche mature at 2-3 years of age (Leggett 1965; Lee 1971; Leggett and Power 1969) and may live for up to 10 years in Newfoundland (Leggett 1965). Adults are generally pelagic and feed heavily on pelagic and surface organisms during June and July, but as water temperatures increase during the summer, move to deeper, cooler water and appear to feed more on benthic organisms (Leggett 1965). Scruton et al. (1997) have shown that Ouananiche will overwinter in deep warmer waters of reservoir systems as well as fast-flowing ice-free waters of inlets, outlets and canals.

<u>American Eel (*Anguilla rostrata*)</u>

The American eel is distributed from the southern tip of Greenland, southward along the Atlantic coast and the Gulf of Mexico to the northern portion of the east coast of South America. They have been reported throughout Newfoundland and the south-eastern coast of Labrador as far north as Hamilton Inlet. The American eel is catadromous spending most of its life in freshwater and estuaries but migrating to sea to spawn. Eels typically begin their spawning migration in late summer and fall throughout much of eastern Canada, although migration from lakes that are far inland may begin earlier. Peak migratory activity often occurs in September-October during the last quarter of the moon and is enhanced by dark, stormy nights and rising water levels.

Eels spawn in the Sargasso Sea, with peak spawning occurring in mid-winter between January and March, but may extend as late as May or June. Although the depth at which spawning occurs is not known, evidence suggests that eels spawn in the upper few hundred metres of the water column. Adult eels presumably die after spawning.

During their freshwater phase of their life cycle, eels move into streams, rivers and muddy or silt-bottomed lakes, generally following the bank of the river in very shallow water. Eels can be very mobile and may gain access to ponds and lakes, which appear unavailable to them, by using very small watercourses or by moving overland through wet grass. Being nocturnal, they usually spend the day hiding under rocks and logs or buried in the mud. Investigations on diet composition of juvenile eels suggest that American eels rely heavily on benthic organisms and demersal fishes as food sources. There are indications that a proportion of eels remain in brackish estuaries and do not enter freshwater at all. In Newfoundland, eels migrate to sea after spending twelve to thirteen years in freshwater.

Recent concern regarding population decreases in the Great Lakes has prompted COSEWIC to list the American eel as a Species of Concern in 2006 (COSEWIC 2006). This designation is defined as a wildlife species that may become a threatened or an endangered species because of a combination of biological characteristics and identified threats. The reason for the designation has been indicators of the status of the total Canadian component of this species are not available. Indices of abundance in the Upper St. Lawrence River and Lake Ontario have declined by approximately 99% since the 1970s. The only other data series of comparable length (no long-term indices are available for Scotia/Fundy, Newfoundland and Labrador) are from the lower St. Lawrence River and Gulf of St. Lawrence, where four out of five time series declined. Because the eel is panmictic (i.e. all spawners form a single breeding unit), recruitment of eels to Canadian waters would be affected by the status of the species in the United States as well as Canada. Prior to there declines, eels reared in Canada comprised a substantial portion of the breeding population of the species. The collapse of the Lake Ontario-Upper St. Lawrence component may have significantly affected total reproductive output, but time series of elver abundance, although relatively short, do not show evidence of an ongoing decline. Recent data suggest that declines may have ceased in some areas; however, numbers in Lake Ontario and the Upper St. Lawrence remain drastically lower than former levels, and the positive trends in some indicators for the Gulf of St. Lawrence are too short to provide strong evidence that this component is increasing. Possible causes of the observed decline include habitat alteration, dams, fishery harvest, oscillations in ocean conditions, acid rain and contaminants. The designation as a Species of Concern does not enact any additional conservation measures outside those within the *Fisheries Act*.

Loss of Fish Habitat

The *Fisheries Act* contains a prohibition with respect to the "harmful alteration disruption or destruction" of fish habitat (HADD). The Act permits the Minister to issue an Authorization under Section 35 (2) which will permit a "HADD" to occur. The issuance of an Authorization is at the discretion of the Minister; however the "rules" for issuing an Authorization are well established. A HADD Authorization will be issued only in accordance with the Policy for the Management of Fish Habitat. This policy has an objective of achieving a "net gain" in the productive capacity of fish habitat in Canada. The Policy has a Guiding Principle of "No Net Loss", i.e., existing fish habitat will be protected, while unavoidable habitat alterations are to be balanced by development of new habitat or the increased productive capacity of existing habitat. An Authorization must be issued before any action can be taken to alter, disrupt or destroy fish habitat.

The location of the Tailings Management Area covers identified fish habitat. The total amount of habitat directly within the Project Area has been quantified as per DFO guidelines and direction. The fish habitat identified within the HADD determination includes habitat that has been affected by past operations and tailings storage and disposal.

Siltation, Erosion and Dust

Siltation and erosion of fish habitat due to earthworks, culvert/bridge installation and poor water management can occur throughout the construction phase of the Project. Increased erosion of stream bank soils or uncontrolled transportation of fine material from exposed areas can be deposited into freshwater habitat. Excess siltation can have a negative effect on the health of freshwater biota and can cause the loss or avoidance of critical/productive freshwater habitat. A potential pathway can also include airborne deposition (i.e. dust). Fine material can settle on substrates, particularly areas with lower water velocities, affecting physical processes, structural attributes and ecological conditions such as water clarity and overall habitat suitability. Suspended sediment can also reduce water clarity and can cause damage to gills (Gosse et al. 1998).

This pathway can be associated with activities such as earthworks, atmospheric emissions, road and pipeline installations as well as tailings area construction. Therefore there is the potential for "within project" cumulative effect for this pathway as all activities could occur simultaneously. As such, the cumulative, or worse-case, scenario has been assumed and assessed.

Blasting

The detonation of explosives may result in a number of adverse impacts on fish and marine mammals and their habitats (Wright and Hopky 1998). Wright and Hopky (1998) describe several potential pathways which include the production of post-detonation compressive shock waves, vibrations, production of sediment and residue. The effects can affect many life stages, the degree depending upon many factors such as type of explosive, size and pattern of the charge(s), method of detonation, distance from the point of detonation, water depth and species of fish. Typical potential effects on fish include damage to swim bladders, rupture/haemorrhage of kidney, liver, spleen and sinus venous as well as damage to incubating eggs.

In addition to direct damage, both wild and aquacultured species also display avoidance behaviour to noise (Chapman and Hawkins 1969; Schwartz and Greer 1984; Pearson et al. 1992) and can be negatively affected by intense sounds (such as those from blasting) or from prolonged exposure to certain types of acoustic disturbances (McCauley et al. 2003).

Blasting may be associated with construction activities such as earthworks around the tailings and mine/mill area.

Tailings Effluent

With any increased elevation of metals identified as currently being above CCME guidelines, potential effects on fish and fish habitat may occur. The metals identified as currently being above CCME guidelines are cadmium, aluminum, copper and iron.

Cadmium

Cadmium is a chemical element that can occur naturally in the environment, typically in rocks as a component in mineral sulphides. Cadmium can enter aquatic environments through two major sources; atmospheric fallout such as burning of fossil fuels (coal or oil) or incineration of municipal waste, and as effluent from smelting and refining industries. More recently, fungicides for turf grass production are known to contain cadmium and can also enter aquatic environments either directly through discharging into water or watersheds, or via runoff.

Cadmium which has entered the aquatic environment typically settles and accumulates in sediments with the risk of re-entering the water column in both freshwater and marine systems. Across Canada, cadmium amounts in fresh water range from <0.1 to 122 ug/L and marine waters from 0.02 to 0.083 ug/L (CCME 1999). Water quality guidelines for cadmium for the protection of aquatic life are 0.017 ug/L^{-1} (application of a correcting value for hardness required) for freshwater (CCME 1999). Cadmium has a high affinity for negatively charged particles that can compound creating fatal conditions in aquatic systems. Chemical forms of cadmium are affected by salinity, dissolved organic matter, and hydrogen ion concentration (pH). Water hardness also influences the toxicity of cadmium in freshwater organisms and can affect several orders of magnitude.

Aluminum

Aluminum is the third most abundant common metal in the world. It has a high oxidation potential and is found within the earth's crust, as a compound it can be found in most rocks, surface waters and living organisms. In fresh water, aluminum is usually low in concentration, generally less than 1 mg/L (ppm) (Howells 1994) with its concentration related to pH and the solubility of Aluminium minerals. In water with pH greater than 5.5, Aluminium has as a low solubility; however lower pH causes solubility to increases. In general, waters of low pH (e.g. 5.5) and low ionic strength can allow dissolved concentrations of aluminum that are toxic. Reduced pH conditions can arise from mine drainage, naturally occurring acidic sulphate soils (found in water), geothermal waters and lake and streams receiving acidic runoff (with no buffering within the watercourse).

Response of aquatic organisms (invertebrates, fish) to dissolved aluminum concentrations is diverse reflecting the different modes of respiration and ion regulation within aquatic organisms. High aluminum and low pH exposure to fish can be lethal. Additional effects of exposure include osmoregulation disturbance and enzyme reduction in the gills and effects of stress response.

Copper

Copper is an essential element needed for many physiological processes (Sloman 2003); however, at high concentrations, copper acts as a neurotoxicant and can be potentially lethal. Fish, unlike most other vertebrates, are exposed to copper both in the diet and the external environment, uptake being through the gills (Marr et al. 1999). Similar to nickel, the physical and chemical properties of the water exert a strong influence on the toxicity of copper to fish (Marr et al. 1999). In water containing high concentrations of organic substances, copper can become bound into soluble and insoluble complexes. In very alkaline water it forms hydroxides of low solubility and in waters with a high bicarbonate/carbonate concentration, copper precipitates as poorly soluble or insoluble cupric carbonate (Marr et al. 1999). Compounds that are slow to dissolve or are insoluble are unlikely to be absorbed to any extent into fish, so their toxicity is considered low. The CCME concentrations below are based on various CaCO3 concentrations:

CCME Copper guideline.= 2 µg•L-1 [at CaCO3 concentrations between 0–120 mg•L-1]

= 3 µg•L-1 [at CaCO3 concentrations between 120–180 mg•L-1]

= 4 µg•L-1 [at CaCO3 concentrations >180 mg•L-1].

The characteristic clinical symptoms of fish poisoned by copper ions and copper compounds include laboured breathing and, in cyprinids, gasping for air at the water surface. The typical patho-anatomic appearance includes a large amount of mucus on body surface, under the gill covers and in the gills. Excess levels of copper can cause changes in the fish's ionoregulation, neurological function, swimming ability and behaviour (Hansen et al. 1999a; 1999b). It also affects a fish’s olfaction (Baldwin et al. 2003), especially in salmonids, diminishing their ability to locate prey, avoid predators, migrate to natal streams and spawn (Branion 1981; Branion et al. 1984). Exposure to copper also induces a stress response, causing the release of the stress hormone cortisol which can negatively affect health, reproduction and growth (Taylor et al. 2000).

Iron

The main target of iron toxicity on fish is accumulation on the gill. More specifically, the effects include clogging of the gills and gill damage causing respiratory problems for the fish (Dalzel and Macfarlane 1999).

6.1.2.3 Impacts of Construction

The Project activities interaction matrix presented in Section 5.10.1 present the effects that have been determined to have a reasonable probability of interacting with fish and fish habitat during construction. Construction interactions with freshwater fish and fish habitat relate primarily to those activities that could interact via potential pathways such as siltation, erosion, dust and blasting. Spills are addressed separately in Accidental Events (Section 5.7).

Provided below is a brief description of each pathway. Descriptions of Project activities are provided in Section 5.2.

Siltation and Erosion

Sediment entering freshwater will result in increased turbidity and sedimentation, potentially causing negative effects on the freshwater fish and fish habitat. There are potential interactions between earthworks activities and all components of the freshwater fish and fish habitat VEC (Table 5.10-1).

All fish species within the freshwater environment could be potentially affected by increased turbidity and sedimentation. All freshwater spawning species would have eggs and larvae particularly sensitive to excess sedimentation during egg incubation. Since most life-cycle stages are mobile once hatched, the degree of effect on juvenile and adult life-cycle stages would be dependent upon the quantity of sediment, the duration of the release/disturbance and the overall extent of habitat affected.

Mitigations to reduce the effect of turbidity and sedimentation will be detailed in the EPP. The control of siltation, erosion and runoff from construction sites is addressed in many standard practices and guidelines such as the Guidelines for Protection for Freshwater Fish Habitat (Gosse et al. 1998), Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al. 1993) and the Environmental Guidelines for General Construction Practices (Water Resources Management Division 1997). All discharges of runoff from construction activities will conform to the Environmental Control Water and Sewage Regulations, 2003 under the Water Resources Act (O.C. 2003-231).

Special consideration is needed when working in or near freshwater fish habitat. Construction activities that will encroach on freshwater habitat include: tailings management area and installation of culverts and fording associated with pipeline and powerline construction, as applicable. DFO provides several guideline publications. These include:

- The National Policy for the Management of Fish Habitat
- Land Development Guidelines for the Protection of Aquatic Habitat

- The Fisheries Act - Habitat Protection and Pollution Prevention Provisions –
- Compliance and Enforcement Policy
- Guidelines for the Use of Explosives In or Near Canadian Waters
- National Fact Sheets – Brook Trout (Specifically)
- Newfoundland Factsheets for:
    - Effects of Silt on Fish and Fish Habitat
    - Blasting - Fish and Fish Habitat Protection
    - Forwarder Trails
    - Temporary Bridges
    - Resource Road Construction
    - In stream Work in the Dry Cofferdams
    - Stream bank Stabilization
    - In stream Work in the Dry – Temporary Diversion and Elevated Pipes
- Freshwater Salmonid Habitat Requirements
- Freshwater Intake End-of-Pipe Fish Screen

Specific mitigative measures can be drawn from these documents to help minimize construction affects. For example, siltation control structures (i.e., silt curtains, cofferdams, and/or sediment fences) will be constructed prior to beginning any activities involving disturbance of the soil, work along the shoreline or near areas of high runoff potential. Construction activities will be coordinated to avoid periods of heavy precipitation and not coincide with sensitive periods for fish. Mitigative measures will be implemented prior to any grubbing or excavation to direct any natural drainage around work areas, avoiding sediments above ambient suspended particle concentration in runoff waters.

Soil disturbance will be minimized by limiting the area exposed at any one time, stabilizing exposed soil with anti-erosion devices (i.e., rip rap, filter fabrics, gravel or wood chips) and revegetation of disturbed areas. Grubbing of the organic vegetation mat and/or the upper soil horizons will be restricted to the minimum area required. The organic vegetation mat and upper soil horizon material that has been grubbed will be spread in a manner so as to cover inactive exposed areas. Further, a buffer zone of undisturbed natural vegetation between construction areas and all waterbodies will be defined in the EPP and respected during construction to prevent sediments from entering local waterways.

No runoff will be allowed to freely flow into any water body. Runoff during construction will be directed to adequate vegetated areas or settling ponds to allow particles to settle out. Any natural vegetated areas receiving runoff will first be assessed to ensure they can adequately handle anticipated flows and do not represent critical habitat for any species of concern.

Settling Ponds will be designed according to Chilibeck et al. (1993). The number and size of ponds required during construction will be based on final area of disturbance and calculations of maximum runoff anticipated. Ponds both for construction and operations, will be built with required safety factors, adhering to guidelines with respect to such design standards as the accommodation of storms (1:5, 1:10, and 1:100 years storms), effective capacity, retention times and location. Their operation and maintenance will include regular inspection and assessment of accumulated sediment load, removing it when required.

Construction runoff near blasting operations may also have the potential to contain nitrogenous residues if ammonia-based explosives are used. Any releases that may enter freshwater will meet the required limit of 0.019 mg/L for ammonia (Canadian Water Quality Guidelines for the Protection of Aquatic Life, CCME 2006). Currently there is no set limit for waters entering marine waters (CCME 2006). If required, settling ponds used for construction will be designed to allow for chemical degradation of nitrogenous wastes.

Runoff water from any settling ponds will adhere to the guidelines set by DFO, containing less than 25 mg/liter of suspended solids (or non-filterable residue) above the background suspended solids levels of the receiving waters during normal dry weather operation, and less than 75 mg/liter of suspended solids above background levels during design storm events. Suspended solids in effluent will be regularly tested to ensure compliance.

Dust

Dust emission during the Construction Phase will be localized to the areas where overburden is being cleared to allow for construction of all permanent structures and roads. Any areas with a high dust potential will be sprayed with water to decrease the chance of particles becoming airborne. Waste oil will not be used for dust control. Once construction activities are completed, the potential for dusting will be minimal.

Vehicle-related dusting from the access roads will be largely confined to the construction stage while large trucks are transporting equipment and material. Once construction is completed, the dusting potential will be low, as the majority of on-site movement will be company vehicles following designated paved roadways. Further, wet conditions common to the area greatly decrease the amount of dust that will be released as a result of vehicle movement. Remaining gravel roads during operation (i.e., service roads and tailings storage area) will receive minimal travel.

During operations, the ship loader will be fed by covered conveyor belts at the marine terminal which will be designed to minimize dust. Dust suppression procedures will be implemented in these areas to comply with the NL Criteria for Acceptable Air Quality (which allows a total suspended particulate concentration of 80 $\mu g/m^3$ and 120 $\mu g/m^3$ for 1 hour and 24 hour exposure, respectively).

With the incorporation of all mitigations, the effects of sedimentation as a result of construction are predicted to be of a low magnitude. While the structures will be permanent and activities will be relatively continuous throughout construction, the duration is considered moderate (13-36 months during construction), the geographic extent is low (<1 km^2) with effects being reversible once the structures are constructed (Table 6.1-11). The residual sedimentation, erosion and dust effects associated with construction activities on the freshwater fish and fish habitat VEC are predicted to be *not significant* (Table 6.1-12).

Blasting and Noise

Two main variables should be examined when determining how sound and vibrations can affect aquatic wildlife. These are: (1) shock pressure, represented and measured in Peak Particle Velocity (PPV), and; (2) compressional seismic waves, measured as a pressure force (kPa). These phenomena can lead to disturbance or damage to fish by affecting their internal organs (Hawkins and Johnstone 1978; Whalberg and Westererberg 2005).

Blasting may be required during construction to remove areas of bedrock, primarily in the location of the mine/mill and tailings management area. Detonation of explosives during construction activities will produce vibrational and acoustic noise in the surrounding environment. Blasting protocols have been designed to be as efficient and effective as possible, using publications such as: Wright and Hopky's (1998) Technical Report for the Use of Explosives Near Canadian Fisheries Water, Guidelines for Protection of Freshwater Fish

Habitat in Newfoundland and Labrador (Gosse et al. 1998) and DFO's Mitigation of Seismic Noise in the Marine Environment - Statement of Canadian Practice.

Guidance on blasting activities in or near the freshwater environment is provided in Gosse et al. (1998):

- Large charges should be subdivided into a series of smaller charges and time delayed to reduce the overall detonation to a series of smaller detonations;
- For multiple charges, time-delay (e.g., blasting caps) should be used to reduce the overall detonation to a series of single explosions separated by a minimum of 25 millisecond delay between charge detonation;
- The on-land set-back distance from the blast site to the watercourse and the set-back distance (zone) around the blast site in the watercourse are based on the maximum weight of the charge to be detonated at one instant in time and the type of fish and fish habitat in the area of the blast. Blasting activities are to take place at a minimum set distance from the watercourse as indicated in Table 6.1-13.
- If on-land blasts are required nearer to a watercourse than indicated above, then additional mitigative measures should be initiated which include the following:
    - Installation of bubble/air curtains to disrupt the shockwave. When bubble curtains are used, the curtain should surround the blast site and be started up only after fish have been moved outside the surrounded area;
    - Blasting should be undertaken at the time of least biological activity or biological sensitivity;
    - Isolation of the work area from fish movement;
    - Detonation of small scaring charges set off one minute prior to the main charge to scare fish away from the site;
    - The use of noise generators to move fish out of the area.
- To confine the blast, sand or gravel should be used to backfill blast hoses to grade or to streambed/water interface;
- Blasting mats should be placed atop the blasting holes to minimize the scattering of blast debris;

Table 6.1-11: Effects Assessment of Construction Activities on Freshwater Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Freshwater)								
Project Activity	Potential Positive (P) or Negative (N) Environmental Effect	Possible Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/ Socio-Cultural and Economic Context
Construction Activities and Physical Works								
Siltation / Erosion/Dust	Increased turbidity and suspended solids (N); Sedimentation (N)	Silt curtains, Settling Ponds; Water spray dust suppression; Minimize material stockpiling Equipment maintenance	1	1	6	3	R	2
Blasting/Noise	Habitat Damage (N); Fish Injury/Death(N)	Water spray dust suppression Minimization of material stockpiling Equipment maintenance	1	1	2	1	R	2
Accidental events	Tailings dam failure	design in accordance with Dam Safety Association, inspections						

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Table 6.1-12: Significance of Potential Residual Environmental Effects of Construction Activities on the Freshwater Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Freshwater)				
Project Activity	**Significance of Predicted Residual Environmental Effects**		**Likelihood**	
	Significance Rating	**Level of Confidence**	**Probability of Occurrence**	**Scientific Certainty**
Construction Activities and Physical Works				
Siltation/Erosion/Dust	NS	3	-	-
Blasting and Noise	NS	3	-	-
Accidental event (dam failure)	NS	3	1	2

[a] **Only rated if residual environmental effect predicted to be significant**

Key:

Residual environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P= Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

Table 6.1-13: Minimum Required Distances from a Watercourse for Blasting (Confined Charges)

Habitat	**Weight of Explosive Charge (kg)**					
	0.5	**1**	**5**	**10**	**25**	**50**
H1	7 m	10 m	15 m	20 m	35 m	50 m
H2	15 m	20 m	45 m	65 m	100 m	143 m

Key: H1 – rearing/general fish habitat
H2 – spawning habitat where egg or early fry development is occurring

- The use of Ammonium nitrate based explosives (i.e., Ammonium Nitrate Fuel Oil mixtures or ANFO) should be minimized in or near surface water due to the production of toxic by-products (ammonia);
- All blasting and other associated equipment and products are to be removed from the blast area, including any debris that may have entered the aquatic environment.

With the incorporation of all mitigations, the effects of siltation /erosion, blasting and noise as a result of construction are predicted to be of a low magnitude. While construction activities will be relatively continuous throughout the construction period (18 months), blasting will be of low frequency (most will occur during the site development of less than 6 months), with a low geographic extent (<1 km^2) with effects being reversible once construction is complete (Table 6.1-11).

The residual blasting and noise effects associated with construction activities on the freshwater fish and fish habitat VEC are predicted to be *not significant* (Table 6.1-12).

Summary and Conclusion – Construction

As shown above the residual impact of the construction activities on freshwater fish and fish habitat is ***not significant***.

6.1.2.4 Effects of Operation

Table 5.10.2 presents the effects that have been determined to have a reasonable probability of interacting with fish and fish habitat during operation. Operation interactions with freshwater fish and fish habitat relate primarily to those activities that could interact via potential pathways such as siltation/erosion/dust, loss of fish habitat and effluent discharge. Spills are addressed separately in Accidental Events.

Provided below is a brief description of each pathway. Descriptions of Project activities associated with operations, accidental events and malfunctions are provided in Section 5.2.3 and 5.7.

Siltation, Erosion and Dust

The control of siltation, erosion and runoff from operation is addressed in many standard practices and guidelines such as the Guidelines for Protection for Freshwater Fish Habitat (Gosse et al. 1998) and Land Development Guidelines for the Protection of Aquatic Habitat (Chilibeck et al. 1993). All discharges of runoff from operation activities will conform to the Environmental Control Water and Sewage Regulations, 2003 under the Water Resources Act (O.C. 2003-231).

Potential effects would be similar to those anticipated during construction, with some change in the duration and magnitude. With the incorporation of all mitigations, the effects of sedimentation as a result of operation (eg. road use and maintenance) are predicted to be of a negligible magnitude. While structures will be permanent and activities will be relatively continuous throughout operation (duration is continuous - >72 months), the geographic extent and frequency are low (<1 km^2 and 1 respectively) with effects being reversible (Table 6.1-14).

The residual sedimentation, erosion and dust effects associated with operation activities on the freshwater fish and fish habitat VEC are predicted to be *not significant* (Table 6.1-15).

Loss of Fish Habitat

The location of the Tailings Management Area covers identified fish habitat. The total amount of habitat directly within the Project Area has been quantified as per DFO guidelines and direction (see Beak 1980). The fish habitat identified within the HADD determination includes that habitat that has been affected by past operations and tailings storage and disposal.

Tailings Management Area (TMA)

The preferred Tailings Management Area includes a portion of Clarke's Pond Brook, Shoal Cove Pond, a small portion of tributaries draining into Shoal Cove Pond and Shoal Cove Brook. A complete description of the TMA is provided in Section 5.1.5 and 5.4.

Table 6.1-14: Effects Assessment of Operation Activities on the Freshwater Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Freshwater)								
Project Activity	**Potential Positive (P) or Negative (N) Environmental Effect**	**Possible Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**					
			Magnitude	**Geographic Extent**	**Frequency**	**Duration**	**Reversibility**	**Ecological/ Socio-Cultural and Economic Context**
Operation Activities and Physical Works								
Siltation / Erosion/Dust	Increased turbidity and suspended solids (N); Sedimentation (N)	Silt curtains, Settling Ponds; Water spray dust suppression; Equipment maintenance	0	1	1	5	R	2
Tailings Management Area	Habitat Loss (N)	Fisheries Act Authorization and Compensation Plan	1	1	6	5	I	2
Effluent Discharge	Increased turbidity and suspended solids (N); Sedimentation (N)	Tailings Treatment; Compliance with Water and Sewer Regulations	1	1	6	5	R	2
Accidental events	Dam Failure (N)	Dam Regulation Compliance	1	1	1	5	R	2

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Table 6.1-15: Significance of Potential Residual Environmental Effects of Construction Activities on the Freshwater Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Freshwater)				
Project Activity	**Significance of Predicted Residual Environmental Effects**		**Likelihood[a]**	
	Significance Rating	**Level of Confidence**	**Probability of Occurrence**	**Scientific Certainty**
Construction Activities and Physical Works				
Siltation/Erosion/Dust	NS	3	-	-
Tailings Management Area	NS	3	-	-
Effluent Discharge	NS	3	-	-
Accidental event (dam failure)	S	3	1	2

[a] **Only rated if residual environmental effect predicted to be significant**

Key:

Residual environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

As stated previously, the *Fisheries Act* contains a prohibition with respect to the “harmful alteration disruption or destruction “of fish habitat (HADD). The Act permits the Minister to issue an Authorization (under Section 35 (2)) which will permit a HADD to occur. If Fisheries and Oceans determine that a HADD is likely, an Authorization must be issued before any action can be taken to destroy or harmfully alter fish habitat. A HADD determination also triggers federal environmental assessment under the CEAA.

The Proponent is required to quantify the habitat which will be affected by their undertaking. This quantification must reflect the productivity of the habitat, and take into account the actual and potential use of the habitat by different fish species and life cycle stages. It must also identify all opportunities to avoid or mitigate potential habitat alteration, damage or disruption. Once the habitat quantification is accepted by DFO, a HADD determination is made, i.e., a formal statement is made identifying the residual habitat which will be lost following the application of all reasonable mitigation measures. This determination establishes the basis for compensation. The Proponent then develops a Compensation Plan

The targeted habitat with respect to a freshwater HADD determination for this Project is related to the Tailings Management Area. The determination was completed and outlined in a Department of Fisheries and Oceans CEAA Screening Report (DFO 1997) as:

- Loss of less than 1 unit of Type II habitat in the lower portion of Clarke Pond Brook for tailings management;
- Loss of all habitat in Shoal Cove Pond for tailings management system;
- Loss of access to upstream habitat in Clarke's Pond Brook and Clarke's Pond due to construction of the dams associated with the tailings and polishing ponds;
- Potential loss of approximately 32 units of Type II habitat in Shoal Cove Pond Brook due to dewatering and/or low flows associated with the polishing pond dam at the outlet of Shoal Cove Pond; and
- Potential increase in sedimentation of Shoal Cove due to construction of tailings and polishing pond dams in Shoal Cove Pond.

As such, a Compensation Agreement has been negotiated between DFO and the proponent in accordance with the No Net Loss guiding principle of DFO's Policy of the Management of Fish Habitat. The Proponent has agreed to:

- Create rearing habitat in a diversion channel between Hay Pook Pond and Salt Cove Brook;
- Restore stream flow to a 1.25 km dewatered/diverted section of the original streambed of Salt Cove Brook;
- Provide fish passage at an existing concrete barrier in Hay Pool Pond Canal improving access to eight kilometres of stream habitat and five ponds upstream; and
- Repair a breach in an old tailings dam from previous operations to reduce siltation in Salt Cove Brook.

Compensation will mitigate harmful impacts on fish habitat (DFO 1997). The Proponent is also to develop an Environmental Protection Plan which outlines mitigation for activities associated with construction, operation and decommissioning. No residual impacts on fish and fish habitat are anticipated as a result of activities associated with the construction, operation or decommissioning of the Shoal Cove Pond tailings management system (DFO 1997). Based on the DFO CEAA Screening Report and a submitted Fish Habitat Compensation Plan, a Fisheries

Act Authorization was issued by DFO. The Compensation Plan provides the details of the habitat activities outlined above.

With the incorporation of all mitigations as outlined above, such as the requirements of a Section 35(2) Authorization under the Fisheries Act, the effects of the Tailings Management Area and System as a result of operations are predicted to be of a negligible magnitude. While Tailings Management structures will be permanent and activities will be relatively continuous throughout operation (duration is continuous - >72 months), the geographic extent is low (<1 km^2) with effects being irreversible but mitigatable (Table 6.1-14).

The residual loss of habitat associated with operation activities on the freshwater fish and fish habitat VEC are predicted to be *not significant* (Table 6.1-15).

Tailings Effluent

Tailings effluent characterization and the final design of treatment processes have been ongoing. The current summary of tailings characterization would be as follows:

- The waste stream released into the first cell of the tailings pond will not contain any chemicals or harmful reagents;
- Sulfides and most Fluorspar will be removed prior to release;
- Tailings will contain only silt-clay size grains of inert materials, such as granite and other rock constituents.

In this respect, tailings treatment will remove all chemical and physical constituents prior to release from the polishing pond (i.e. the lower section of Shoal Cove Pond). In addition, the HADD determination by DFO for the tailings management area and system includes the lower section of Shoal Cove Brook therefore any loss or alteration of habitat below Shoal Cove Pond will be compensated. In addition, all releases will be monitored for compliance with all applicable criteria such as the Environmental Control Water and Sewage Regulations, 2003 under the Water Resources Act (O.C. 2003-231).

With the incorporation of all mitigations as outlined above, the effects of the Tailings Management Area and System as a result of operation are predicted to be of a negligible magnitude. While Tailings Management effluent discharge will be permanent and activities will be relatively continuous throughout operation (duration is continuous - >72 months), the geographic extent is low (<1 km^2) with effects being reversible and mitigatable (Table 6.1-14). The residual effect of effluent discharge associated with operation activities on the freshwater fish and fish habitat VEC are predicted to be *not significant* (Table 6.1-15).

Summary and Conclusion – Operations

As shown above it can be concluded that residual impact (after mitigation) of the operation activities on freshwater fish and fish habitat is ***not significant***.

6.1.2.5 Accidental Events

Dam Failure

Dam failure of the lower dam within the Tailings Management Area would negatively affect freshwater fish and fish habitat. The contents of the clarification pond would be released into the lower section of Shoal Cove Brook; the quantity and constituent would be dependant on the condition of the dam failure. The maximum quantity would be the volume contained within the clarification pond as well as any increase in migration from the upper treatment cell. The degree of severity will depend on the location of the failure, water level, amount of suspended solids, and the degree of treatment of tailings, it would be predicted that the impact would not be catastrophic, but may be rated as *high* on fish and fish habitat downstream (mainly due to increase in Total Suspended Solids). However, the likelihood of a dam failure is extremely low as all dams must be constructed to comply with provincial dam safety regulations, in addition, regular maintenance and inspection of the dam structures will be carried out by the proponent, and the geographical extent of impact would be expected to be less than 1 km^2. Therefore the effect of dam failure is determined to be likely ***not significant***.

6.1.3 Marine Fish and Fish Habitat

This subsection describes the baseline conditions of marine fish and fish habitat as they relate to this EPR/EA. It also includes assessment of the potential effects of Project activities on marine fish and fish habitat, including appropriate mitigations required to minimize the residual effects. In particular, the effects of the construction and operation of the proposed marine terminal at Blue Beach Cove as described in Section 5.

6.1.3.1 Existing Baseline Conditions

Marine fish habitat baseline conditions at Blue Beach Cove are based on comprehensive underwater surveys conducted in June 2009.

Marine macroinvertebrate and fish baseline conditions are based on information collected from various sources, including primary 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]).

<u>Habitat</u>

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 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, the north and south options for the marine terminal (Figure 6.1.1). The habitat surveys used drop camera (videography) and SCUBA diving (photography, videography, diver observation) approaches for data collection.

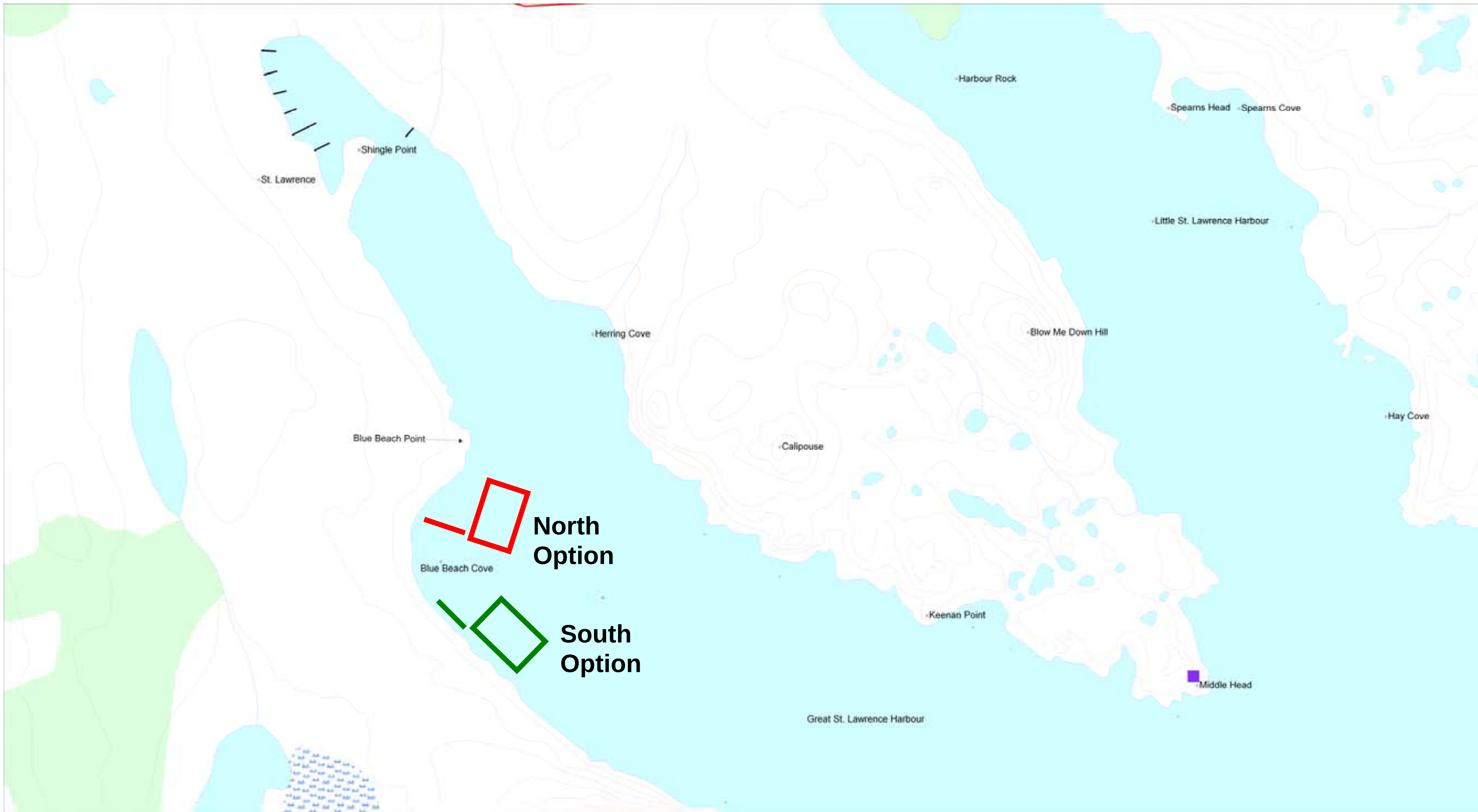

Figure 6.1.1. Location of the Survey Areas at Blue Beach Cove, St. Lawrence, Newfoundland.

Northern Blue Beach

The area surveyed in the northern portion of Blue Beach Cove (Figure 6.1.1) had water depths ranging from 3 to 20m. The depth and substrate of the north option was very consistent over large areas with limited surface irregularity or complexity observed

Large portions of the survey area were characterized by coarse sand substrate that appeared to be underlain by bedrock. The northern side of the north option 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 that 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 (*Macrozoarces 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 bottom and on some sandy areas. Flatfishes, likely winter flounder (*Pleuronectes americanus*) were occasionally observed despite being camouflaged by a layer of sand.

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*, 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 were not observed during the drop camera and SCUBA surveys but local fishers have confirmed their presence in Blue Beach Cove.

Macroinvertebrates and Fishes

The following species descriptions provide background information on notable macroinvertebrate and finfish species whose occurrences in the vicinity of Blue Beach Cove have been indicated by commercial fisheries landings statistics and local ecological knowledge (see Subsection 6.1.4 on Commercial Fisheries).

Macroinvertebrate Species

American Lobster

The American lobster (Homarus americanus) is a benthic decapod crustacean that is distributed nearshore around the island of Newfoundland, including Placentia Bay (DFO 2009a). Lobster populations tend to be much localized in nature (DFO 2006a). The distribution of lobster in the Great St. Lawrence Harbour area extends from Blue Beach Point to Deadmans Cove (DFO 2009a).

The major lobster life history events (i.e., molting, mating, spawning, larval hatching), described by DFO (2009a), typically occur between mid-summer and early fall, after the commercial fishing season. Mating typically occurs from July to September and the fertilized eggs are carried in clutches on the underside of the female's tail for a period of 9 to 12 months. Hatching occurs over a four month period extending from late May through September. The larvae are planktonic for approximately six weeks and undergo three molts. After the third molt, the larvae resemble miniature adults and settle within suitable benthic habitat. Newly settled lobster progress through several juvenile stages and an adolescent phase before reaching adulthood. The diet of the adult lobster consists of crabs, polychaetes, molluscs, echinoderms, and various finfishes. Most of adult lobster mortality is attributed to the commercial fishery, considering the belief that they have few natural predators. The last stock assessment was recently completed in 2009 (DFO 2009a).

Snow Crab

Snow crab (Chionoecetes opilio) is a decapod crustacean that occurs over a broad depth range (50 to 1,300 m) in the Northwest Atlantic. The distribution of this decapod in waters off Newfoundland and southern Labrador is widespread but the stock structure remains unclear. Snow crabs have a tendency to prefer water temperatures ranging between -1.0 and 4.0ºC. Large snow crabs (≥95mm carapace width or CW) occur primarily on soft bottoms (mud or mud-sand) (DFO 2009b), particularly in water depths of 200 to 500 m. Small snow crabs appear to be most common on relatively hard substrates (DFO 2009b). Mating generally occurs during the early spring and the females subsequently carry the fertilized eggs for about two years. Large numbers of sexually paired snow crabs have been observed in relatively shallow water (10 to 40 m) during late April/early May in coastal Newfoundland (Taylor et al. 1985; Hooper 1986; Ennis et al. 1990). Snow crab larvae hatch in late spring or early summer remain in the water column for 12 to 15 weeks before settling on the bottom and maintaining a benthic existence (DFO 2009b). Snow crab typically feed on fish, clams, polychaetes, brittle stars, shrimp and crustaceans, including smaller snow crab. Snow crabs are prey for groundfish, seals, and other snow crab (DFO 2009b).

Squid

Two species of squid – the northern shortfin squid (Illex illecebrosus) and the longfin inshore squid (Loligo pealeii) – are distributed in Newfoundland waters. The northern shortfin squid occurs in the Northwest Atlantic from the Labrador Sea to the Florida Straits (Hendrickson and Holmes 2004) while the longfin inshore squid inhabits continental shelf and slope waters from Newfoundland to Cape Hatteras, North Carolina (Jacobson 2005). In general, both species are distributed in shallow inshore waters during summer and fall and in deeper waters during winter and spring (Hendrickson and Holmes 2004; Jacobson 2005). Spawning occurs while deep offshore areas are occupied. Adult squid predominately prey on crustaceans and small fishes.

In turn, juvenile and adult squid are food for many pelagic and demersal fish species as well as marine mammals and seabirds (Hendrickson and Holmes 2004; Jacobson 2005).

Squid are harvested recreationally in the Great St. Lawrence Harbour area (DFO 2009c; E. Jarvis, pers. comm. 2009). Typically caught on hook and line, squid are fished at depths ranging from roughly 4 to 18 m in August to September.

Icelandic Scallop

Icelandic scallops (Chlamys islandica) are widely distributed throughout the sub-arctic at depths with populations off Newfoundland and Labrador normally found in water depths from 30 – 100 fathoms and on hard substrates consisting of sand, gravel, shells and stones (DFO 2009d). These bivalve mollusks occur in commercial-sized beds in NAFO Subdivision 3Ps, primarily on St. Pierre Bank (JWEL 2003). Being suspension feeders, Iceland scallops tend to be most abundant in areas with substantial water movements (Naidu 1997).

The spawning season for Iceland scallop is short and is typically sometime between April and August, depending on location (Wallace 1981, Crawford 1992). For example, Iceland scallops on the St. Pierre Bank usually spawn in late summer (Ollerhead et al. 2004) but it appears that current abundance of Iceland scallops on St. Pierre Bank is less than in the 1980s and early 1990s (Ollerhead et al. 2004). Juveniles usually settle to the seabed in the fall after an approximate 5-10 week planktonic larval phase, juveniles usually settle onto substrata consisting of shell debris and filamentous materials (Vahl 1982). The areas of adult Iceland scallop occurrence on St. Pierre Bank have sediments consisting of a mixture of gravel (> 90%) and sand (<10%) (Fader et al.1982).

Northern Shrimp

Northern or pink shrimp (Pandalus borealis) are found in the Northwest Atlantic from Davis Strait to the Gulf of Maine, usually in areas where the ocean floor is soft and muddy and where temperatures near the bottom range from about 1°C to 6°C (DFO 2008a). These conditions occur throughout the Newfoundland and Labrador offshore area within a depth range of roughly 150-600 m, thus providing a vast area of suitable habitat. The species is the primary cold-water shrimp resource in the North Atlantic.

These shrimp are protandrous hermaphrodites (DFO 2008a). They first mature as males, mate as males for one to several years and then change sex to spend the rest of their lives as mature females. They are known to live for more than 8 years in some areas. Some northern populations exhibit slower rates of growth and maturation but greater longevity results in larger maximum size. Most of the fishable biomass is female. The shrimp are thought to begin to recruit to the fishery at age three, but may not be fully recruited until much later.

During the daytime, northern shrimp rest and feed on or near the ocean floor (DFO 2008a). At night, substantial numbers migrate vertically into the water column, feeding on zooplankton. They are important prey for many species such as Atlantic cod, Greenland halibut, skates, wolffish, snow crab and harp seals.

Pelagic Fish Species

Atlantic Herring

Ranging from western Greenland to Cape Hatteras in the Northwest Atlantic, the Atlantic herring is primarily pelagic and often schools, particularly just prior to spawning. Along the Canadian coast, Atlantic herring may spawn in any month between April and October, but spawning is concentrated in May (spring spawners) and September (fall spawners) (Ahrens 1993). Atlantic herring are demersal spawners depositing their adhesive eggs on stable bottom substrates (Scott and Scott 1988; Reid et al. 1999). In the Newfoundland region, spawning generally occurs in shallow (<20 m) coastal waters. Spring spawning usually occurs in shallower waters than fall spawning.

Atlantic herring prey on euphausiids, copepods, fish eggs, pteropods, mollusc larvae, and the larvae of finfishes, such as sandlance, silversides, capelin, and herring (Scott and Scott 1988). The species are important prey for many species including other fish, seabirds, and marine mammals, particularly harp, hooded, grey, and harbour seals (DFO 2006b).

Defined by tagging studies carried out in the 1970s and early 1980s, five stock complexes, including the St. Mary's Bay-Placentia Bay complex, are recognized in the coastal waters of eastern and southern Newfoundland (Wheeler and Winters 1984; Wheeler et al. 2008). Reported commercial landings for the St. Mary's Bay – Placentia Bay complex decreased from 1,528 t in 2006 to 759 t in 2007 with approximately 30% of the Total Allowable Catch (TAC) taken in 2007 (Wheeler et al. 2008). The 2008 purse seine fishery, from April to June, was on the eastern sides of Placentia Bay and St. Mary's Bay (Wheeler et al. 2008). In addition to landings from the commercial fishery, an estimated 150 t of herring is harvested annually for bait in Placentia Bay and St. Mary's Bay combined (Wheeler et al. 2008). Atlantic herring has been historically harvested for bait in St. Lawrence Harbour using seines and nets (DFO 2009c).

The herring bait fishery occurs from January to April and the depths fished range from 9 to 36 m. The herring fishery in the St. Lawrence Harbour area was more prominent in the 1980s until the stock was overfished by seiners. Fish harvesters interviewed by Sjare et al. (2003) indicate herring aggregations occur throughout Great St. Lawrence Harbour; however, specific information on abundance, timing, and spawning areas was not provided. Gillnets are often set towards the east side of the harbour across from Blue Beach to target herring for bait (E. Jarvis, pers. comm. 2009).

Atlantic Mackerel

The Atlantic mackerel is a pelagic fish that ranges from North Carolina to Newfoundland in the Northwest Atlantic (DFO 2008b). Mackerel is found in inshore waters during spring and summer and in deeper, warmer offshore waters at the edge of the continental shelf during late fall and winter (DFO 2008b). There are two major spawning areas for mackerel in the Northwest Atlantic: (1) southern Gulf of St. Lawrence and (2) between the coasts of Rhode Island and Virginia (DFO 2008b). In Canadian waters, spawning occurs during June and July while in American waters, it occurs from March to April (DFO 2008b).

Mackerel are prey for many predators, including groundfish (e.g., Atlantic cod), highly migratory pelagics (e.g. bluefin tuna, swordfish, sharks), and marine mammals (e.g., porpoises, harbour seals). Capturing prey by filter feeding or by individual selection of organisms, mackerel are predators on a large variety of planktonic animals, including amphipods, euphausiids, shrimps, crab larvae, small squid, fish eggs, and young finfish, including capelin and herring (Scott and Scott 1988).

In the Maritime Provinces, Newfoundland, and Quebec (NAFO Subareas 3 and 4), over 15,000 commercial fishermen participate in the mackerel fishery (DFO 2008b). They fish mainly inshore using gillnets, jiggers, handlines, purse seines and traps. The type of gear used varies according to the region and time of the year. According to LEK, mackerel are distributed along the eastern portion of Great St. Lawrence Harbour from Herring Cove to Calipouse (DFO 2009c). Atlantic mackerel are harvested from August through September in Herring Cove located on the eastern shore of Great St. Lawrence Harbour. Used as bait for the fall fisheries, the species is fished with mackerel nets to a depth of approximately 18 m (DFO 2009c). Atlantic mackerel are not harvested in the vicinity of Blue Beach Cove.

Capelin

The capelin is a small marine fish of cold, deep waters, found in the Atlantic Ocean on the offshore banks and in coastal waters, occasionally spending the winter and early spring in deep bays off the coast of Newfoundland (Scott and Scott 1988). After overwintering in offshore waters, capelin move shoreward in early spring to spawn on beaches throughout the region in the spring-summer, and return to offshore waters in autumn (Templeman 1948). Beach spawning is demersal with the eggs being deposited in the intertidal zone. However, occurrence of egg masses indicate that subtidal spawning occurs to depths ranging from approximately one to 37 m and up to approximately 400 m from shore in years and areas where water temperatures on the beaches exceeds the preferred spawning temperatures (Templeman 1948). In the Newfoundland region beach spawning may occur over a wide range of temperatures from 2.5 to 10.8°C (Frank and Leggett 1981). Subtidal spawning is assumed to be variable from year-to-year.

The size of the substrate on the beach determines the suitability of the beach for spawning with capelin usually preferring gravel five to 15 mm in diameter. When the most favoured substrate is occupied, or not available because of tidal conditions beach spawning capelin may spawn on sand less than 2 mm in diameter or on larger gravel up to 25 mm in diameter. Capelin do not spawn on larger substrates or mud. However, it appears that eggs may incidentally adhere to rocks, large boulders, and macroalgae if present among preferred substrates. Subtidal spawning inshore appears to be predominantly on sand (Templeman 1948).

Several capelin spawning beaches including Blue Beach Cove occur within Great St. Lawrence Harbour based on LEK collected by Sjare et al. (2003). Blue Beach Cove and Herring Cove were also noted as capelin spawning beaches by DFO (2009c). Fish harvesters noted that capelin were small in size and abundance was too low to sustain a commercial fishery. Capelin were typically targeted with seines and dipnets, in addition to buckets on shore, in June at depths of 9 to 27 m. Capelin traps have also been used at Blue Beach in the past, but not in recent years (E. Jarvis, pers. comm. 2009). Capelin demersal spawning areas were not identified within Great St. Lawrence Harbour.

Groundfish Species

Atlantic Cod

Atlantic cod have historically been distributed throughout Newfoundland and Labrador waters, including Placentia Bay (Scott and Scott 1988). The distribution of cod within Placentia Bay varies seasonally. Most of the cod aggregate at specific spawning grounds within the bay during the spring. After spawning, cod disperse with many migrating to summer feeding grounds outside of the bay, predominately in an eastern direction. The cod return to over-wintering grounds in Placentia Bay during summer and fall. There is also evidence that suggests some cod remain in Placentia Bay year-round and others that enter the bay from the west during summer (Lawson and Rose 2000a).

Spawning cod are present in Placentia Bay from March until August (DFO 2009e). Spawning occurs in the vicinity of the Bar Haven Island shoals and also in the outer bay off Cape St. Mary's and Oderin Bank (Lawson and Rose 2000b). Peak spawning generally occurs from April to June. Southwestward flowing currents are believed to carry the planktonic eggs and larvae out of the bay towards offshore banks, such as St. Pierre Bank and Burgeo Bank (Robichaud and Rose 2006). Nearshore areas, particularly those with marine vegetation (e.g., eelgrass), have been identified as important nursery habitats for juvenile cod (Gotceitas et al. 1997). Unlike northeastern Newfoundland bays where the planktonic cod stages are transported toward nearshore nursery habitats, few eggs or larvae are carried shoreward in Placentia Bay (Bradbury et al. 2000; Robichaud and Rose 2006), suggesting nearshore areas, such as Blue Beach Cove, are under-utilized by juvenile cod.

Cod larvae and pelagic juveniles are primarily zooplankton feeders but once the switch is made to the demersal lifestyle, benthic and epibenthic invertebrates become the main diet. As the fish grow, the array of prey also widens. Prey often includes various crustaceans (crab, shrimp, euphausiids) and fish (capelin, sand lance, redfish, other cod, herring). The predators of young cod include older, larger cod, squid, and pollock, while larger cod are predominately eaten by marine mammals (Scott and Scott 1988).

In the Great St. Lawrence Harbour area, Atlantic cod are commercially harvested south of the harbour at depths ranging from 27 to 90 m (DFO 2009c). The fishing season typically occurs from June to October with cod historically harvested using gillnets, cod traps, hook and line, and trawl (DFO 2009c). Recreational fisheries for cod have also occurred over the past few years in

Placentia Bay. This fishery is largely prosecuted using small open boats and gears typically consist of hook and line and rod and reel. Though variable and weather dependent, the recreational cod fishery is usually open for three weeks in August and one week in September or October. It is likely that the same cod grounds targeted for the commercial fishery are used by participants in the recreational fishery.

Witch Flounder

Witch flounder or greysole (Glyptocephalus cynoglossus) are a deep water flatfish that occur in the Northwest Atlantic from Hamilton Inlet in Labrador to Cape Hatteras. These relatively non-migratory flatfish are typically found offshore, in moderately deep water (primarily in 45 to 275 m depth range) and appear to prefer mud or sand-mud substrates and water temperatures of 2 to 6°C (Scott and Scott 1988). Witch flounder are a slow growing, long lived species that have been aged over 20 years old (Maddock-Parsons 2005).

In the Northwest Atlantic, spawning typically occurs over a prolonged period from March through September. Spawning by witch flounder in 3Ps is early by comparison with the highest intensity usually observed between January and March. During winter and spring, witch flounder can be found in spawning concentrations along the continental shelf of the St. Pierre Bank, particularly in the Halibut Channel. The offshore commercial fisheries often focus their efforts to coincide with the spawning concentrations noted above (Maddock-Parsons 2005). Seabed spawning results in buoyant fertilized eggs that float to the surface, followed by larval hatch approximately one week later. The larvae may remain pelagic for as long as a year before settling to the seabed (Cargnelli et al. 1999). This is the longest pelagic stage of any flatfish in Newfoundland waters (Scott and Scott 1988).

The diet of witch flounder consists of benthic polychaetes and crustaceans, small fishes, molluscs and echinoderms (Scott and Scott 1988).

American Plaice

American plaice is generally considered a coldwater species preferring water temperatures from 0 to 1.5ºC and a depth range of 90 to 250 m (Pitt 1982); however, it may occur in shallow waters <50 m or deep waters >700 m (Scott and Scott 1988). Tagging studies in Div. 3LNO indicate that adults and juveniles are rather sedentary after settlement and do not undertake large scale migrations (DFO 2008c). Limited offshore migrations into deeper water in winter and to shallower water in spring have been noted for adults (Scott and Scott 1988).

American plaice in the Newfoundland Region have no specific spawning areas, but instead spawn over the entire area of their range (DFO 2008c). The timing of spawning in each area differs with more southerly stocks spawning earlier. American plaice in Subdiv. 3Ps spawn in April, followed by Div. 3LNO in April-May and SA2 + Div. 3K in May. Spawning generally occurs in the spring during April for southern populations on the Grand Banks and Flemish Cap and during May or June for northern populations off Labrador (Pitt 1966). Prey items vary with size of individuals and locality but generally polychaetes, echinoderms, molluscs, crustaceans, and fish are consumed (Scott and Scott 1988).

All three stocks in the Newfoundland Region, including the 3Ps stock, are under moratorium to directed fishing (DFO 2008c). In the St. Lawrence Harbour area, LEK indicates that “flounder” are fished commercially from May to October (DFO 2009c). Though not specified, “flounder” may include American plaice among other species. The flounder are targeted with nets and hook and line at depths ranging from 90 to 108 m. Flounder fishing grounds occur outside of St. Lawrence Harbour, typically from south of Lawn Point east to Ferryland Head.

Redfish

Redfish are benthic fishes that inhabit rocky or clay-silt substrate areas along the slopes of banks and in deep channels with water depths ranging from 100 to 700 m and water temperatures of 3 to 8°C. Redfish typically remain on or near the seabed during the day and move up into the water column at night to feed. These fish are often geographically stratified by size, with smaller fish occurring in shallower water areas (McKone and LeGrow 1984; Scott and Scott 1988). The three species of redfish found in the Northwest Atlantic are Acadian redfish (Sebastes fasciatus), golden redfish (S. marinus), and deepwater redfish (S. mentella). The three species are similar in appearance and are, managed as a single fishery (Power and Mowbray 2000, Gascon 2003).

Redfish species are somewhat separated geographically. Deepwater redfish is the northern range species off Labrador and Greenland, and Acadian redfish is the southern range species on the Scotian Shelf and the Gulf of Maine (Scott and Scott 1988, Gascon 2003). The ranges for these two species overlap in the Laurentian Channel and the Grand Banks (Gascon 2003), possibly including Placentia Bay. In areas of distributional overlap, deepwater redfish generally occur in deeper water (Power and Morbray 2000, Gascon 2003).

Redfish are generally slow growing and long lived fishes (Campana et al. 1990). Redfish are icethotropic viviparous with internal fertilization, meaning that fertilized eggs hatch inside the females and live young are subsequently released (Scott and Scott 1988, Gascon 2003). Mating likely occurs during the late fall and early winter and then the females carry the developing embryos until spring. Larvae hatch internally and are extruded during the late spring and early summer (St. Pierre and de Lafontaine 1995, Gascon 2003, Morin et al. 2004).

Redfish are pelagic or bathypelagic feeders, feeding primarily on zooplankton such as copepods, amphipods and euphausiids. Fishes and crustaceans become more important in the diet of larger redfish (Scott and Scott 1988).

Lumpfish

Lumpfish are found on both sides of the North Atlantic in cold to temperate coastal waters (DFO 2002). They are primarily a bottom dwelling species living on rocky or stony bottoms (Scott and Scott 1988; DFO 2002). A pelvic adhesive disc allows adhesion to solid substrates, such as stones, lobster pots, and other objects (Scott and Scott 1988). Spawning takes place during the spring in Newfoundland waters and continues into the summer (DFO 2002). During early summer, typically late April or early May, lumpfish migrate to shallow coastal waters to spawn and return to deep water in late summer and early fall where they remain from September until April (Collins 1976; Stevenson and Baird 1988). Off Newfoundland, spawning is believed to be temperature-dependent, generally occurring when the water temperature reaches 4ºC. Eggs are deposited as large spongy masses ranging in coloration from black to brown, red, pink, orange, yellow, green, to purple (Collins 1976). After deposition of the egg masses, the females leave and the smaller, reddish colored males guard them (DFO 2002). A wide variety of invertebrates are consumed as prey items and include euphausiid shrimp, pelagic amphipods, copepods, other small crustaceans, pieces of jellyfish, and comb jellies. Small fishes such as herring and sand lance are also consumed (Scott and Scott 1988).

In Newfoundland, the commercial lumpfish fishery targets spawning females for the roe market. Males and immature females are not desired and are discarded (Walsh et al. 2000). The fishery is conducted as an inshore fishery from small vessels from April until July (Blackwood 1983). Typically 20 to 100 large (20 to 25 cm) mesh nets are set in a series of long strings and left to fish two to three days or longer depending on the weather. In the Great St. Lawrence Harbour area, lumpfish roe is largely harvested outside of the harbour though the distribution is indicated to extend around Cape Chateau Rouge. The species is harvested from May to June using lump nets set at depths ranging from 11 to 45 m (DFO 2009c). There is very little directed research ongoing for lumpfish and, due to an overall lack of data, the stock status is unknown (DFO 2002).

6.1.3.2 Marine Fish & Fish Habitat Impact Assessment

Marine fish habitat is very broadly defined here to include aspects such as water and sediment quality, plankton, and benthos. The fish portion of marine fish and fish habitat includes macroinvertebrates and finfishes, and is of prime concern from both a public and a scientific perspective. The marine stages of anadromous (e.g., sea run salmonids) and catadromous fish (e.g., American eel) are also considered where relevant. In most cases, species can be grouped according to life cycle needs and sensitivities. Individual species were selected to represent the fish portion of this VEC component, as it is impossible to individually assess the hundreds of species that potentially occur in Placentia Bay. American lobster and winter flounder are two relatively immobile species found in the Project Area year-round and likely to interact with the marine activities, thereby providing a conservative basis for effects predictions for marine species in general. The primary sources of potential effects on marine fish and fish habitat relate to marine construction activities (see Section 5.2.2), marine operations (Section 5.2.3), and marine accidents (Section 5.7).

Existing Conditions

The existing marine fish and fish habitat is described in detail in previous section (Section 6.1.3.1). Information gathered through various means (e.g., local ecological knowledge, habitat surveys) indicates that lobsters and winter flounder occur in the Project Area and will serve as focal species for this assessment. They represent both macroinvertebrates and finfishes, and both live in direct contact with the bottom substrate, often the component of the fish habitat that is affected by marine anthropogenic activities. Lobsters and winter flounder both feed on infaunal benthic species which also comprise a key component of the fish habitat. Both animals have life stages that occur throughout the habitat (i.e., upper and lower water column, and on bottom substrates).

Assessment Criteria

Assessment criteria, including boundaries, are described in Section 4.4. *Significant* environmental effects are those considered to be of sufficient magnitude, duration, frequency, geographic extent, and/or reversibility to cause a change in the marine fish and fish habitat that will alter its status or integrity beyond an acceptable level. Establishment of the criteria is based on professional judgment, but is transparent and repeatable.

In this EPR/EA, a *significant* effect is defined as *one having a medium or high magnitude, duration greater than one year, and geographic extent greater than 100 km*^{2}.

Reversibility of the effect is also an important consideration.

Issues and Concerns

Three primary concerns are associated with the potential interactions between routine activities of the three phases of the Project and marine fish and fish habitat:

1. Loss and/or alteration of marine fish habitat;
2. Increased total suspended solids, including materials being transferred at wharf; and
3. Characterization of effluent discharged into the marine environment (e.g., the discharge from the tailings pond, no other effluent discharge is planned).

The marine fish and fish habitat component of the Fish and Fish Habitat VEC could potentially interact with a variety of routine activities associated with the Construction, Operation, and Decommissioning phases of the Project (as shown in Section 5.10 interaction matrices). There are three primary marine works activities that will interact with marine fish and fish habitat:

1. Wharf construction in Blue Beach Cove;
2. Marine vessel loading at wharf in Blue Beach Cove; and
3. Discharge of effluent into Shoal Cove.

Accidental events (e.g., hydrocarbon release, fluorspar spill, structural failures) could also occur during all three phases of the Project and they too will be considered.

The potential effects of both routine Project activities and accidental events on marine fish and fish habitat are assessed in the following sections.

Existing Knowledge

The following sections briefly summarize existing knowledge in regard to the focal species, marine habitat disturbance and chemical contamination.

American Lobster

The American lobster (Homarus americanus) is a benthic decapod crustacean that is distributed nearshore around the island of Newfoundland, including Placentia Bay (DFO 2009). The distribution of lobster in the Great St. Lawrence Harbour area extends from Blue Beach Point to Deadmans Cove (DFO 2009).

The major lobster life history events (i.e., molting, mating, spawning, larval hatching), described by DFO (2009), typically occur between mid-summer and early fall, after the commercial fishing season. Mating typically occurs from July to September. Once egg extrusion and fertilization occurs, the eggs/developing embryos are carried in clutches on the underside of the female's tail for a period of 9 to 12 months. Hatching occurs over a four month period extending from late May through September. The larvae are planktonic for approximately six weeks and undergo three molts. After the third molt, the larvae resemble miniature adults and settle within suitable benthic habitat. Newly settled lobster progress through several juvenile stages and an adolescent phase before reaching adulthood. The diet of the adult lobster consists of crabs, polychaetes, molluscs, echinoderms, and various finfishes. Most of adult lobster mortality is attributed to the commercial fishery, considering the belief that they have few natural predators. The last stock assessment was recently completed in 2009 (DFO 2009).

Winter Flounder

The winter flounder occurs in the northwest Atlantic from southern Labrador to Georgia. It is a coastal flatfish that inhabits depths ranging from five to 100 m, but typically less than 40 m, and is most often associated with soft or moderately hard bottoms (Scott and Scott 1988; DeCelles and Cadrin 2007). Winter flounder were observed in Blue Beach Cove during habitat surveys in June 2009.

In Newfoundland, this flatfish typically spawns in shallow coastal areas with sand or mud bottom during spring (March to June), peaking in June. The winter flounder is unique among Atlantic flatfishes in that its fertilized eggs are demersal and adhesive. Time to larval hatch varies from one to four weeks after fertilization, depending primarily on water temperature. The larvae are planktonic in the surface waters until they metamorphose and seek out the bottom. Juvenile and adult winter flounder are found on a variety of substrate types in Newfoundland waters (e.g., soft bottom with eelgrass, hard bottom dominated by cobble, rock and boulder) (DeCelles and Cadrin 2007).

Winter flounder is primarily a daytime feeder, preying on benthic organisms including algae, polychaetes, crabs, amphipods, shrimps, sea urchins, molluscs, and fish eggs (e.g., capelin, herring) (Scott and Scott 1988; DeCelles and Cadrin 2007; Fish Base 2009, http://www.fishbase.org).

The winter flounder has often been used as a bioindicator species in studies conducted in Placentia Bay and other marine areas in Newfoundland (Barker et al. 1994; Khan et al. 1994; Khan 1995, 1997, 1998, 1999, 2003a,b, 2004a,b, 2006; Khan and Hooper 2000; Khan and Payne 2002a,b, 2004).

The winter flounder is fished commercially in some areas of eastern Canada (e.g., NAFO Division 4T in the Gulf of St. Lawrence) for bait and limited food markets (DeCelles and Cadrin 2007).

Harmful Alteration, Disruption and/or Destruction (HADD)

Habitat destruction is always considered harmful, at least temporarily. Alteration, disruption and destruction of marine fish habitat immediately affect the productive capacity of an area, but the return to the pre-impact productive capacity level can be relatively rapid, depending on the nature of the habitat affected. Some alterations and disruptions can result in an increase in productive capacity of an area. For example, habitat alteration and disruption for the Project includes the installation of rock armouring of the wharf causeway and main structure. Biota living at the surface of the covered natural habitat would likely be displaced. If that natural habitat being covered by the armour stone is characterized as hard substrate, then the displaced biota could conceivably use the surface of the introduced armour stone for settlement. There might even be an increase in available surface area for attachment/colonization. An example of a marine activity that would cause habitat destruction is the installation of wharf structure (piling or caisson footprint) in that an amount of sediment is actually removed from a habitat area and can no longer serve as habitat for biota.

Some marine activities associated with the construction of the marine wharf will result in a HADD to marine fish habitat.

Total Suspended Solids

Suspended sediments are typically silt and clay particles measuring two to 60 µm in diameter. They are often measured directly as TSS in mg/L or indirectly as turbidity. Turbidity is the optical property of water resulting in a loss of light transmission caused by absorption and scattering. While suspended sediments are often the primary contributors to turbidity, non-sediment sources that also affect light transmission include natural tannins and algae. An increase in TSS can occur as a result of natural phenomena such as storms or tides and anthropogenic activities such as dredging (U.K. Marine SACs Project website, http://www.ukmarinesac.org.uk /activities/water-quality/wq9_9.htm).

Elevated TSS conditions have been reported to cause physiological stresses, growth reduction, and lower survival. It is important to consider the frequency and duration of exposure to increased TSS and not just the TSS concentration. The effects of elevated TSS conditions also vary depending on the species and its life history stage being affected (Wilber and Clarke 2001; USACE 2004). Elevated TSS conditions can affect marine invertebrates and/or fish in three ways:

1. Behavioural effects including avoidance, attraction, reduced feeding success, and increased 'gill flaring';
2. Physical effects including stress, tissue damage, reduced growth, and mortality; and
3. Habitat effects including increased sedimentation, increased filling of gravel interstitial spaces, and decreased gravel inter-particle dissolved oxygen concentration.

Wilber and Clarke (2001) conducted a review of suspended sediment impacts on fish and shellfish with relation to dredging activities in estuaries. Unlike the attention that has been given to suspended sediment effects on salmonid fish, relatively little is known about the effects on estuarine fish and invertebrates. However, studies of the effects on various marine species have been conducted. The biota studied includes invertebrate eggs, larvae, and adults (Davis 1960, Davis and Hidu 1969, Mulholland 1984, and Hawkins et al. 1996 in Wilber and Clarke 2001). Eggs and larvae of non-salmonid estuarine fish exhibit some of the most sensitive responses to suspended sediment exposure. Behavioural responses to, and sub-lethal and lethal physical effects of suspended sediment has also been observed for several estuarine fish species (Wilber and Clarke 2001).

Chemical Contamination

There are various Project scenarios that could result is some level of contamination of the marine environment. These scenarios relate primarily to accidental events such as hydrocarbon and non-hydrocarbon (e.g., fluorspar) releases, and discharge of tailings pore water into Shoal Cove. The following sections provide brief descriptions of how the relevant chemicals might affect marine fish and fish habitat.

Hydrocarbons

Marine fish and fish habitat includes plankton because it is a source of food for larvae and some adult fish thus, effects of a hydrocarbon release on plankton could affect fish. Dispersion and dissolution cause the soluble, lower molecular weight hydrocarbons to move from the slick into the water column. Effects of spills on pelagic organisms need to be assessed through examination of effects of water-soluble fractions of oil or light hydrocarbon products.

Effects of hydrocarbons on plankton are short-lived, with zooplankton being more sensitive than phytoplankton. Zooplankon accumulate hydrocarbons in their bodies. The hydrocarbons may be metabolized and depurated (Trudel 1985). Hydrocarbons accumulated in zooplankton during a spill would be depurated within a few days after a return to clean water and thus, there is limited potential for transfer of hydrocarbons up the food chain (Trudel 1985). There is a potential for transfer of hydrocarbons up the food chain in an environment subject to chronic inputs of hydrocarbons, but there is no potential for biomagnification. In summary, individual zooplankton could be affected by a hydrocarbon release through mortality, sublethal effects, or hydrocarbon accumulation if hydrocarbon concentrations are high enough.

Under some circumstances, hydrocarbons released in nearshore waters can become incorporated into nearshore and intertidal sediments, where it can remain toxic and affect benthic animals for years after the spill (Sanders et al. 1990).

Planktonic fish eggs and larvae (ichthyoplankton) are less resistant to effects of contaminants than are adults because they are not physiologically equipped to detoxify them or to actively avoid them. In addition, many eggs and larvae develop at or near the surface where hydrocarbon exposure may be the greatest (Rice 1985). Generally, fish eggs appear to be highly sensitive at certain stages and then become less sensitive just prior to larval hatching (Kühnhold 1978; Rice 1985). Larval sensitivity varies with yolk sac stage and feeding conditions (Rice et al. 1986). Eggs and larvae exposed to high concentrations of hydrocarbons generally exhibit morphological malformations, genetic damage, and reduced growth. Damage to embryos may not be apparent until the larvae hatch.

However, the natural mortality rate in fish eggs and larvae is so high that large numbers could be destroyed by anthropogenic sources before effects would be detected in an adult population (Rice 1985). Hydrocarbon-related mortalities would probably not affect year-class strength unless >50% of the larvae in a large proportion of the spawning area died (Rice 1985).

There is an extensive body of literature regarding the effects of exposure to hydrocarbons on juvenile and adult fish. Although some of the literature describes field observations, most refers to laboratory studies. Reviews of the effects of hydrocarbons on fish have been prepared by Armstrong et al. (1995), Rice et al. (1996), Payne et al. (2003) and numerous other authors. If exposed to hydrocarbons in high enough concentrations, fish may suffer effects ranging from direct physical effects (e.g., coating of gills and suffocation) to more subtle physiological and behavioural effects. Actual effects depend on a variety of factors such as the amount and type of hydrocarbon, environmental conditions, species and life stage, lifestyle, fish condition, degree of confinement of experimental subjects, and others.

Fluorspar

Fluorspar (i.e., calcium fluoride) is relatively insoluble in water and therefore does not pose a threat to marine biota in the sense of chemical contamination. However, it could have effects on marine biota in terms of increased turbidity. See the prior section on total suspended solids for a description of potential effects of TSS on marine biota.

Tailings Pore Water/Marine Effluent

The treated tailings pore water will contain very low levels of fluorspar and silt-clay size particles of inert materials (e.g., granite), in addition to those chemicals and substances already in the naturally occurring water of Shoal Cove freshwater system. As explained above, fluorspar is relatively insoluble in water and therefore would not be chemically toxic to marine biota. However, the presence of fluorspar and inert particles could increase turbidity and have some effects on marine biota. See the prior section on total suspended solids for a description of potential effects of TSS on marine biota.

In the event of a structural failure in the tailings management facility, the marine effluent would likely contain inert, fine-grained particles.

Noise

The sea is a naturally noisy environment. Natural ambient noise is often related to sea state, increasing with wind speed and wave height. Disturbance related to underwater noise could also be caused by non-natural sources such as a pile driver or marine vessels. Underwater noise will be introduced during the Project and it could potentially affect all six aspects of the marine component of the fish and fish habitat VEC

The various types of potential effects of exposure to noise on fish and invertebrates can be considered in three categories: pathological, physiological, and behavioural. Pathological effects include lethal and sub-lethal damage to the animals; physiological effects include temporary primary and secondary stress responses, and behavioural effects refer to changes in exhibited behaviours of the fish and invertebrate animals. The three categories should not be considered as independent of each other. They are certainly interrelated in complex ways. For example, it is possible that certain physiological and behavioural changes could potentially lead to the ultimate pathological effect on individual animals (i.e., mortality). However, it appears that fish and invertebrates have to be exposed to high sound pressure levels for extended period of time before physical and physiological effects become apparent. Behavioural effects are another issue. There are suggestions that horizontal and vertical distributions might be affected by exposure to sound; however, any apparent effect seems to be temporary

Fish vary widely in their ability to hear sounds. Some fish have very good auditory capabilities; in many of these species, such as certain herring-like fishes, the swim bladder is connected directly to the inner ear. In contrast, cod do not have this direct connection and are less sensitive to sound

Little is known about invertebrate reactions to sound. Although they do not appear to have 'hearing' organs, they are able to detect certain vibrations (Hawkins 2005; Popper et al. 2006; Payne et al. 2007).

Nedwell et al. (2003) measured the underwater noise produced by vibratory and impact pile drivers and observed its effect on caged fish. They found that caged brown trout neither appeared to react to either type of pile driving nor suffered gross physical injury at a distance of 400 m from the source. The caged fish did not show any behavioural reactions when exposed as close as 50 m from the vibropiling equipment. Source level of the impact pile driver was determined to be 194 dB re 1 μPa at 1-m. Hawkins (2005) pointed out that the typical source levels associated with both vibratory and impact pile drivers exceed the known hearing thresholds of certain fish. It is likely that the hearing of those species with thresholds below the pile driver source levels could be affected when exposed to enough percussive sound. Popper et al. (2006) presented interim criteria for injury of fish exposed to pile driving operations. Based on the best available science, they concluded that is reasonable to use a combined interim single-strike criterion for pile driving received level exposure: a sound exposure level (SEL) of 187 dB re: 1 μPa2 · s, and a peak sound pressure level (SPL) of 208 dB re: 1 μPa peak measured 10 m from source. The important issue of cumulative effects of multiple exposures could not be properly accounted for due to paucity of data.

Underwater recordings of both vibratory and impact pile-driving sounds during recent dock modifications in Alaska were made (HDR Alaska et al. 2006). The mean SPLrms at 56 m (average of several 8.5 second samples) from the vibratory pile driver was 164 dB re: 1 μPa at a depth of 10 m and 162 dB re: 1 μPa at a depth of 1.5 m. The mean SPLrms at 62 m (average of several individual pulses) from the impact pile driver was 189 dB re: 1 μPa at a depth of 10 m and 190 dB re: 1 μPa at a depth of 1.5 m. With respect to the impact pile driving, the distances at which the mean SPLsrms decreased below 180 dB were 250 m (10 m depth) and 195 m (1.5 m depth), and the distances at which the maximum SPLsrms decreased below 180 dB were 650 m (10 m depth) and 330 m (1.5 m depth). The mean SEL at 62 m (average of several individual pulses) associated with impact pile driving was 178 dB re: 1 μPa2 · s at a 10 m depth, and 180 dB re: 1 μPa2 · s at a 1.5 m depth. The dominant frequency ranges for vibratory and impact pile driving were 400 to 2,000 Hz and 100 to 2,000 Hz, respectively (HDR Alaska et al. 2006).

Payne et al. (2009) recently exposed monkfish larvae collected in Newfoundland waters to seismic sound in the laboratory. No significant differences in mortality/moribundity between control and exposed larvae were detected, despite the high levels of exposure.

Lighting

Some marine species (e.g., squid) are known to be attracted to light. This interaction is acknowledged here but considered so small scale and intermittent as to be negligible and not assessed further.

Atmospheric Emissions

Construction activities (e.g., clearing, levelling and grubbing) have the potential to generate considerable levels of dust that could reach the marine environment. Emissions from operation could be from concentrate off-loading into ships, as well as emission from ship engines. Due to the very small number of ships associated with this project (less than 15/year) and with mitigation measures considered (see section 5.2), this effect on marine fish & fish habitat is negligible.

Effects of Construction

Potential interactions between construction routine activities/accidental events and marine fish and fish habitat are shown in Table 6.1-16. Only those construction activities from the main interactions table (Table 5.10-1 that have reasonable likelihoods of interacting with any aspect of the marine fish and fish habitat component of this VEC are considered in this section.

Land-Based Activities

During land-based construction, three activities have been identified as having potential to interact with all aspects of marine fish and fish habitat. They include (1) run-off/siltation, (2) air emissions, including dust, and (3) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.1-16).

Run-off/Siltation

Run-off and associated siltation could result in increased turbidity and sedimentation in the marine environment, thereby *negatively* affecting marine fish and fish habitat. Lobsters and winter flounder, the focal species of the marine component of the Fish and Fish Habitat VEC, could specifically be affected by increased turbidity and sedimentation. Both species might alter their feeding behaviours in response to increased turbidity. Excessive sedimentation has the potential to affect the reproduction of both, particularly since winter flounder eggs are deposited on the bottom substrate. Mitigations intended to reduce the *negative* effects of run-off/siltation on marine fish and fish habitat will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for run-off and siltation include the use of silt curtains (Table 6.1-17) but these measures will be finalized in the EPP. Regardless of the possibility of *continuous* run-off/siltation throughout the land-based construction phase, appropriate mitigation measures would minimize the potential effects of this activity on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of run-off/siltation on marine fish and fish habitat are *negligible to low*, *<1 km^2*, and *13 to 36 months*, respectively (Table 6.1-17). Based on these criteria ratings, the residual effects of run-off/siltation associated with land-based construction on marine fish and fish habitat are *insignificant* (Table 6.1-18).

Air Emissions (including dust)

Air emissions, including airborne dust, could also cause increased turbidity and sedimentation in the marine environment, thereby *negatively* affecting marine fish and fish habitat in the same way described for run-off and siltation. Another aspect of air emissions pertains to chemicals comprising emissions from equipment being used during land-based construction, which could potentially have some *negative* effects on marine fish and fish habitat, including increased turbidity, sedimentation and contamination. Mitigations intended to reduce the *negative* effects of air emissions, including dust, on marine fish and fish habitat will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include water spray dust suppression, the use of silt curtains, and equipment maintenance (Table 6.1-17) but these measures will be finalized in the EPP. Regardless of the possibility of *continuous* air emissions throughout the land-based construction phase, appropriate mitigation measures would minimize the potential effects of this activity on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of air emissions on marine fish and fish habitat are *negligible to low*, *<1 km^2*, and *13 to 36 months*, respectively (Table 6.1-17). Based on these criteria ratings, the residual effects of air emissions associated with land-based construction on marine fish and fish habitat are *insignificant* (Table 6.1-18).

Table 6.1-16: Potential Interactions between Construction Activities and the Marine Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Marine)						
Project Activity	**Feeding**		**Reproduction**		**Adult Stage**	
	Plankton	**Benthos**	**Eggs/Larvae**	**Juveniles[1]**	**Pelagic**	**Benthic/ Demersal**
Construction Activities and Physical Works						
Land-based						
Run-off/siltation	X	x	x	x	x	x
Air emissions (incl. dust)	X	x	x	x	x	x
Accidental events	X	x	x	x	x	x
Marine						
Wharf footprint		x	x	x	x	x
Siltation	X	x	x	x	x	x
Noise	X	x	x	x	x	X
Air emissions	X	x	x	x	x	X
Accidental events	X	x	x	x	x	X

Notes: [1] Juveniles are young fish that have left the plankton and are often found closely associated with substrates.

<u>Accidental Events</u>

Accidental hydrocarbon and non-hydrocarbon releases during land-based construction activities could potentially have *negative* effects on marine fish and fish habitat. Section 5.7 describes some of these potential effects. Mitigations intended to reduce the *negative* effects of land-based accidental events on marine fish and fish habitat will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.1-17) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of land-based accidental events on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of land-based accidental events on marine fish and fish habitat are *low to medium*, *<1 to 10* km^2, and *<1 to 12 months*, respectively (Table 6.1-17). Based on these criteria ratings, the residual effects of land-based accidental events during construction on marine fish and fish habitat are *insignificant* (Table 6.1-18).

Table 6.1-17: Effects Assessment of Construction Activities on the Marine Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Marine)								
Project Activity	Potential Positive (P) or Negative (N) Environmental Effect	Possible Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/ Socio-Cultural and Economic Context
Construction Activities and Physical Works								
Land-based								
Run-off/siltation	Increased turbidity (N); Sedimentation (N)	Silt curtains	0-1	1	6	3	R	2
Air emissions (incl. dust)	Increased turbidity (N); Sedimentation (N); Contamination (N)	Water spray dust suppression;Minimization of material stockpiling Equipment maintenance	0-1	1	6	3	R	2
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-2	1	1-2	R	2
Marine								
Wharf footprint	Loss of bottom habitat (HADD) (N)	Habitat compensation	1-2	1	6	3	R	2
Siltation	Increased turbidity (N); Sedimentation (N)	Silt curtains	1	1	6	2	R	2
Noise	Disturbance (N)	Bubble curtains	1	1	6	2	R	2
Air emissions	Contamination (N)	Equipment maintenance	1	1	6	2	R	2
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-3	1	1-2	R	2

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Table 6.1-18: Significance of Potential Residual Environmental Effects of Construction Activities on the Marine Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Marine)				
Project Activity	**Significance of Predicted Residual Environmental Effects**		**Likelihood[a]**	
	Significance Rating	**Level of Confidence**	**Probability of Occurrence**	**Scientific Certainty**
Construction Activities and Physical Works				
Land-based				
Run-off/siltation	NS	3	-	-
Air emissions (incl. dust)	NS	3	-	-
Accidental events	NS	3	-	-
Marine				
Wharf footprint	NS	3	-	-
Siltation	NS	3	-	-
Noise	NS	3	-	-
Air emissions	NS	3	-	-
Accidental events	NS	3	-	-

[a] **Only rated if residual environmental effect predicted to be significant**

Key:

Residual environmental Effect Rating:
S= Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P= Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

Marine Activities

During marine construction, five activities have been identified as having potential to interact with at least some of the aspects of marine fish and fish habitat. They include (1) wharf footprint, (2) siltation, (3) noise, (4) air emissions, and (5) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.1-16).

Wharf Footprint

The footprint of the proposed marine wharf at Blue Beach Cove, as determined by Fisheries and Oceans Canada (DFO), is 29,475 m^2. This amount of bottom habitat will be lost due to wharf construction, resulting in a *negative* effect. DFO also quantified the amount of Habitat Equivalent Units (HEUs) based on the biological and physical characteristics of the bottom habitat that would be lost and determined that 28, 823 m^2 of habitat will require compensation by the proponent. A compensation strategy that outlines what approaches could be used to compensate for the lost bottom habitat, particularly as it relates to lobsters and winter flounder, is currently being prepared and will be completed and deemed acceptable by DFO before the end of the EPR/EA review process. The approach used to compensate for habitat lost due to the wharf footprint will be the mitigation that minimizes the *negative* effect of the wharf footprint. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of the wharf footprint on marine fish and fish habitat are *low to medium*, *<1* km^2, and *13 to 36 months*, respectively (Table 6.1-17). Based on these criteria ratings, the residual effects of the wharf footprint associated with marine construction on marine fish and fish habitat are *insignificant* (Table 6.1-18).

Siltation

Siltation due to construction in or near the marine environment could result in increased turbidity and sedimentation in the marine environment, thereby *negatively* affecting marine fish and fish habitat. Lobsters and winter flounder, the focal species of the marine component of the Fish and Fish Habitat VEC, could specifically be *negatively* affected by increased turbidity and sedimentation. Both species might alter their feeding behaviours in response to increased turbidity. Excessive sedimentation has the potential to *negatively* affect the reproduction of both, particularly since winter flounder eggs are deposited on the bottom substrate. Mitigations intended to reduce the *negative* effects of *continuous* siltation on marine fish and fish habitat will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for siltation due to marine construction include the use of silt curtains (Table 6.1-17) but these measures will be finalized in the EPP. Regardless of the possibility of *continuous* siltation throughout the marine construction phase, appropriate mitigation measures would minimize the potential *negative* effects of this activity on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of siltation on marine fish and fish habitat are *low*, *<1* km^2, and *1 to 12 months*, respectively (Table 6.1-17). Based on these criteria ratings, the residual effects of siltation associated with marine construction on marine fish and fish habitat are *insignificant* (Table 6.1-18).

Noise

There are potential interactions between noise and all aspects of the marine component of the fish and fish habitat VEC (Table 6.1-16). Numerous underwater noise sources will occur *continuously* in the Project Area during marine construction, including marine vessels, piling installation, and heavy equipment associated with work. It is likely that the most intrusive noise source from the perspective of marine fish and fish habitat will be the equipment used to install wharf pilings. Previous discussions above identify recent publications on the topic of *negative* effects of pile driving noise on fish. The effects of exposure to noise on marine fish and fish habitat are likely to be *negative* but minimal. There is some evidence that prolonged exposure to sound with relatively high sound pressure levels (SPL) (e.g., pile driving) could potentially cause injury to some fishes, however, the most likely *negative* effect will be the displacement of fish (e.g., winter flounder) and mobile invertebrates (e.g., lobsters) in the proximity of the noise source. Both animals might also habituate to the underwater noises introduced during marine construction. Mitigations intended to reduce the *negative* effects of noise on marine fish and fish habitat will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for exposure to noise caused by marine construction include the use of bubble curtains (Table 6.1-17) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential *negative* effects of construction noise on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of exposure to noise on marine fish and fish habitat are *low*, *<1* km^2, and *1 to 12 months*, respectively (Table 6.1-17). Based on these criteria ratings, the residual effects of underwater noise associated with marine construction on marine fish and fish habitat are *insignificant* (Table 6.1-18).

Air Emissions

Air emissions from equipment and marine vessels being used during marine construction could potentially have some *negative* contaminating effects on marine fish and fish habitat. Mitigations intended to reduce the *negative* effects of *continuous* air emissions on marine fish and fish habitat will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include equipment maintenance (Table 6.1-17) but these measures will be finalized in the EPP. Regardless of the possibility of *continuous* air emissions throughout the marine construction phase, appropriate mitigation measures would minimize the potential effects of this activity on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of air emissions on marine fish and fish habitat are *negligible to low*, *<1* km^2, and *1 to 12 months*, respectively (Table 6.1-17). Based on these criteria ratings, the residual effects of air emissions associated with marine construction on marine fish and fish habitat are *insignificant* (Table 6.1-18).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during marine-based construction activities could potentially have *negative* effects on marine fish and fish habitat. Section 5.7 describes some of these potential effects. Mitigations intended to reduce the *negative* effects of marine-based accidental events on marine fish and fish habitat will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.1-17) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of marine-based accidental events on marine fish and fish habitat are *low to medium*, *<1 to 100 km*^{2}, and *<1 to 12 months*, respectively (Table 6.1-17). Based on these criteria ratings, the residual effects of marine-based accidental events during construction on marine fish and fish habitat are *insignificant* (Table 6.1-18).

Effects of Operations

Potential interactions between operations routine activities/accidental events and marine fish and fish habitat are shown in Table 6.1-19. Only those operations activities from the main interactions table (Table 5.10-2) that have reasonable likelihoods of interacting with any aspect of the marine fish and fish habitat component of this VEC are considered in this section.

Land-Based Activities

During land-based operations, two activities have been identified as having potential to interact with all aspects of marine fish and fish habitat. They include (1) air emissions, and (2) accidental events (e.g., hydrocarbon and non-hydrocarbon releases, structural failures) (Table 6.1-19).

Air Emissions

Air emissions from the mine site during operations could potentially have some *negative* contaminating effects on marine fish and fish habitat. Mitigations intended to reduce the negative effects of *continuous* air emissions on marine fish and fish habitat will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include treatment and monitoring (Table 6.1-20) but these measures will be finalized in the EPP.

Regardless of the possibility of *continuous* air emissions throughout the mine operations phase, appropriate mitigation measures would minimize the potential *negative* effects of this activity on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of air emissions on marine fish and fish habitat are *negligible to low*, *<1 km²*, and *>72 months*, respectively (Table 6.1-20). Based on these criteria ratings, the residual effects of air emissions associated with mine operations on marine fish and fish habitat are *insignificant* (Table 6.1-21).

Table 6.1-19: Potential Interactions Between Operations Activities and Marine Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Marine)						
Project Activity	**Feeding**		**Reproduction**		**Adult Stage**	
	Plankton	**Benthos**	**Eggs/Larvae**	**Juveniles[1]**	**Pelagic**	**Benthic/ Demersal**
Operations Activities and Physical Works						
Land-based						
Air emissions	x	x	x	x	x	x
Accidental events	x	x	x	x	x	x
Marine						
Marine effluent	x	x	x	x	x	x
Vessel loading	x	x	x	x	x	x
Noise				x	x	x
Air emissions	x	x	x	x	x	x
Accidental events	x	x	x	x	x	x

Notes: [1] Juveniles are young fish that have left the plankton and are often found closely associated with substrates.

Table 6.1-20: Effects Assessment of Operations Activities on the Marine Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Marine)								
Project Activity	**Potential Positive (P) or Negative (N) Environmental Effect**	**Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**					
			Magnitude	**Geographic Extent**	**Frequency**	**Duration**	**Reversibility**	**Ecological/ Socio-Cultural and Economic Context**
Operations Activities and Physical Works								
Land-based								
Air emissions	Contamination (N)	Treatment; Compliance monitoring	0-1	1	6	5	R	2
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-2	1	1-2	R	2
Marin								
Marine effluent	Contamination (N)	Treatment; Compliance monitoring	0-1	1	6	5	R	2
Vessel loading	Increased turbidity (N); Contamination (N)	Enclosed loading/off-loading system	1	1	1	5	R	2
Noise	Disturbance (N)	Minimization of exposure to noise	0-1	1	1	5	R	2
Air emissions	Contamination (N)	Equipment maintenance	0-1	1	1	5	R	2
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-3	1	1-2	R	2

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Table 6.1-21: Significance of Potential Residual Environmental Effects of Operations Activities on the Marine Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Marine)				
Project Activity	Significance of Predicted Residual Environmental Effects		Likelihood[a]	
	Significance Rating	Level of Confidence	Probability of Occurrence	Scientific Certainty
Operations Activities and Physical Works				
Land-based				
Air emissions	NS	3	-	-
Accidental events	NS	3	-	-
Marine				
Marine effluent	NS	3	-	-
Vessel loading	NS	3	-	-
Noise	NS	3	-	-
Air emissions	NS	3	-	-
Accidental events	NS	3	-	-

[a] Only rated if residual environmental effect predicted to be significant

Key:
Residual environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases and structural failures during land-based operation activities could potentially have *negative* effects on marine fish and fish habitat. Section 5.7 describes some of these potential effects. Mitigations intended to reduce the *negative* effects of land-based accidental events on marine fish and fish habitat will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.1-19) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of land-based accidental events on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of land-based accidental events on marine fish and fish habitat are *low to medium*, *<1 to 10 km*^{2}, and *<1 to 12 months*, respectively (Table 6.1-19). Based on these criteria ratings, the residual effects of land-based accidental events during operations on marine fish and fish habitat are *insignificant* (Table 6.1-20).

Marine Activities

During marine operations, five activities have been identified as having potential to interact with aspects of marine fish and fish habitat. They include (1) marine effluent, (2) vessel loading, (3) noise, (4) air emissions, and (5) accidental events (e.g., hydrocarbon and non-hydrocarbon releases, including large fluorspar spills at the wharf) (Table 6.1-19).

Marine Effluent

Effluent that will be discharged into Shoal Cove via Shoal Cove Brook will have the potential to affect marine fish and fish habitat (Table 6.1-19). Potential effects relate primarily to total suspended solids. Mitigations intended to reduce the effects of marine effluent on marine fish and fish habitat will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include treatment and compliance monitoring (Table 6.1-20) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine effluent on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of marine effluent on marine fish and fish habitat are *negligible to low*, *<1* km^2, and *>72 months*, respectively (Table 6.1-20). Based on these criteria ratings, the residual effects of marine effluent associated with mine operations on marine fish and fish habitat are *insignificant* (Table 6.1-21).

Vessel Loading

The loading of marine vessels at the wharf could potentially result in incidental spillage of fluorspar into the marine environment. This activity will have a frequency of *<11 events/yr*. Regardless of the amount of fluorspar spilled, there is potential for *negative* effect on the marine fish and fish habitat through contamination and increased turbidity (Table 6.1-19). Mitigations intended to reduce the *negative* effects of vessel loading on marine fish and fish habitat will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include the use of an enclosed conveyor system (Table 6.1-20) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of vessel loading on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of vessel loading on marine fish and fish habitat are *low*, *<1 km^2*, and *>72 months*, respectively (Table 6.1-20). Based on these criteria ratings, the residual effects of vessel loading associated with mine operations on marine fish and fish habitat are *insignificant* (Table 6.1-21).

Noise

There are potential interactions between noise and the juvenile and adult life history stages of fishes (Table 6.1-19), but most of these interactions will occur infrequently, likely *<11 events/yr*, especially at times of vessel loading. Compared to marine construction, underwater noise produced during operations will be considerably less. Mitigations intended to reduce the *negative* effects of noise on marine fish and fish habitat will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for exposure to noise caused by marine operations include the minimization of noise production (Table 6.1-20) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential *negative* effects of operations noise on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of exposure to noise on marine fish and fish habitat are *negligible to low*, *<1 km^2*, and *>72 months*, respectively (Table 6.1-20). Based on these criteria ratings, the residual effects of underwater noise associated with marine activities during the operations phase on marine fish and fish habitat are *insignificant* (Table 6.1-21).

Air Emissions

Air emissions from equipment and marine vessels during the marine operations phase could potentially have some *negative* contaminating effects on marine fish and fish habitat (Table 6.1-19). However, as with vessel loading and noise, air emissions from marine operations will likely only occur infrequently, not continuously as air emissions associated with land-based operations. Mitigations intended to reduce the *negative* effects of air emissions on marine fish and fish habitat will be detailed in the Operations in Environmental Protection Plan (EPP). Candidate mitigations for this activity include equipment maintenance (Table 6.1-20) but these measures will be finalized in the EPP. Regardless of the possibility of air emissions during the marine operations phase, appropriate mitigation measures would minimize the potential effects of this activity on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of air emissions on marine fish and fish habitat are *negligible to low*, *<1 km^2*, and *>72 months*, respectively (Table 6.1-20). Based on these criteria ratings, the residual effects of air emissions associated with marine operations on marine fish and fish habitat are *insignificant* (Table 6.1-21).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases (including major fluorspar spills at the wharf) during marine-based operations activities could potentially have *negative* effects on marine fish and fish habitat. Section 5.7 describes some of these potential effects. Mitigations intended to reduce the *negative* effects of marine-based accidental events on marine fish and fish habitat will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.1-20) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of marine-based accidental events on marine fish and fish habitat are *low to medium*, *<1 to 100* km^2, and *<1 to 12 months*, respectively (Table 6.1-20). Based on these criteria ratings, the residual effects of marine-based accidental events during operations on marine fish and fish habitat are *insignificant* (Table 6.1-21).

Effects of Decommissioning

Potential interactions between decommissioning routine activities/accidental effects and marine fish and fish habitat are shown in Table 6.1-22. Only those decommissioning activities from the main interactions table in Section 5.10.2 that have reasonable likelihoods of interacting with any aspect of the marine fish and fish habitat component of this VEC are considered in this section.

Table 6.1-22: Potential Interactions between Decommissioning Activities and the Marine Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Marine)						
Project Activity	Feeding		Reproduction		Adult Stage	
	Plankton	Benthos	Eggs/Larvae	Juveniles[1]	Pelagic	Benthic/ Demersal
Decommissioning Activities and Physical Works						
Land-based						
Air emissions	x	x	x	x	x	x
Accidental events	x	x	x	x	x	x
Marine						
Noise				x	x	x
Air emissions	x	x	x	x	x	x
Accidental events	x	x	x	x	x	x

Notes: [1] Juveniles are young fish that have left the plankton and are often found closely associated with substrates.

Land-based Activities

During land-based decommissioning, two activities have been identified as having potential to interact with all aspects of marine fish and fish habitat: (1) air emissions, and (2) accidental events (e.g., hydrocarbon and non-hydrocarbon releases, structural failures) (Table 6.1-22).

Air Emissions

Air emissions from the mine site during decommissioning could potentially have some *negative* contaminating effects on marine fish and fish habitat. Mitigations intended to reduce the negative effects of *continuous* air emissions on marine fish and fish habitat will be detailed in the Decommissioning Environmental Protection Plan (EPP). Candidate mitigations for this activity include equipment maintenance (Table 6.1-23) but these measures will be finalized in the EPP. Regardless of the possibility of *continuous* air emissions throughout the land-based decommissioning phase, appropriate mitigation measures would minimize the potential *negative* effects of this activity on marine fish and fish habitat.

Table 6.1-23: Effects Assessment of Decommissioning Activities on the Marine Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Marine)									
Project Activity	Potential Positive (P) or Negative (N) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects						
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/ Socio-Cultural and Economic Context
Decommissioning Activities and Physical Works								
Land-based								
Air emissions	Contamination (N)	Treatment; Compliance monitoring	0-1	1	6	2	R	2
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-2	1	1-2	R	2
Marine								
Noise	Disturbance (N)	Minimization of exposure to noise	0-1	1	6	2	R	2
Air emissions	Contamination (N)	Equipment maintenance	0-1	1	6	2	R	2
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-3	1	1-2	R	2

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of air emissions on marine fish and fish habitat are *negligible to low*, *<1 km²*, and *<12 months* respectively (Table 6.1-23). Based on these criteria ratings, the residual effects of air emissions associated with decommissioning on marine fish and fish habitat are *insignificant* (Table 6.1-24).

Table 6.1-24: Significance of Potential Residual Environmental Effects of Decommissioning Activities on the Marine Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Marine)				
Project Activity	**Significance of Predicted Residual Environmental Effects**		**Likelihood[a]**	
	Significance Rating	**Level of Confidence**	**Probability of Occurrence**	**Scientific Certainty**
Decommissioning Activities and Physical Works				
Land-based				
Air emissions	NS	3	-	-
Accidental events	NS	3	-	-
Marine				
Noise	NS	3	-	-
Air emissions	NS	3	-	-
Accidental events	NS	3	-	-

[a] Only rated if residual environmental effect predicted to be significant

Key:

Residual environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

<u>Accidental Events</u>

Accidental hydrocarbon and non-hydrocarbon releases and structural failures during land-based decommissioning activities could potentially have *negative* effects on marine fish and fish habitat. Section 5.7 describes some of these potential effects. Mitigations intended to reduce the *negative* effects of land-based accidental events on marine fish and fish habitat will be detailed in the Decommissioning Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.1-23) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of land-based accidental events on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of land-based accidental events on marine fish and fish habitat are *low to medium*, *<1 to*

10 km^2, and *<1 to 12 months*, respectively (Table 6.1-23). Based on these criteria ratings, the residual effects of land-based accidental events during decommissioning on marine fish and fish habitat are *insignificant* (Table 6.1-24).

Marine Activities

During marine-associated decommissioning, three activities have been identified as having potential to interact with aspects of marine fish and fish habitat: (1) noise, (2) air emissions, and (3) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.1-22).

Noise

There are potential interactions between noise and the juvenile and adult life history stages of fishes during decommissioning (Table 6.1-22) but compared to marine construction, underwater noise produced during decommissioning will be considerably less. Mitigations intended to reduce the *negative* effects of noise on marine fish and fish habitat will be detailed in the Decommissioning Environmental Protection Plan (EPP). Candidate mitigations for exposure to noise caused by marine decommissioning include the minimization of noise production (Table 6.1-23) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential *negative* effects of decommissioning noise on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of exposure to noise on marine fish and fish habitat are *negligible to low*, *<1 km^2*, and *<12 months*, respectively (Table 6.1-23). Based on these criteria ratings, the residual effects of underwater noise associated with marine activities during the decommission phase on marine fish and fish habitat are *insignificant* (Table 6.1-24).

Air Emissions

Air emissions from equipment and marine vessels during the marine decommissioning phase could potentially have some *negative* contaminating effects on marine fish and fish habitat (Table 6.1-22). However, air emissions during marine decommissioning will be minimal compared to the other phases. Mitigations intended to reduce the *negative* effects of air emissions on marine fish and fish habitat will be detailed in the Decommissioning Environmental Protection Plan (EPP). Candidate mitigations for this activity include equipment maintenance (Table 6.1-23) but these measures will be finalized in the EPP. Regardless of the possibility of air emissions during the marine decommissioning phase, appropriate mitigation measures would minimize the potential effects of this activity on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of air emissions on marine fish and fish habitat are *negligible to low*, *<1 km²*, and *<12 months* respectively (Table 6.1-23). Based on these criteria ratings, the residual effects of air emissions associated with marine decommissioning on marine fish and fish habitat are *insignificant* (Table 6.1-24).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during marine-based decommissioning activities could potentially have *negative* effects on marine fish and fish habitat. Section 5.7 describes some of these potential effects. Mitigations intended to reduce the *negative* effects of marine-based accidental events on marine fish and fish habitat will be detailed in the Decommissioning Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.1-23) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on marine fish and fish habitat. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of marine-based accidental events on marine fish and fish habitat are *low to medium*, *<1 to 100 km²*, and *<1 to 12 months*, respectively (Table 6.1-23). Based on these criteria ratings, the residual effects of marine-based accidental events during decommissioning on marine fish and fish habitat are *insignificant* (Table 6.1-24).

Effects of Decommissioning

Considering the predicted *insignificant* residual effects of the routine activities and accidental events associated with both construction and operations activities on marine fish and fish habitat, it is reasonable to conclude that any residual effects of decommissioning activities on marine fish and fish habitat can also be predicted to be *insignificant*.

6.1.3.3 Residual Effects

As shown above, the Project residual effects on Marine Fish and Fish Habitat after mitigation is ***Insignificant*** for all phases of the project (construction, operation and decommissioning).

6.1.4 Commercial Fisheries

This subsection describes the baseline conditions of commercial fisheries as they relate to this EPR/EA. It also includes assessment of the potential effects of Project activities on commercial fisheries, including appropriate mitigations required to minimize these effects.

6.1.4.1 Baseline Conditions

The two primary sources of information on macroinvertebrates, fishes and commercial 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).

Commercial Landings Database

This section provides a description (qualification and quantification) of the commercial fisheries within the Study Area. In particular, it presents an analysis of harvesting data for the 1999 - 2008 fishing seasons, and describes expected fish harvesting activities in the Study Area in the foreseeable future. In relation to regional fishing management areas, the Study Area falls within North Atlantic Fisheries Organization (NAFO) Unit Area 3Psc.

Information and Data Sources

The fisheries data analyses use Department of Fisheries and Ocean's (DFO) Newfoundland Region (Newfoundland and Labrador), Maritimes Region (New Brunswick and Nova Scotia Atlantic coasts), Gulf Region (Prince Edward Island, and New Brunswick and Nova Scotia Gulf coasts) and Quebec (Gulf and St. Lawrence River) georeferenced catch and effort datasets. The DFO datasets record domestic harvest and foreign harvest landed in Canada.

The time period used for analyses was 1999 to 2008. Landings data for 2009 were not available at the time of writing. It should be noted that the last three years of commercial fisheries landings data (i.e. 2006 to 2008) are still classified as preliminary by DFO though the species data in this report are not likely to change to any significant extent when the data are finalized. The most recent data were accessed in October 2009.

Georeferencing by latitude and longitude allows the mapping of specific harvesting locations. The DFO data are georeferenced in two ways: by latitude and longitude (degrees and minutes) of the gear set location, and by the Unit Area in which the catch was harvested. Areas farther from shore, fished generally by larger boats, tend to have a greater proportion of their catch georeferenced, while those closer to shore have less. For example, in 2008, roughly 24% of catches were georeferenced in Unit Area 3Psc (Placentia Bay) while close to 99% of catches were georeferenced in Unit Area 3Psf, which is located to the south and further offshore. Also, certain inshore species (e.g., lobster) are not thus georeferenced, while the GPS coordinates of the harvesting locations of deeper water species (e.g., snow crab) are usually reported. While the harvest that carries the latitude and longitude information may be variable (24% by weight for all of Unit Area 3Psc in 2008), virtually all the data carries a Unit Area designation.

The Unit Area designation allows all the harvesting data to be tabulated according to these fisheries management sub-zones. The Study Area incorporates the portion of Unit Area 3Psc that occurs west of 54.75°W (Figure 6.1-21) and this part was used in the Study Area Unit Area analysis for this report. The georeferenced harvesting locations occurring east of 54.75°W in Unit Area 3Psc were omitted from fisheries data analysis.

The maps in the sections that follow show harvesting locations, based on the latitude and longitude (lat/long) data, as dark points. The points are not "weighted" by quantity of harvest, but show where fishing effort was recorded. Such location information data is typically groundtruthed through consultations with fishers and other stakeholders and has proven, in past assessments, to be particularly useful for petroleum industry operators in understanding the likely location of gear concentrations and timing of fisheries in order to eliminate or minimize potential mutual interference.

<u>Commercial Fisheries Overview</u>

The 1999 – 2008 commercial harvests recorded from within the Study Area are shown in Table 6.1-25.

As indicated, the principal fisheries (by quantity of harvest) are snow crab (52.2%), Atlantic cod (24.0%), Atlantic herring (8.5%), witch flounder (2.5%), American plaice (2.3%), Icelandic scallop (2.1%), northern shrimp (1.4%), redfish (1.3%), and lumpfish (1.1%). As Table 6.1.25 shows, some species are harvested on an annual basis (e.g., snow crab, Atlantic cod, and American plaice) while catches of other species appear to be sporadic (e.g., Atlantic herring, witch flounder, northern shrimp, and redfish). Figure 6.1-21 shows the georeferenced harvesting locations within the Study Area for all species, all months, for 1999 – 2008 combined.

As the map indicates, the harvest locations are distributed throughout the Study Area, including within and near the mouth of Great St. Lawrence Harbour.

Harvest Timing

Timing of harvesting within the Study Area was highest during June and July and lowest from December to March (Figure 6.1-22). The timing of harvests can vary from year to year with resource availability, fisheries management plans, and enterprise harvesting strategies. As shown in Table 6.1-26, the harvest timing also depends on the target species.

Table 6.1-25: Study Area Quantity of Harvest by Species, All Months, 1999 – 2008.

Species	Catch Weight (t)												
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	Total	Average	%Total
Snow crab	793.4	892.2	304.5	227.5	1.1	37.7	34.3	25.1	17.8	33.0	2,366.7	236.7	52.2%
Atlantic cod	105.7	111.0	210.2	136.4	84.0	144.2	75.7	56.7	64.7	102.1	1,090.8	109.1	24.0%
Atlantic herring	0.0	0.0	48.0	0.0	288.5	0.0	0.0	0.0	47.1	0.0	383.5	38.4	8.5%
Witch flounder (greysole)	0.0	0.0	0.0	15.3	95.8	0.0	0.0	0.0	0.0	0.0	111.2	11.1	2.5%
American plaice	2.5	3.2	27.6	14.4	10.0	12.1	7.3	11.1	11.0	7.4	106.5	10.7	2.3%
Icelandic scallop	37.2	20.3	22.0	1.6	2.8	3.2	3.7	2.6	0.0	0.0	93.4	9.3	2.1%
Northern shrimp	0.0	7.1	0.0	0.6	53.9	0.3	0.0	0.0	0.0	0.0	62.0	6.2	1.4%
Redfish	0.0	0.3	0.1	0.2	32.8	0.0	0.0	26.6	0.0	0.0	60.0	6.0	1.3%
Lumpfish roe	9.5	11.8	4.3	0.1	8.1	8.2	5.1	1.5	0.6	0.4	49.6	5.0	1.1%
Sea scallop	0.0	0.2	0.3	0.0	41.3	0.0	0.4	0.0	0.0	0.0	42.2	4.2	0.9%
Whelk	0.0	0.0	0.0	0.0	0.0	15.6	4.7	17.3	0.0	3.6	41.3	4.1	0.9%
Skate	0.5	8.7	1.5	0.6	8.7	1.9	1.7	5.0	1.1	2.3	32.0	3.2	0.7%
Atlantic mackerel	0.0	0.0	0.0	0.0	17.7	0.0	2.3	0.0	0.0	0.0	19.9	2.0	0.4%
White hake	0.0	0.0	0.5	0.5	12.1	0.0	3.5	0.0	0.1	0.0	16.8	1.7	0.4%
Greenland halibut (turbot)	0.0	0.1	0.0	0.0	14.9	0.1	0.0	0.0	0.0	1.6	16.7	1.7	0.4%
Haddock	0.0	0.1	0.0	0.2	10.3	0.0	0.1	0.0	0.5	0.0	11.2	1.1	0.2%
Winter flounder	0.0	3.6	0.3	1.2	0.1	0.1	0.3	0.2	0.9	3.3	10.0	1.0	0.2%
Atlantic halibut	0.0	0.1	0.0	0.0	5.4	0.0	0.1	0.1	0.1	0.1	5.9	0.6	0.1%
Monkfish	0.0	0.1	0.0	0.1	3.1	0.0	0.2	2.1	0.1	0.0	5.6	0.6	0.1%
Pollock	0.0	0.0	0.6	1.1	1.1	0.2	0.0	0.1	1.3	0.0	4.5	0.4	0.1%
Wolffish (catfish)	0.1	2.0	0.7	0.0	0.4	0.0	0.0	0.0	0.0	0.0	3.2	0.3	0.1%
All Others	0.0	1.2	0.6	1.0	0.1	0.2	0.1	0.0	0.0	0.1	3.2	0.3	0.1%
TOTAL	**949.1**	**1,062.0**	**621.4**	**400.8**	**692.0**	**223.8**	**139.4**	**148.5**	**145.1**	**154.1**	**4,536.1**	**453.6**	**100.0%**

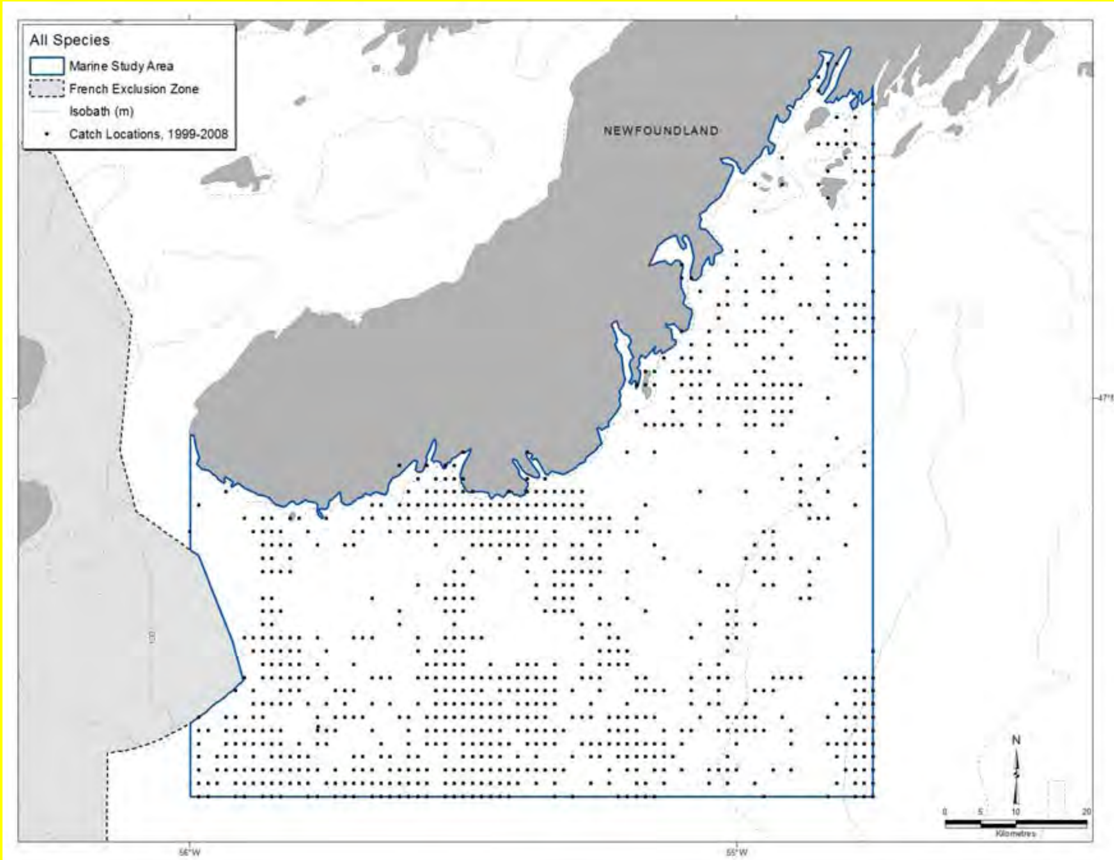

Figure 6.1-21: All Species: Study Area Harvesting Locations, All Species, Months, 1998 – 2008 Combined.

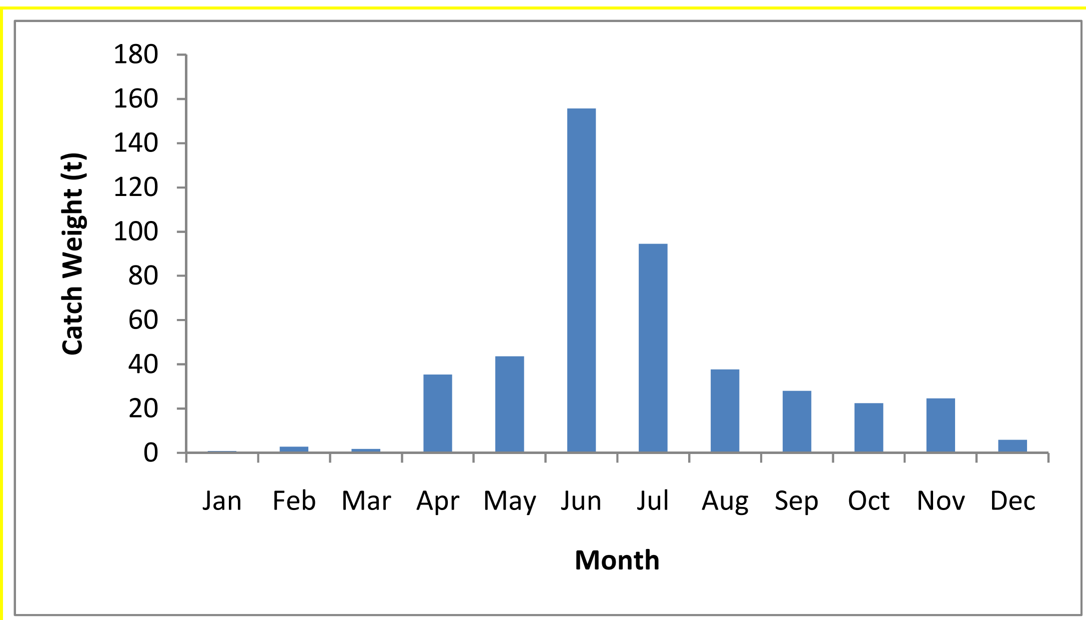

Figure 6.1-22: Study Area Quantity of Harvest by Month for Principal Species, 1999 – 2008 Aggregated.

Table 6.1-26: Target Species Harvest Times

Species	Catch Weight (t)											
	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Atlantic cod	7.9	12.0	1.1	0.0	10.6	177.1	244.9	98.1	160.7	133.3	200.2	44.9
Snow crab	0.0	0.0	0.0	47.2	253.0	1287.2	545.9	141.2	28.1	46.6	17.3	0.0
Atlantic herring	0.0	0.0	0.0	298.0	85.5	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Witch flounder (greysole)	0.0	0.0	0.0	0.0	6.4	12.1	18.4	15.0	21.3	23.8	14.1	0.0
American plaice	0.0	0.0	0.0	0.0	10.8	32.4	34.4	16.7	4.5	4.2	3.1	0.4
Icelandic scallop	0.1	7.1	17.5	8.9	18.1	7.7	6.3	7.0	4.1	0.9	3.4	12.4
Northern shrimp	0.0	0.0	0.0	0.2	0.0	2.8	11.2	26.2	16.4	4.4	0.4	0.2
Redfish	0.6	6.7	0.2	0.0	0.0	0.5	19.4	18.6	9.9	1.8	1.7	0.6
Lumpfish roe	0.0	0.0	0.0	0.0	40.0	9.6	0.0	0.0	0.0	0.0	0.0	0.0

Fishing Gear

From 1999 – 2008, the majority of fishing gear used within the Study Area was fixed gear. Crab pots for snow crab and gillnets for groundfish made up nearly 77% of the harvesting gear, by quantity of catch (Table 6.1-27). Longlines and trap nets made up a further 6% of the harvesting gear. The mobile gears used in the Study Area, ranging from 0.4% to 6.9% in terms of harvest quantity, are seines (beach and bar, Danish, purse), dredges, trawls (bottom otter trawl, shrimp), and handlines.

In general, the fixed gears (crab pots and gillnets) have a much greater potential for interacting with marine activities than mobile gears since the former are hard to detect when there is no fishing nearby. Furthermore, fixed gears may be set out over long distances in the water.

Figures 6.1-22 and 6.1-23 show the locations of fixed and mobile gear harvesting locations during 1999 – 2008 aggregated.

Table 6.1-27: Study Area Quantity of Harvest by Fishing Gear, 1999 – 2008 Averaged.

Gear	Catch Weight (t)	
	Average	% Average
Fixed Gear		
Pot	240.9	53.1%
Gillnet (set or fixed)	106.7	23.5%
Longline	19.5	4.3%
Trap net	7.3	1.6%
Mobile Gear		
Beach and Bar Seine	31.3	6.9%

Gear	Catch Weight (t)	
	Average	% Average
Fixed Gear		
Danish Seine	13.7	3.0%
Dredge - boat	13.6	3.0%
Bottom otter trawl - stern	6.4	1.4%
Handline - baited	6.3	1.4%
Shrimp beam trawl	6.2	1.4%
Purse Seine	1.8	0.4%
Total	**453.6**	**100.0%**

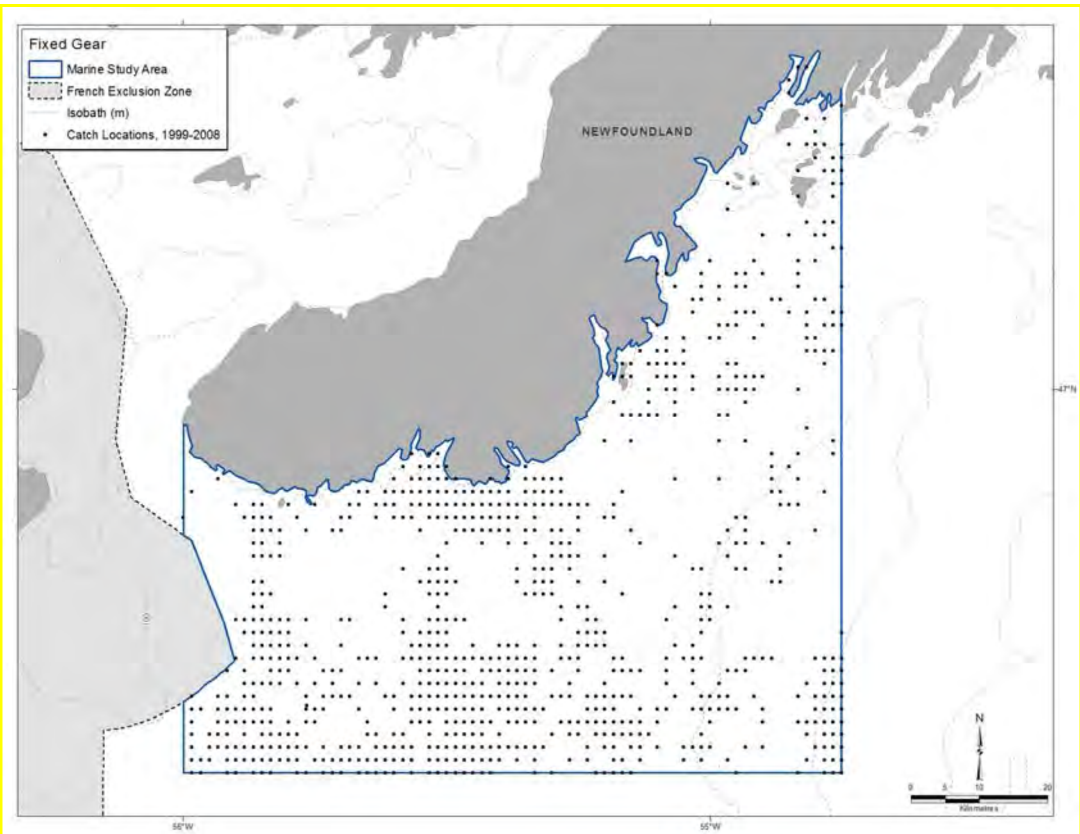

Figure 6.1-23: Fixed Gear Harvesting Locations, 1999 – 2008 Aggregated

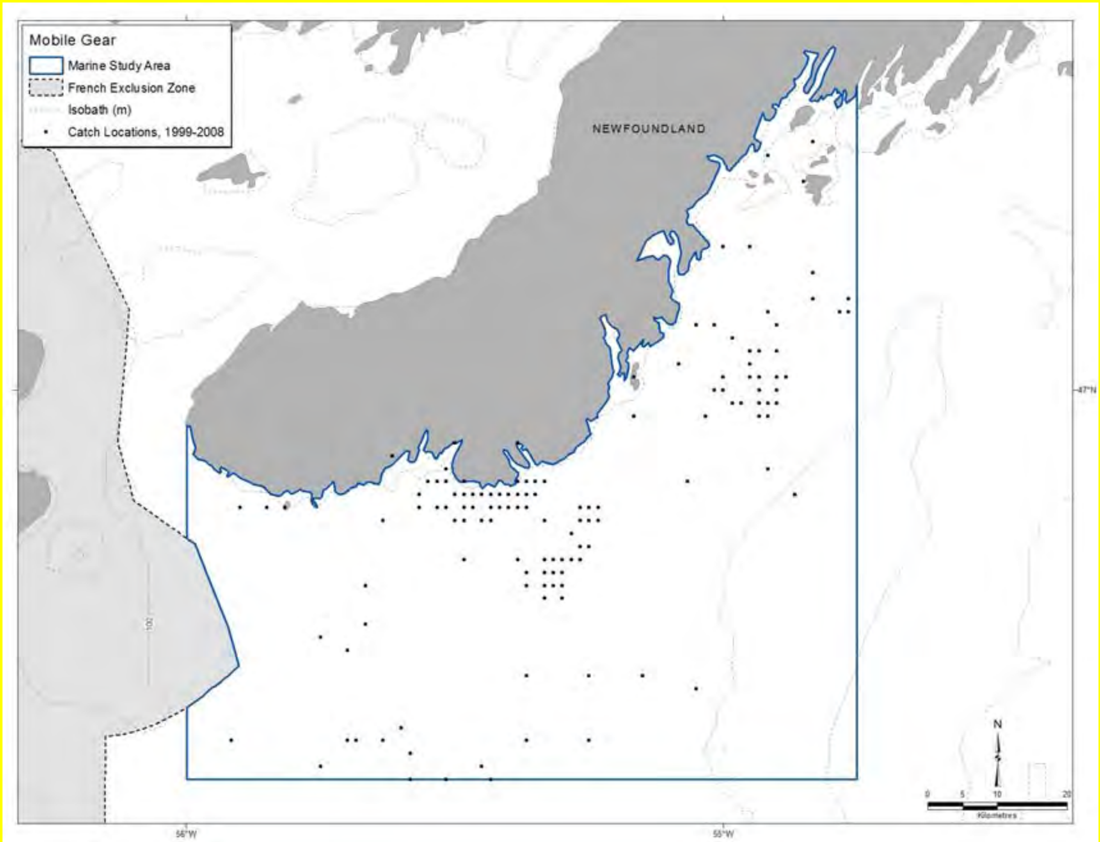

Figure 6.1-24: Mobile Gear Harvesting Locations, 1999 – 2008 Aggregated

<u>Principal Fisheries</u>

Information pertaining to catch locations, harvest timing, and fishing gears is provided for each principal species, if available. The catch locations of some species (Atlantic herring, witch flounder, redfish, northern shrimp) are not displayed graphically because georeferenced data was limited. Profiles describing important biological and ecological information are provided earlier in this subsection.

Snow Crab

Snow crab was the predominant species harvested in the Study Area from 1999 to 2008 though catches have declined recently over the ten year period examined (Table 6.1-25). According to Figure 6.1-24, the majority of georeferenced catch locations occur in the southern part of the Study Area. Snow crab was largely harvested between April and November with a peak catch in June (Table 6.1-27). The species was solely harvested with crab pots.

Crab harvesters use fleets of conical baited traps and the minimum legal size is 95 mm CW. The legal size excludes females and ensures a portion of the population of adult males will be available for reproduction (DFO 2005). In NAFO Subdivision 3Ps, the landings from offshore areas have been about twice as high as those from inshore areas in recent years (DFO 2009b). In inshore areas of 3Ps, landings doubled from 660 t in 2005 to 1,350 t in 2008, following an 80% decline since 2002 (DFO 2009b). In the St. Lawrence Harbour area, snow crabs are generally harvested 2 to 3 miles, or approximately 3 to 5 km, outside the harbour (E. Jarvis, pers. comm. 2009). Crab pots are fished at depths ranging from 99 to 180 m from May to September (DFO 2009c). Crab vessel traffic is relatively high in Great St. Lawrence Harbour, particularly the eastern side, because the area is home to the Supplementary Crab Fleet during the fishing season (E. Jarvis, pers. comm. 2009).

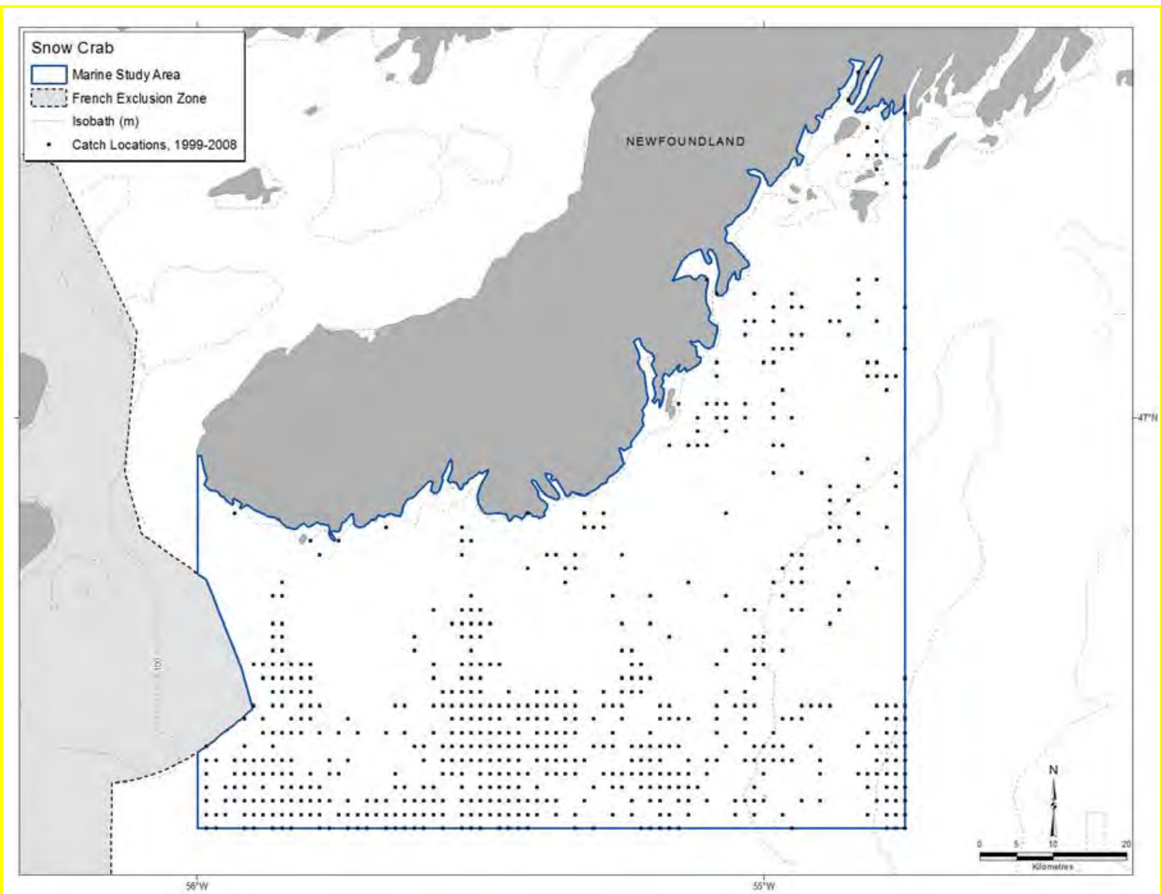

Figure 6.1-25: Snow Crab Harvesting Locations, 1999 – 2008 Aggregated

Atlantic cod

On average, Atlantic cod catches accounted for a little over 109 t annually from 1999 to 2008 (Table 6.1-25). The groundfish was largely harvested within a few kilometers off shore, with some catches occurring near the mouth of Great St. Lawrence Harbour (Figure 6.1-26). Within the Study Area, Atlantic cod have been harvested in all months, except April, with the majority of the harvest occurring from June and November (Table 6.1-27). Atlantic cod was largely caught with gillnets and longlines, and to a lesser extent, hand lines, bottom trawls, and Danish seine.

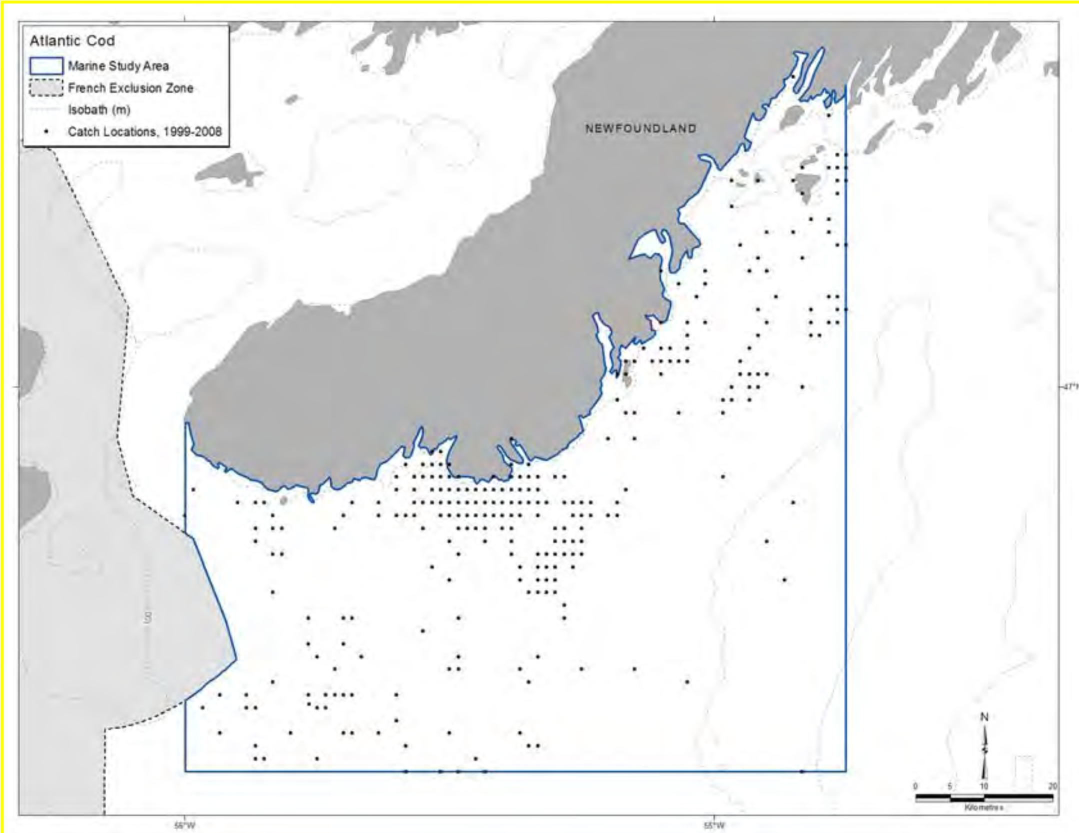

Figure 6.1-26: Atlantic Cod Harvesting Locations, 1999 – 2008 Aggregated

Atlantic herring

Based on overall catch harvest by quantity of weight, Atlantic herring was the third largest species caught over the ten year period examined despite annual catches being very sporadic (Table 6.1-25). A limited number of georeferenced harvest locations were available in the DFO commercial landings data for 1999 to 2008; however, those that were reported all occurred north of 47°N. According to Table 6.1-27, Atlantic herring were typically harvested in April and May. Harvests were largely made with beach and bar seine and, to a lesser extent, trap net.

Witch flounder

Witch flounder comprised 2.5% of the overall catch from 1999 to 2008 within the Study Area (Table 6.1-25). Like Atlantic herring, witch flounder catches have been sporadic over the ten year period with the last reported georeferenced catch occurring in 2003. A limited number of georeferenced harvest locations were available in the DFO commercial landings data for 1999 to 2008; however, those that were reported indicated no catches occurred near Great St. Lawrence Harbour. Witch flounder were predominately harvested with Danish seines between May and November within the Study Area (Table 6.1-27). A negligible amount was also caught with gillnets.

American plaice

American plaice was harvested on an annual basis from 1999 to 2008 within the Study Area and comprised 2.3% of the overall catch (Table 6.1-25). Like Atlantic cod, American plaice was largely harvested within a few kilometers of shore with some catches occurring near the mouth of Great St. Lawrence Harbour (Figure 6.1-27). Generally harvested from May to December with a peak in June and July (Table 6.1-27), the groundfish was largely targeted with gillnets. Small amounts were also caught with longlines, hand lines, and Danish seines.

Icelandic scallop

The Icelandic scallop comprised 2.1% of the overall commercial harvest within the Study Area from 1999 to 2008; however, no catches occurred in 2007 or 2008 (Table 6.1-25). The aggregated catch locations for Icelandic scallop are shown in Figure 6.1-28. Catches were year-round with peaks occurring in March and May (Table 6.1-27). Scallops were harvested solely with dredges deployed from boats.

Northern shrimp

From 1999 to 2004, northern shrimp catches have ranged from 0 t to nearly 54 t within the Study Area; however, since 2005, no catches have been reported (Table 6.1-25). When harvested in the Study Area, catches were generally from June to October with small harvests occurring in November, December, and April (Table 6.1-27). Shrimp beam trawl was the sole gear type used to harvest shrimp in the Study Area.

Redfish

Comprising 1.3% of the overall catch in the Study Area, the harvest of redfish has been sporadic and ranged from 0 t to 32.8 t from 1999 to 2008 (Table 6.1-25). A limited number of georeferenced harvest locations were available in the DFO commercial landings data for 1999 to 2008. When targeted, redfish were harvested nearly year-round, except for April and May (Table 6.1-27). Like some other groundfish in the Study Area, redfish were exploited using a variety of fishing gears, including bottom trawls and gillnets and, to a lesser extent, longlines, Danish seines, and pots.

Lumpfish

The roe of lumpfish was harvested on an annual basis within the Study Area form 1999 to 2008 and ranged from 0.1 t to 11.8 t (Table 6.1-25). According to Figure 6.1-29, the majority of lumpfish were caught in nearshore waters south of Great St. Lawrence Harbour. The species is largely harvested in May and June with gillnet (Table 6.1-27).

Lobster

The lobster fishery in Newfoundland is localized and prosecuted from small open boats during an 8 to 10 week spring fishing season (DFO 2009a). Traps are set close to shore, generally at depths less than 20 m (DFO 2009a). Restrictive licensing and trap limits control fishing effort and stocks are currently assessed every three years. The Project Area occurs within Lobster Fishing Area (LFA) 10.

In the St. Lawrence area, the lobster fishery occurs from April to June with traps generally fished along the shoreline at depths ranging from roughly 4 to 36 m (DFO 2009c). There are currently two active lobster licenses in the Great St. Lawrence Harbour area with one fisherman setting approximately 20 to 30 lobster pots in the vicinity of Blue Beach, most notably along the western corner of Blue Beach Cove (E. Jarvis, pers. comm. 2009).

Lobster catch locations are not georeferenced, so catch distribution mapping based on the DFO commercial fishery landings database is not possible.

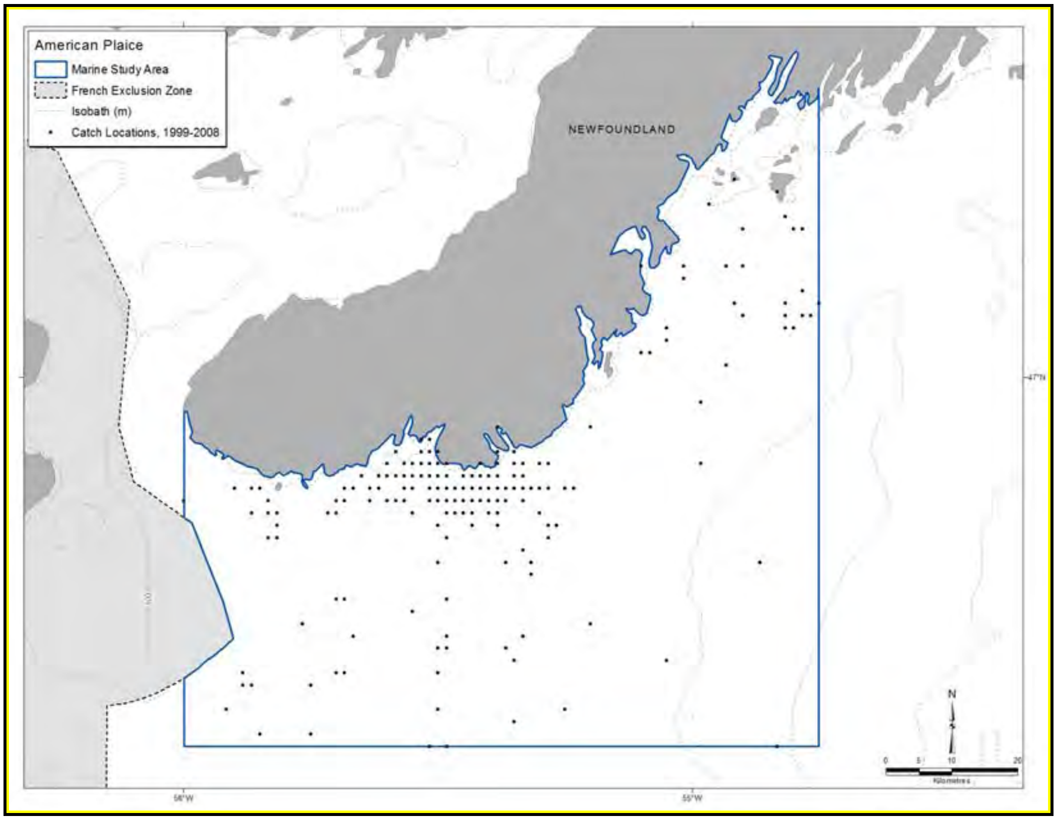

Figure 6.1-27: American plaice Harvesting Locations, 1999 – 2008 Aggregated

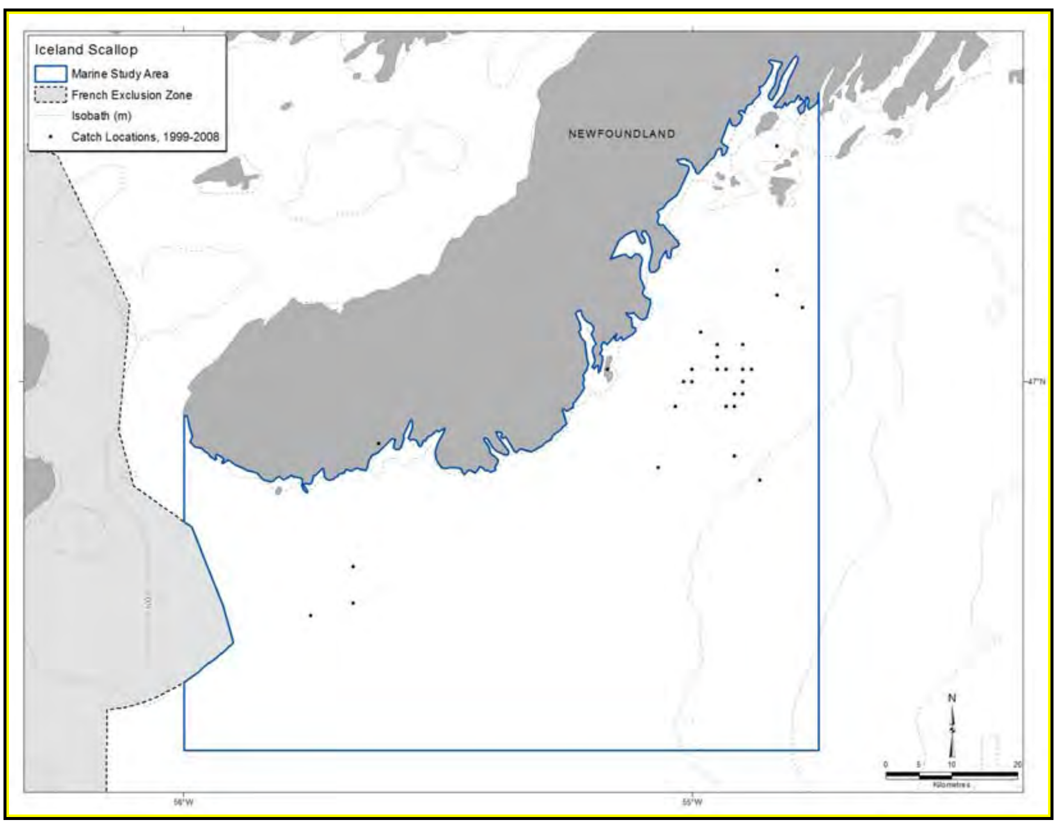

Figure 6.1-28: Icelandic Scallop Harvesting Locations, 1999 – 2008 Aggregated

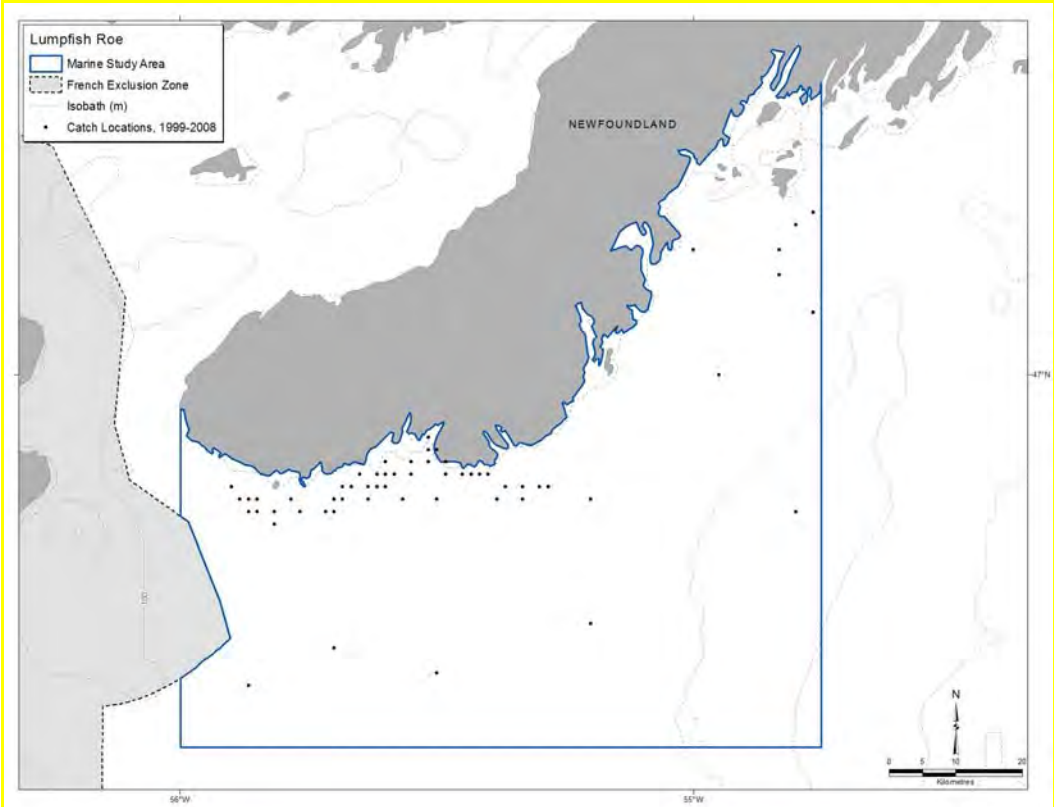

Figure 6.1-29: Lumpfish Harvesting Locations, 1999 – 2008 Aggregated

Local Ecological Knowledge

In addition to DFO commercial landings data, local ecological knowledge (LEK) 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 (DFO 2000). 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 were 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 (DFO 2009c). 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 (Figure 6.1-29).

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, crab) occur (or have occurred) within or near Great St. Lawrence Harbour. These fisheries are summarized in Table 6.1-28.

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.

Figure 6.1-30: Area Assessed for Community-Based Coastal Resource Inventory for the St. Lawrence Area (map generated using DFO GeoBrowser v5.0)

Table 6.1-28: Fisheries Resources Located within Great St. Lawrence Harbour Based on the Burin Peninsula Community-Based Coastal Resource Inventory and Consultation with Fishermen.

Species	Fishery Type	Season	Depth Fished (m)	Gear Type	Location
Atlantic mackerel	Bait	August-September	18	Mackerel nets	Great St. Lawrence Harbour
Atlantic herring	Bait	January-April	9 – 36	Seine nets, gillnets	Great St. Lawrence Harbour
Capelin	Observed	June	9 – 27	Seine, dip nets, buckets	Great St. Lawrence Harbour, including Blue Beach Cove
Atlantic cod	Commercial	June – October	27 – 90	Gillnets, cod trap, hook and line, trawl	South of Great St. Lawrence Harbour
Lumpfish	Commercial	May – June	11 – 45	Lump nets	Outside of Great St. Lawrence Harbour
Flounder	Commercial	May – October	90 – 108	Nets, hook and line	South of Lawn Point East to Ferryland Head
Squid	Recreational	August – September	4 – 18	Hook and line	Great St. Lawrence Harbour
Snow crab	Commercial	May – September	99 – 180	Crab pots	2-3 miles (3-5 km) outside of Great St. Lawrence Harbour
American lobster	Commercial	April – June	4 – 36	Lobster pots	West shore of Great St. Lawrence Harbour, including Blue Beach Cove

6.1.4.2 Commercial Fishery Effects Assessment

The commercial fishery is a component of the Fish and Fish Habitat VEC. Most potential for Project effects on commercial fisheries in the Study Area relates to marine-associated Project activities, including wharf construction (see Section 5.2.2), discharge of marine effluent, and marine operation (see Section 5.2.3).

<u>Existing Conditions</u>

The existing commercial fisheries in the Study Area are described in detail in previous subsection (Section 6.1.4.1). While commercial catches are relatively low in the immediate vicinity of Greater St. Lawrence Harbour (i.e., Project Area), there is considerable activity in the Study Area, including in waters off of Greater St. Lawrence Harbour. A considerable amount of fixed gear is used in the Study Area.

<u>Assessment Criteria</u>

Assessment criteria, including boundaries, are described in Section 4.4. *Significant* environmental effects are those considered to be of sufficient magnitude, duration, frequency, geographic extent, and/or reversibility to cause a change in the commercial fishery component of the Fish and Fish Habitat VEC that will alter its status or integrity beyond an acceptable level. Establishment of the criteria is based on professional judgment, but is transparent and repeatable.

In this EPR/EA, a *significant* effect is defined as ***one having a medium or high magnitude, duration greater than one year, and geographic extent greater than 100*** km^2***.***

Reversibility of the effect is also an important consideration.

<u>Issues and Concerns</u>

Three primary concerns are associated with the potential interactions between routine activities of the three phases of the Project and the commercial fishery:

1. Loss and/or alteration of commercial marine fish habitat;
2. Characterization of effluent discharged into the marine environment that may affect fisheries; and

3. Conflict between fishing gear and marine vessels.

The commercial fishery component could potentially interact with a variety of routine activities associated with the Construction, Operation, and Decommissioning phases of the Project. There are three primary marine works activities that could interact with the commercial fishery:

1. Wharf construction in Blue Beach Cove;
2. Discharge of effluent into Shoal Cove; and
3. Marine vessel traffic associated with the Project

Accidental events (e.g., hydrocarbon release, fluorspar spill, structural failures) could also occur during all three phases of the Project and they too will be considered.

The potential effects of both routine Project activities and accidental events on the commercial fishery are assessed in the following sections.

Effects of Land-based Activities

During land-based construction, operations and decommissioning, three activities have been identified as having potential to interact with all aspects of marine fish and fish habitat. They include (1) run-off/siltation, (2) air emissions, including dust, and (3) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Section 5.10-1). All of these interactions were assessed and the residual effects on marine fish and fish habitat were deemed to be *insignificant*. Based on this assessment, it is logical to conclude that the residual effects of land-based construction, operations and decommissioning activities on the commercial fishery in the Study Area are also *insignificant* and will not be discussed further.

Effects of Marine Construction

Potential interactions between marine construction routine activities/accidental events and the commercial fishery are shown in Table 6.1-29. Only those marine construction activities from the main interactions table (Section 5.10-1) that have reasonable likelihoods of interacting with commercial fishery component of the Fish and Fish Habitat VEC are considered in this section.

Table 6.1-29: Potential Interactions between Marine Construction Activities and the Commercial Fishery Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Commercial Fishery)	
Marine Construction Activities and Physical Works	**Commercial Fishery**
Wharf footprint	x
Noise	x
Solid waste/construction debris	x
Accidental events	x

During marine construction, four activities have been identified as having potential to interact with the commercial fishery (1) wharf footprint, (2) noise, (3) solid waste/construction debris, and (4) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.1-29).

Wharf Footprint

The wharf footprint has the potential to cover an area where commercial fishing has been conducted in the past. Local ecological knowledge has indicated that lobster fishing is conducted in Blue Beach Cove, albeit at a limited scale. Most of the habitat that will be covered by the wharf footprint is not prime lobster habitat so impact on lobster fishing is likely limited. However, the covering of a small area of lobster habitat will be a *negative* effect. The mitigation for habitat lost in the wharf footprint will be some type of compensation that produces an amount of marine habitat equal to the number of HEUs lost. Theoretically, the compensation works could provide new fishing grounds, perhaps for lobster, and thereby mitigate the *negative* effect of the wharf footprint on the commercial fishery. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of the wharf footprint on the commercial fishery are *negligible to low*, *<1* km^2, and *13 to 36 months*, respectively (Table 6.1-30). Based on these criteria ratings, the residual effects of the wharf footprint associated with marine construction on the commercial fishery are *insignificant* (Table 6.1-31).

Table 6.1-30: Effects Assessment of Marine Construction Activities on the Commercial Fishery Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Commercial Fishery)									
Project Activity	Potential Positive (P) or Negative (N) Environmental Effect	Possible Mitigation	Evaluation Criteria for Assessing Environmental Effects						
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/ Socio-Cultural and Economic Context
Marine Construction Activities and Physical Works									
Wharf footprint	Loss of fishing area (N)	Compensation	0-1	1	6	3	R	2
Noise	Temporary decreases in catch rates (N)	Use of bubble curtain; Communication with fishers	0-1	1	6	3	R	2
Solid waste/construction debris	Gear damage (N); Lost fishing time(N);	Proper handling of wastes and materials; Compensation for damaged gear	0-1	2-3	1	3	R	2
Accidental events	Tainting or perception of tainting (N); Effect on health of target species (N)	Preventative protocols; Response plans; Coompensation	1-2	1-3	1	1-2	R	2

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

<u>Noise</u>

As indicated in the assessment of marine fish and fish habitat (Section 6.1.3.2), the noise source during marine construction that has the most potential to *negatively* affect macroinvertebrates and finfishes is pile driving. Although there is some evidence that marine invertebrates and fishes in very close proximity to a source with a very high sound pressure level, it appears that exposure would still have to be prolonged before damage was caused to the animal. From a commercial fishery perspective, the most likely *negative* effect of underwater noise on the commercial fishery would involve causing a redistribution of the animals (i.e., behavioural effects) and perhaps temporarily affecting catch rates. Commercial fishery activity in the immediate area of Blue Beach Cove is very limited so effects of noise would also be very limited. Certain mitigations could be applied to lessen noise effects but it is more likely that fishers would avoid the construction area anyway. Therefore, the predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of marine construction noise on the commercial fishery are *negligible to low*, *<1 km²*, and *13 to 36 months*, respectively (Table 6.1-30). Based on these criteria ratings, the residual effects of marine construction noise on the commercial fishery are *insignificant* (Table 6.1-31).

Table 6.1-31: Significance of Potential Residual Environmental Effects of Marine Construction Activities on the Commercial Fishery Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Commercial Fishery)				
Project Activity	Significance of Predicted Residual Environmental Effects		Likelihood[a]	
	Significance Rating	Level of Confidence	Probability of Occurrence	Scientific Certainty
Marine Construction Activities and Physical Works				
Wharf footprint	NS	3	-	-
Marine traffic	NS	3	-	-
Noise	NS	3	-	-
Solid waste/construction debris	NS	3	-	-
Accidental events	NS	3	-	-

[a] **Only rated if residual environmental effect predicted to be significant**

Key:

Residual environmental Effect Rating:
S= Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P= Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km² (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

Solid Waste/Construction Debris

Debris associated with construction routine activities could potentially float into fixed gear and cause damage, thereby having negative effects on the commercial fishery. Appropriate precautions will be taken during construction to prevent the release of debris from onshore and marine sites. CFI will establish a compensation policy to address damage to fishing gear, equipment or vessels resulting from an interaction with Project-related marine activities. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of solid waste/construction debris on the commercial fishery are negligible to low, 1 to 100 km^2, and 13 to 36 months, respectively (Table 6.1-30). Based on these criteria ratings, the residual effects of marine construction solid waste and debris on the commercial fishery are insignificant (Table 6.1-31).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during marine-based construction activities could potentially have negative effects on the commercial fishery. As indicated in Table CF-2, possible effects of accidental events on the commercial fishery include effect on the health of target species and either actual or perceived tainting of the species fished commercially. Mitigations intended to reduce the negative effects of marine-based accidental events on the commercial fishery will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols, rapid response plans, and compensation to fishers for lost product (Table 6.1-30) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on the commercial fishery. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine-based accidental events on the commercial fishery are low to medium, <1 to 100 km^2, and <1 to 12 months, respectively (Table 6.1-30). Based on these criteria ratings, the residual effects of marine-based accidental events during construction on marine fish and fish habitat are insignificant (Table 6.1-31).

Effects of Marine Operations

Potential interactions between marine operations routine activities/accidental events and the commercial fishery are shown in Table 6.1-32. Only those marine construction activities from the main interactions table (Section 5.10-1) that have reasonable likelihoods of interacting with the commercial fishery component of the Fish and Fish Habitat VEC are considered in this section.

During marine operations, four activities have been identified as having potential to interact with the commercial fishery (1) marine traffic, (2) marine effluent, (3) vessel loading, and (4) accidental events (e.g., hydrocarbon and non-hydrocarbon releases, including large fluorspar spills at the wharf) (Table 6.1-32).

Table 6.1-32: Potential Interactions between Marine Operations Activities and the Commercial Fishery Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Commercial Fishery)	
Marine Operations Activities and Physical Works	**Commercial Fishery**
Marine traffic	x
Marine effluent	x
Vessel loading	x
Accidental events	x

Marine Traffic

Project-related marine vessels will be sailing to and from Greater St. Lawrence Harbour during the operations phase. The primary potential impact of marine vessel movement on the commercial fishery relates to damage to fixed fishing gear and perhaps even fishing vessels. Mitigations intended to reduce the *negative* effects of marine traffic on the commercial fishery will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for gear-marine vessel conflict include open communication between fishers and CFI, and a compensation policy to address damage to fishing gear, equipment or vessel (Table 6.1-33) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential *negative* effects of marine traffic on the commercial fishery. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of marine traffic on the commercial fishery are *low*, *11 to 100* km^2, and *>72 months*, respectively (Table 6.1-34). Based on these criteria ratings, the residual effects of siltation associated with marine construction on marine fish and fish habitat are *insignificant* (Table 6.1-35).

Marine Effluent

The chemical characterization of the marine effluent that will be discharged in Shoal Cove is not yet available; however the effluent will meet all regulatory requirements. Total suspended solids rather than chemical contamination would be the most likely parameter to have potential *negative* effects on the fish and fish habitat, and thus the commercial fishery. Mitigations intended to reduce the *negative* effects of marine effluent on the commercial fishery will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for the discharge of marine effluent include monitoring and treatment of the tailings pore water (Table 6.1-33) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential *negative* effects of marine effluent on the commercial fishery. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of marine effluent on the commercial fishery are *negligible to low*, *<1 km²*, and *>72 months*, respectively (Table 6.1-33). Based on these criteria ratings, the residual effects of marine effluent on the commercial fishery are *insignificant* (Table 6.1-34).

Table 6.1-33: Effects Assessment of Marine Operations Activities on the Commercial Fishery Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Commercial Fishery)								
Project Activity	**Potential Positive (P) or Negative (N) Environmental Effect**	**Possible Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**					
			Magnitude	**Geographic Extent**	**Frequency**	**Duration**	**Reversibility**	**Ecological/ Socio-Cultural and Economic Context**
Marine Operations Activities and Physical Works								
Marine traffic	Gear/vessel damage (N); Lost fishing time(N);	Gear/vessel compensation plan Good communication	1	3	2	5	R	2
Marine effluent	Increased total suspended solids (N); Contamination (N)	Treatment and compliance monitoring	0-1	1	6	5	R	2
Vessel loading	Contamination (N); Increased total suspended solids (N)	Enclosed conveyor system	0-1	1	2	5	R	2
Accidental events	Tainting or perception of tainting (N); Effect on health of target species (N)	Preventative protocols; Response plans;	1-2	1-2	1	5	R	2

Valued Ecosystem Component: Fish and Fish Habitat (Commercial Fishery)									
Project Activity	Potential Positive (P) or Negative (N) Environmental Effect	Possible Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/ Socio-Cultural and Economic Context
Marine Operations Activities and Physical Works								
		Compensation						

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Table 6.1-34: Significance of Potential Residual Environmental Effects of Marine Operations Activities on the Commercial Fishery Component of the Fish and Fish Habitat VEC

Valued Ecosystem Component: Fish and Fish Habitat (Commercial Fishery)				
Project Activity	Significance of Predicted Residual Environmental Effects		Likelihood[a]	
	Significance Rating	Level of Confidence	Probability of Occurrence	Scientific Certainty
Marine Operations Activities and Physical Works				
Marine traffic	NS	3	-	-
Marine effluent	NS	3	-	-
Vessel loading	NS	3	-	-
Accidental events	NS	3	-	-

[a] **Only rated if residual environmental effect predicted to be significant**

Key:

Residual environmental Effect Rating:
S= Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P= Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

Vessel Loading

Routine loading (e.g., fluorspar) and off-loading of marine vessels at the wharf could result in the incidental introduction of some material to the marine environment. Major spills are considered in the next section on accidental events. Material entering the marine environment could result in increased total suspended solids or even contamination, thereby potentially causing *negative* effects on the commercial fishery, albeit in an indirect way. Mitigations intended to reduce the *negative* effects of vessel loading on the commercial fishery will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for the discharge of marine effluent include enclosed conveyor systems (Table 6.1-33) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential *negative* effects of vessel loading on the commercial fishery. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of vessel loading on the commercial fishery are *negligible to low*, *<1 km^2*, and *>72 months*, respectively (Table 6.1-33). Based on these criteria ratings, the residual effects of vessel loading on the commercial fishery are *insignificant* (Table 6.1-34).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases (including major fluorspar spills at the wharf) during marine-based operations activities could potentially have *negative* effects on the commercial fishery. As indicated in Table 6.1-33, possible effects of accidental events on the commercial fishery include effect on the health of target species and either actual or perceived tainting of the species fished commercially. Mitigations intended to reduce the *negative* effects of marine-based accidental events on the commercial fishery will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols, rapid response plans, and compensation to fishers for any lost product (Table 6.1-33) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on the commercial fishery. The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of marine-based accidental events on the commercial fishery are *low to medium*, *<1 to 100 km²*, and *<1 to 12 months*, respectively (Table 6.1-33). Based on these criteria ratings, the residual effects of marine-based accidental events during operations on the commercial fishery are *insignificant* (Table 6.1-34).

Effects of Decommissioning

Considering the predicted *insignificant* residual effects of the routine activities of both marine construction and operations activities, the residual effects of decommissioning routine activities on the commercial fishery are predicted to also be *insignificant*.

6.1.5 Aquaculture

The aquaculture industry in Newfoundland and Labrador is currently focusing on the development of four species, including Atlantic cod, Atlantic salmon (*Salmo salar*), steelhead trout (*Oncorhynchus mykiss*), and blue mussels (*Mytilus edulis*) (DFA 2009). Aquaculture is a rapidly growing industry in Newfoundland and Labrador. In 2006, approximately 10,500 t of product, with a value of roughly $52.3 million, was produced compared to 1,750 t nearly a decade earlier. Aquaculture sites around the island are largely concentrated on the northeastern and southern coast.

There are currently no aquaculture developments in the St. Lawrence Harbour area.

6.1.5.1 Aquaculture Effects Assessment

Considering that the residual effects of the Project activities on both the marine fish and fish habitat and commercial fishery components of the Fish and Fish Habitat VEC are predicted to be *insignificant* (see Sections 6.1.3 and 6.1.4), it is justified to predict that the residual effects of the Project activities on the aquaculture component of the Fish and Fish Habitat VEC will also be *insignificant*. This is especially true given that the nearest aquaculture facilities are located in the northern portion of the Study Area, relatively distant from the Project Area.

6.2 MARINE TRAFFIC

6.2.1 Existing Shipping

6.2.1.1 St. Lawrence Harbour

Vessels that currently occupy and navigate the St. Lawrence Harbour are primarily used for commercial and recreational fishing activities. According to DFO 2004 statistics, St. Lawrence is a Class “A” harbour that served 26 enterprises operating from 28 vessels with total length of 245 m. Crab vessel traffic is relatively high in Great St. Lawrence Harbour, particularly the eastern side, because the area is home to the Supplementary Crab Fleet during the fishing season. A new marginal wharf was constructed in St. Lawrence Harbour in 2006/2007.

6.2.1.2 Outer Placentia Bay and the Atlantic Shipping Route

Various vessels pass through the waters of the Atlantic off the coast of the Burin peninsula as they continue west to the Gulf of St. Lawrence or down the Eastern Seaboard, or travel east across the Atlantic. These include crude tankers, product tankers, chemical tankers, ore ships, grain ships, general cargo, paper ships, reefer ships, container ships, passenger ships and fishing vessels. Many of these vessels pass by the south coast without entering the waters off the coast of Newfoundland. Others enter Placentia Bay en route to the North Atlantic Refinery or the Transshipment facility.

The South Coast Risk Assessment (Transport Canada, 2007) contains information regarding large ships that travel off the south coast of the province. Data is available for ships traveling in and out of Placentia Bay, St. John’s Harbour and those traveling to Trinity Bay en route to the Holyrood generating station, however specific information regarding the number of vessels in-transit that do not enter a designated port in

Newfoundland is not available. Any vessel that enters into the boundary of 12 nautical miles of the Newfoundland coast is required under ECAREG regulations to report to CCG marine traffic control, however vessels not entering this area are not required to do so. Therefore, shipping volume in this region cannot be accurately defined.

6.2.2 Anticipated Shipping Activity

The AG fluorspar concentrate production from the proposed operation is relatively small (at 120,000 to 180,000 t/yr). Vessels in the range of 10,000 – 20,000 DWT could easily accommodate this, however Canada Fluorspar (NL) Inc. proposes to construct the wharf to accommodate larger vessels (up to 65,000 DWT in size) to allow partially-loaded bulk carriers to "top up" with fluorspar concentrate. The proposed marine terminal will be situated at Blue Beach, in outer St Lawrence Harbour, as shown on Figure 5.1-19.

Approximately 15-20 shipments of fluorspar are anticipated per year from the CFI marine facility. In addition washed aggregate, a by-product from the fluorspar milling process may also be shipped from time to time. It should also be noted that neither fluorspar nor aggregate shipping falls under the *Transportation of Dangerous Goods Act*.

The proposed deep-water wharf consists of an armour stone, rock-filled causeway, which would likely terminate at rock-filled steel sheet pile cells interconnected by steel sheet pile arcs for an overall wharf length of approximately 126 m or rock-filled concrete caissons, as described in previous sections.

An intermediate concentrate storage building may be erected adjacent to the wharf. During times of loading, concentrate will be conveyed from this building along the wharf to a ship loader comprising a gantry tower (on rails) with a retractable conveyor. Alternatively, concentrate may be conveyed directly from the mill storage building to the gantry tower. A lay-down area will be constructed adjacent to the wharf causeway for by-product storage. Figure 5.1-19 indicates the proposed marine terminal, which will be a multi-user facility available to other businesses in the region.

6.2.3 Potential Impacts from Shipping

Shipping associated with Project operations is not anticipated to result in significant impacts to the area (e.g., fluorspar export would require approximately 15-20 ships per year of size 10,000 DWT). All marine fish habitat that may be impacted by Project activities have been evaluated in section 6.1 and appropriate mitigation measures will be developed in accordance with the requirement of the Fisheries Act. The potential impact of the project on the present fishing activities at the proposed marine terminal and also assessed and appropriate mitigation measures will be implemented.

Similarly Impacts of marine traffic on other biophysical Project VECs (fish, birds and SARA mammals) are described in sections 6.1.3, 6.1.4, 6.3 and 6.4.

Effect of Additional Marine Traffic

With the addition of 18-20 ships per year to the area, it is anticipated that the impact of the project shipping activities will be minor.

Aquatic Invasive Species

Alien invasive species are often introduced to an area by way of the transport of ballast water from one body of water to another, or by attaching to the hulls of marine vessels. In recent years, several such species have been introduced to the waters of other Atlantic provinces. The possibility of introduction of alien species to Placentia Bay is currently a concern.

Ballast is defined by Transport Canada as “any solid or liquid brought on board a vessel to increase the draft, change the trim, regulate the stability or to maintain stress loads within acceptable limits” (TC, 2007). With advances in technology, water has become the ballast of choice. Water is pumped into ballast tanks within the hull of the vessel and is later released once the ballast is no longer needed.

This system poses some level of risk, as aquatic species can make their way into the tanks of the vessel during the process of taking on water for ballast. These aquatic species may include bacteria, microbes, micro-algae, etc. The emptying of untreated ballast water at a later time may lead to the introduction of these species to areas in which they are not native. If the introduction of non-native species to an area has serious impacts on the ecosystem, environment, economy, and human health of the area, they are considered to be invasive species.

Invasive species have been known to cause negative and irreversible changes to local biodiversity and disrupt ecosystem balance. This can also have economic implications: millions of dollars have been spent in areas such as the Great Lakes and the province of Prince Edward Island in attempts to control the spread of invasive species.

Due to these risks, the Canadian government has implemented *Ballast Water Control and Management Regulations* to govern the exchange of ballast water by vessels in Canadian waters (TC, 2007). These regulations, which came into effect in December 2006, control the conditions under which the release of ballast water is permitted, as well as protocols that must be followed throughout the process.

There are several methods currently available to prevent the introduction of aquatic species to non-native ports, however mid-ocean exchange of ballast water appears to be the most accessible and cost effective method currently available.

Canada Fluorspar (NL) Inc. will institute measures to ensure vessels making use of the marine terminal practise proper ballast water management. These measures will support and comply with the *Canadian Ballast Water Control and Management Regulations* that govern the protection of waters under Canadian jurisdiction from non-indigenous aquatic organisms. These measures will be incorporated into the EPPs developed for various project phases.

6.3 MIGRATORY BIRDS

This subsection describes the baseline conditions of migratory birds as they relate to this EPR/EA. It also includes assessment of the potential effects of Project activities on migratory birds, including appropriate mitigations required to minimize the residual effects.

6.3.1 Baseline Conditions

6.3.1.1 Marine-associated Birds of Placentia Bay Area

The coastal area of St. Lawrence experiences high to moderate wave energy, and bounds the western mouth of the Placentia Bay area, an area rich in marine bird life. In summer, colonies of gannets, cormorants, alcids, gulls and terns nest along cliffs and on numerous islands, archipelagos and adjacent headlands of the Placentia Bay area. Shearwaters breed in the southern hemisphere, and migrate north to 'over-winter' in the summer of the northern hemisphere where they forage in pelagic waters and can be abundant in the inshore zone during inclement weather. In winter, significant populations of sea ducks occur in the near-shore waters, especially adjacent to the outer headlands and offshore islands.

Many marine-associated birds are pelagic and are observed inshore only in or following inclement conditions such as heavy fog and winds. More than 70 species of marine-associated birds regularly use the Placentia Bay area from the tidal zone to the offshore zone (Table 6.3-1).

Seabird breeding colonies are numerous on headlands and islands along the entire perimeter of the Placentia Bay area., four of which rank as Important Bird Areas (IBA), including Cape St. Mary's at the south-east corner of the Placentia Bay area, and Corbin Island, Middle Lawn Island and Green Island off the southern Burin Peninsula (Table 6.3-2). Cape St. Mary's supports the third largest Northern Gannet colony in North America (12,156 pairs), the third largest Common Murre colony in Newfoundland and Labrador (10,000 pairs), and the fifth largest Black-legged Kittiwake colony in Newfoundland and Labrador (10,000 pairs). Middle Lawn Island supports the only known active breeding colony of Manx Shearwater in North America (Robertson et al. 2002). A significant portion of the world population of Greater Shearwaters spends the summer months moulting on the Grand Banks, including the Placentia Bay area. An area in the south-eastern part of Placentia Bay has also been designated an IBA because of the large numbers of Greater Shearwaters (concentrations of up to 100,000) that feed there in summer.

Only Middle Lawn Island and Corbin Island occur within the Study Area, while Green Island is located immediately west of the Study Area. The Cape St. Mary's and Greater

Shearwater IBAs are located some distance from the Study Area in eastern Placentia Bay.

Table 6.3-1: List of Marine-associated Bird Species that occur in the Placentia Bay Area, Including Months of Known Occurrence (shaded cells).

Species	Abundance[1]	AOU[2]	Scientific Name	JAN	FEB	MAR	APR	MAY	JUN	JUL	AUG	SEP	OCT	NOV	DEC
Canada Goose	Uncommon	CAGO	*Branta canadensis*			■	■	■	■	■	■	■	■	■	■
Gadwall	Rare	GADW	*Anas strepera*	■	■	■						■	■	■	■
American Wigeon	Scarce	AMWI	*Anas americana*				■	■				■	■	■	
American Black Duck	Common	AMBL	*Anas rubripes*	■	■	■	■	■	■	■	■	■	■	■	■
Mallard	Scarce	MALL	*Anas platyrhynchos*	■	■	■	■	■				■	■	■	■
Blue-winged Teal	Scarce	BWTE	*Anas discors*				■	■			■	■	■		
Northern Pintail	Uncommon	NOPI	*Anas acuta*				■	■	■	■	■	■	■	■	
Green-winged Teal	Uncommon	AMGW	*Anas crecca*				■	■	■	■	■	■	■	■	■
Ring-necked Duck	Uncommon	RNDU	*Aythya collaris*				■	■	■	■	■	■	■		
Greater Scaup	Uncommon	GRSC	*Aythya marila*	■	■	■	■	■					■	■	■
Lesser Scaup	Scarce	LESC	*Aythya affinis*				■	■				■	■	■	■
King Eider	Scarce	KIEI	*Somateria spectabilis*	■	■	■	■	■					■	■	■
Common Eider	Common	COEI	*Somateria mollissima*	■	■	■	■	■				■	■	■	■
Harlequin Duck	Scarce	HARD	*Histrionicus histrionicus*	■	■	■	■					■	■	■	■
Surf Scoter	Uncommon	SUSC	*Melanitta perspicillata*	■	■	■	■	■	■	■	■	■	■	■	■
White-winged Scoter	Uncommon	WWSC	*Melanitta fusca*	■	■	■	■	■	■	■	■	■	■	■	■
Black Scoter	Uncommon	BLSC	*Melanitta nigra*	■	■	■	■					■	■	■	■
Long-tailed Duck	Common	LTDU	*Clangula hyemalis*	■	■	■	■						■	■	■

Bufflehead	Scarce	BUFF	*Bucephala albeola*												
Common Goldeneye	Uncommon	COGO	*Bucephala clangula*												
Barrow's Goldeneye	Rare	BAGO	*Bucephala islandica*												
Hooded Merganser	Rare	HOME	*Lophodytes cucullatus*												
Common Merganser	Uncommon	COME	*Mergus merganser*												
Red-breasted Merganser	Common	RBME	*Mergus serrator*												
Red-throated Loon	Uncommon	RTLO	*Gavia stellata*												
Common Loon	Common	COLO	*Gavia immer*												
Horned Grebe	Scarce	HOGR	*Podiceps auritus*												
Red-necked Grebe	Uncommon	RNGR	*Podiceps grisegena*												
Northern Fulmar	Common	NOFU	*Fulmarus glacialis*												

Notes:
Shaded Areas Represent the Months When Species May Be Expected
1 Rare – occurs rarely, usually not present monthly, may be less than annual.
Scarce – occurs in very low numbers, may be absent in some months.
Uncommon – occurs in low numbers in appropriate habitat and season.
Common – occurs in moderate numbers in appropriate habitat and season.
2 Acronyms for birds species used by the American Ornithologists Union.

Table 6.3-2: Number of Pairs of Breeding Marine-associated Birds at Important Bird Areas (IBA) of the Placentia Bay Area.

Marine-associated Bird Species	IBA			
	Cape St. Mary's, Avalon Peninsula	Middle Lawn Island, Burin Peninsula	Corbin Island, Burin Peninsula	Green Island, Burin Peninsula
Manx Shearwater	-	11 [4]		
Leach's Storm-Petrel	-	13,879 [3]	100,000[2]	65,280 [3]
Northern Gannet	12,156 [1]			
Black-legged Kittiwake	10,000 [2]		50[2]	
Common Murre	10,000 [2]			
Thick-billed Murre	1000 [2]			
Razorbill	100 [2]			
Black Guillemot	present	present	present	

Sources: 1 Chardine 2000; 2 IBA web site: www.bsc-eoc.org/iba/IBAsites.html ; 3 Robertson et al. 2002; 4 Robertson 2002

In winter, large numbers of Common Eiders occur at headlands, rocky islets and shoals in the Placentia Bay area, notably off the southern end of Burin Peninsula. The Burin Peninsula may be the eastern extent of wintering distribution of the southern race (*S. m. dresseri*), whereas further north and east is the southern extension of the northern race (*S. m. borealis*) which nests further north in the eastern Canadian Arctic (Goudie 1986, Goudie et al. 2000). Cape St. Mary's supports one of the largest known concentrations of wintering Harlequin Ducks in eastern North America.

In winter, few marine-associated birds remain in the Placentia Bay area compared to the larger numbers that breed in the general area, notably Black Guillemots that are scattered in small numbers. Murres (*Uria* spp.) are pelagic in winter, occurring on open water areas of the Placentia Bay area and Fortune Bay. Northern Gannets only occur in spring to fall whereas cormorants are present throughout the year. Great Cormorant (*Phalacrocorax carbo*) remain in the area during winter (Table 6.3-3).

Table 6.3-3: Total Numbers of Alcids, Gannets and Cormorants Observed by LGL during Aerial Surveys of the Placentia Bay Area, Winter/Spring 2007.

Date	Marine-associated Bird Species					
	Murre	Dovekie	Black Guillemot	Alcids	Northern Gannet	Great Cormorant
27/02/07	68	3	24			197
13/03/07	50	3	11			74
21/04/07			21	82	4	162

Offshore Marine-associated Birds

Procellariiformes (fulmars, shearwaters and storm-petrels)

Northern Fulmar is a common species of the north Atlantic. Large numbers breed in the eastern Arctic and occur in offshore Newfoundland in winter. However, relatively low numbers breed in eastern Newfoundland. Sub-adult Northern Fulmars remain in eastern Newfoundland waters through the summer. Northern Fulmar is expected to be present year-round in the Placentia Bay area, being less numerous in the summer months.

Three species of shearwater (Greater, Manx, Sooty) occur annually in the Placentia Bay area. The Manx Shearwater is the only species known to breed in the Placentia Bay area, and Middle Lawn Island off the southern Burin Peninsula contains the only known colony in North America. This European nesting species was discovered nesting at Middle Lawn Island in 1977. This satellite colony continues to maintain an existence. A census in 2000 resulted in totals of 11 active nests (Robertson et al. 2002). The large number of empty nesting burrows (102) and the estimated 360 birds attending the island are indications that environmental conditions for breeding success are not optimal. In 2006, there were 13 nests with eggs or chicks (G. Robertson, CWS, pers comm.). Greater Shearwater and Sooty Shearwater breed in the Southern Hemisphere and spend the summer months in the Northern Hemisphere. A significant portion of the global population migrates to Newfoundland waters and occurs there from May to October (Brown 1986; Lock et al. 1994). Counts of 100,000 Greater Shearwater and numerous Sooty Shearwaters have been recorded at the mouth of Placentia Bay (P. Linegar, pers. comm.). Concentrations of spawning capelin are an important food source for shearwaters while moulting flight feathers during June and July.

Leach's Storm Petrel is an abundant marine-associated bird in eastern Canada from April to October. More than three million pairs (greater than a third of the world's population breed on

Baccalieu Island) on the northeast Avalon Peninsula (Sklepkovych and Montevecchi 1989). Significant nesting colonies in the Placentia Bay area are located off the southern Burin Peninsula at Corbin Island (100,000 pairs), Middle Lawn Island (13,789 pairs) and Green Island (65,280 pairs) (Table 6.3-4) (Robertson et al. 2002). In addition, 100,000 pairs nest on Grand Colombier Island in the St. Pierre et Miquelon area (Cairns et al. 1989).

Table 6.3-4: Significant Leach's Storm-Petrel Breeding Colonies in the Placentia Bay Area.

Colony	Location	No. of Pairs	Census Year	Source
Corbin Island	46.97º N 55.22º W	100,000	1974	CWS data base
Middle Lawn Island	46.87º N 55.62º W	13,879	2001	Robertson et al. 2002
Green Island	46.52º N 56.05º W	65,280	2001	Robertson et al. 2002
Grand Colombier Island, St. Pierre et Miquelon	46.49º N 56.10º W	100,000	1989	Cairns et al. 1989

Wilson's Storm-Petrels nest in the Southern Hemisphere and fly to the Northern Hemisphere from May to October. It is uncommon in southern Newfoundland waters, including the Placentia Bay area.

<u>Pelecaniformes (gannets and cormorants)</u>

There are six breeding colonies of Northern Gannets in Canada, three in Quebec and three in Newfoundland. Cape St. Mary's is the largest of three Newfoundland breeding colonies, containing 12,156 pairs in 1999 (Chardine 2000). This is about 51% of the total Newfoundland breeding population and 15% of the Canadian breeding population. Northern Gannets are common in the Placentia Bay area where they prey on capelin, herring, mackerel and squid throughout the area.

There are two species of cormorant occurring in Atlantic Canada and both are common breeders in the Placentia Bay area. Double-crested Cormorants migrate south of Newfoundland in winter but the Great Cormorant is a year-round resident. Both species of cormorant nest in small isolated cliff side colonies in the Placentia Bay area.

Phalaropodinae (phalaropes)

Two species of phalaropes occur regularly in the pelagic zones of the Placentia Bay area during spring and fall migrations. Red Phalarope and Red-necked Phalarope use the Placentia Bay area to feed on zooplankton, and small concentrations can be expected in late May to early June, and again from mid-July to September.

Laridae (gulls and terns)

Four species of large gulls occur regularly throughout the Placentia Bay area, including Herring Gull, Great Black-backed Gull, Glaucous Gull and Iceland Gull. Herring and Great Black-backed Gulls are common year-round residents. They breed on islands and headlands around the perimeter of the Placentia Bay area, including the Burin Peninsula, and forage in coastal and pelagic areas. Glaucous Gulls and Iceland Gulls breed north of Newfoundland and occur in the Placentia Bay area mainly during the winter season. Iceland Gulls outnumber the larger but similar plumaged Glaucous Gull.

Smaller gulls which occur in the Placentia Bay area include Black-legged Kittiwake and Ringed Bill Gull. About 10,000 pairs of Black-legged Kittiwake nest at Cape St. Mary's and there is a colony of 788 pairs nesting on Goose Island near Arnold's Cove (CWS, unpubl. data, 2005). In April 2007, approximately 1,000 were estimated on Corbin Island (LGL Limited 2007). This species is a common year round resident in the Placentia Bay area where it is pelagic during the non-breeding season. Ring-billed Gulls nest in several closely packed colonies around the Placentia Bay area, including 992 pairs on Crawley Island and 304 pairs on Goose Island (CWS, unpubl. data, 2005). Ring-billed Gulls feed close to shore and in tidal areas, and are less frequently encountered offshore.

Large gulls are ubiquitous throughout the Placentia Bay area. Herring Gulls are most abundant followed by Great Black-backed Gulls. In 2007, more Iceland Gulls were recorded on the March 13, 2007 survey, especially in the southern Burin Peninsula area, and Ring-billed Gulls were not detected until the April 21, 2007 survey. The larger numbers of Herring Gulls, Great Black-backed Gulls and Black-legged Kittiwakes detected on April 21, 2007 were related to pre-breeding occupation of nesting colonies (Table 6.3-5). Hundreds of large gulls, including up to 40 or 50 Ring-billed Gulls have been documented using Shoal Cove and Shoal Cove Pond (JWEL 2003).

Table 6.3-5: Total Numbers of Gulls, and Purple Sandpipers Observed during Aerial Surveys by LGL Limited of the Placentia Bay Area, Winter/Spring 2007.

Date	Marine-associated Bird Species							
	Glaucous Gull	Iceland Gull	Herring Gull	Ring-billed Gull	Great Black-backed Gull	Gulls	Black-legged Kittiwake	Purple Sandpiper
27/02/07	1	1	503		192	277	5	386
13/03/07	1	182	363		57	47	12	270
21/04/07	1		4,639	706	476	12	954	515

Common Tern and Arctic Terns nest in numerous colonies of varying size around the entire coastline of the Placentia Bay area. Tern colonies were identified at 22 sites with an estimated 1,635 individuals during aerial surveys in 2005 by CWS. These aerial surveys only sampled a portion of the available nesting habitat in the Placentia Bay area. Additional tern breeding colonies are known to exist in the Placentia Bay area. Both species are common near inshore with smaller numbers occurring offshore from late May to mid September.

Stercorariidae (skuas and jaegers)

There are two species of skua and three species of jaegers occurring in the Placentia Bay area and the North Atlantic. Great Skua and South Polar Skua occur in low densities in the Placentia Bay area from late spring to mid fall. The Pomarine, Parasitic and Long-tailed Jaeger nest in the Arctic and winter at sea in the middle latitudes. They migrate through Newfoundland waters in spring and fall. Non-breeding sub-adult birds summer south of the breeding range including Newfoundland waters. The jaegers occur in low densities in the Placentia Bay area from May to October. Pomarine Jaeger is generally the most numerous species and Long-tailed Jaeger the least numerous.

Alcidae (auks)

There are six species of auks in the North Atlantic. All of them are common during part of the year in the Placentia Bay area. Dovekies nests by the millions in Greenland, Iceland and Norway. Coastal Newfoundland is an important wintering area for the Dovekie (Lock et al. 1994), and it is common in the Placentia Bay area from October to April. There are two species of murre, the Common Murre and Thick-billed Murre, and one or both are common in the Placentia Bay area throughout the year. Ten thousand pairs of Common Murres nest at Cape St. Mary's (Cairns et al 1989). These birds use the Placentia Bay area as part of their feeding area during the breeding season. Common Murres from other colonies in eastern Newfoundland may be present in the Placentia Bay area during migration and winter. Thick-billed Murre is more abundant during winter, although small numbers breed in Newfoundland. The majority of birds present during the winter season (October to April) are from large Arctic breeding colonies. Razorbill Auks are much less common than the other murre species, and at least 100 pairs nest at Cape St. Mary's. The majority of the Razorbill population winters south of the Placentia Bay area, mainly in the Bay of Fundy and Georges Bank. Black Guillemot is a ubiquitous breeding and winter resident of the coastal zone area of the Placentia Bay area. Atlantic Puffin is a locally abundant breeder on the eastern Avalon Peninsula. The closest known breeding population to the Placentia Bay area is the 400 pairs breeding on Grand Colombier, St. Pierre et Miquelon. Atlantic Puffins are fairly common in the Placentia Bay area from May to October.

Near Shore and Tidal Marine-associated Birds

Anatidae (geese and ducks)

Both diving and non-diving species of geese and ducks occur in the Placentia Bay area. Canada Goose, Black Duck, Northern Pintail and Green-winged Teal are the non-diving members of this group. They feed mainly by dabbling in shallow fresh water but also in rich tidal areas. Black Ducks have been over-wintering in coastal Newfoundland in increasing numbers over the past few decades. Small numbers may be found at a variety of locations in coastal sections of the study area, particularly during spring and fall migration. Diving ducks are more adapted to salt water conditions than non-diving waterfowl.

Sea ducks, notably Common Eider are common in winter in Newfoundland. Wintering concentrations of several thousand birds are known to occur at Cape St. Mary's, Virgin Rocks and several island locations off the Burin Peninsula. Three to four thousand Common Eiders were observed in the coastal areas along the southern Burin Peninsula in 2007. This represents a substantial wintering population for which there is very little information. Other sea ducks were detected in low numbers, and the lack of scoters was notable (only three white-winged Scoters and seven Black Scoters observed). Audubon Christmas Bird Count data for Common Eiders and Black Scoters (at Cape St. Mary's area) indicate that these species are in long-term decline in the Placentia Bay area whereas Long-tailed Ducks are more or less stable.

The eastern North American population of the Harlequin Duck is currently listed as a species of special concern by COSEWIC (see Subsection 6.4 on Species at Risk). The largest concentration of wintering Harlequin Ducks in Atlantic Canada occurs at Cape St. Mary's. Up to 200 individuals over-wintered there in recent years. Other species of sea ducks found regularly during the fall, winter and spring seasons in the Placentia Bay area are the three species of scoter (White-winged, Surf and Black), Long-tailed Duck and Red-breasted Merganser.

During aerial surveys on March 13, 2007 and April 20, 2007, LGL biologists observed 3,366 and 3,990 Common Eiders, respectively, particularly in the St. Lawrence to Point May area of the Burin Peninsula. There were small numbers of Red-breasted Mergansers, and only incidental numbers of White-winged Scoters and Black Scoters (Table 6.3-6). Long-tailed Ducks were more ubiquitous in small numbers whereas Common Goldeneye (*Bucephala clangula*) and Common Loons (*Gavia immer*) were noted only occasionally (LGL Limited 2007).

<u>Gaviidae, Podicipedidae and Phalacrocoracidae (loons, grebes and cormorants)</u>

The Common Loon is a common breeder in inland Newfoundland and birds breeding near the coast will fly to sea to feed. Although there have been no official surveys, good numbers of Common Loons over-winter along the south coast of Newfoundland including the Placentia Bay area. Red-throated Loons breed north of insular Newfoundland but migrate through Newfoundland coastal waters in spring (May and June) and in fall (September and October). Red-necked Grebe is the only regularly occurring species of grebe found in the Placentia Bay area. This species nests in western Canada but there is a small, though relatively substantial wintering population on the southern Avalon Peninsula including the Placentia Bay area.

Table 6.3-6: Numbers of Waterfowl Observed by LGL Limited during Aerial Surveys of the Placentia Bay Area, Winter/Spring 2007.

Date	Waterfowl Species							
	Common Loon	Canada Goose	American Black Duck	Mallard	Northern Pintail	Green-winged Teal	White-winged Scoter	Black Scoter
27/02/07	1		106	1				
13/03/07	10		16				3	8
21/04/07	4	28	11		2	2		

Date	Waterfowl Species						
	Long-tailed Duck	Harlequin Duck	Common Eider	Unidentified Scaup	Common Goldeneye	Red-breasted Merganser	Unidentified Merganser
27/02/07	165		634	10	5	43	
13/03/07	255	12	3,366		15	26	10
21/04/07	224	12	3,990			15	11

Accipitridae (Bald Eagle and Osprey)

One of the highest densities of Bald Eagles in eastern North America breeds in the Placentia Bay area, Newfoundland (Dominguez 1998). The Wildlife Division of the NL Department of Environment and Conservation has conducted Bald Eagle surveys in the Placentia Bay area most years since 1983. Since the early 1990s, permanent survey plots nesting Bald Eagles was established on Long Island, Merasheen Island, Ragged Island and a section of coastline along the adjacent western the Placentia Bay area. This area contains 20-30 active nests annually (J. Brazil, Department of Environment and Conservation, Wildlife Division, pers. comm.). Bald Eagles are year round residents in the Placentia Bay area. The Osprey is less numerous than the Bald Eagle in the Placentia Bay area but occurs regularly from late April to September. During fall migratory, the Peregrine Falcon is observed with increasing frequency (see Subsection 6.4 on Species at Risk).

Charadriiformes (shorebirds)

There are seventeen species of shorebirds that occur regularly in the Placentia Bay area (Table 6.3-1). Most of these are migrants from breeding areas north of Newfoundland. The largest numbers of shorebirds migrate through Newfoundland during the fall migration period from mid July to mid November when they feed in tidal areas. The area of Shoal Cove beach and Shoal Cove Pond supports a variety of shorebird species during migration (Table 6.3-7) including observations of the Piping Plover currently designated as endangered on Schedule 1 of *SARA*. (see Subsection 6.4 on Species at Risk). Purple Sandpiper (*Calidris maritima*) is the only shorebird that winters in the Placentia Bay area, and is a species of current management interest (P. Thomas, CWS, pers. comm.). They are relatively common and ubiquitous in the general area of the Burin Peninsula and Placentia Bay in general. Flocks were detected along the wave wash and intertidal areas where seaweeds were abundant on the April 21, 2007 (Table 6.3.5).

6.3.1.2 Birds in the St. Lawrence Area

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

Based on a 2002 windfarm 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). From 2003 to 2009, Gail and Norman Wilson recorded 132 bird species in the St. Lawrence area; 50 migratory breeder species of which 8 are marine/coastal, 34 migratory species of which 16 are marine/coastal, and 33 resident species of which two are marine/coastal (Table 6.3-8).

Table 6.3-7: Shorebird Observations in the Shoal Pond – Shoal Cove area in 2002.

Species	Date	Shoal Cove Beach	Shoal Cove Pond	Hares Ears	Winterton Pond
Black-bellied Plover	27 Sep-2 Oct	3			
American Golden Plover	18 Sep		1		
	19 Sep		17		
	21 Sep		4		
	25 Sep		6		
	30 Sep		1		
	30 Oct		21		
Whimbrel	19 Sep			1	
	27 Sep				1
Dunlin	21Sep	7			
	30 Sep-2 Oct	3			

Species	Date	Shoal Cove Beach	Shoal Cove Pond	Hares Ears	Winterton Pond
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	Sep-Oct	Grps < 20	Grps < 20		
Semipalmated Plover	18 Sep	4			
	30 Sep	1			
	2 Oct	6			

Source: JWEL 2003

Table 6.3-8: List of Birds Observed in the St. Lawrence Area, 2003 to 2009.

Species	Category*	Month											
		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							

Species	Category*	Month											
		J	F	M	A	M	J	J	A	S	O	N	D
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	
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	V									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				

Species	Category*	Month											
		J	F	M	A	M	J	J	A	S	O	N	D
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				
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			

Species	Category*	Month											
		J	**F**	**M**	**A**	**M**	**J**	**J**	**A**	**S**	**O**	**N**	**D**
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: Gail & Norman Wilson, St. Lawrence, NL.

*Category
M – Migratory
MB – Migratory Breeder
R – Resident
V - Vagrant

6.3.2 Potential Impacts

Migratory birds are broadly defined here to include terrestrial and marine birds that are resident and seasonal. The migratory birds as a VEC includes birds classed residents (year-round), migrant breeders, migratory visitors and vagrants, and they are of prime concern from both a public and a scientific perspective, locally, nationally, and internationally. Various marine bird species are also considered where relevant. In most cases, species can be grouped according to life cycle needs and sensitivities. Individual species or species groups (e.g. shorebirds) were selected to represent the bird portion of this VEC, as it is impossible to individually assess the numerous species that potentially occur in the study area. Sea ducks and some seabirds are species groups found in the study area seasonally and likely to interact with the marine activities hence providing a conservative basis for effects predictions for marine species in general. The main potential for effects on these species and the marine environment in general stem from marine construction and operation activities, marine effluent, and marine accidents, see Sections 5.2 and 5.7.

The existing migratory bird habitat is described in detail in Section 6.3.1. The study area supports a sparse bird population and species diversity is relatively low. Nevertheless some notable findings include the observation of Piping Plovers (see SAR Section) and a diversity of other shorebird species using Shoal Cove Pond and Shoal Cove beach (Table 6.3-7) area which is in the project footprint. For the most part, this use appears to be seasonal either as spring or fall migrants. Shorebirds rely on invertebrates in the upper sediments of substrates at sites such as Shoal Cove and Shoal Cove Pond, and anthropogenic factors that could affect these food items could impinge on shorebirds that feed there.

Information gathered through various means (e.g., local ecological knowledge, previous aerial surveys) indicates that sea ducks, especially Common Eiders occur in the study area in winter, and seabirds such as Manx Shearwaters and Leach's Storm Petrels breed nearby on offshore islands that are designated as Important Bird Areas (IBAs), and would well serve as focal species. The Great Cormorant is a year-round resident in the study area, and therefore represent both the wintering and breeding components of the life history. Many seabirds rely on fish (cormorants), bottom invertebrates (eiders), and pelagic plankton (petrels) for food, the components of the marine habitat that can be affected by marine anthropogenic activities. Therefore these species of birds have life stages that occur throughout the habitat (i.e., upper/surface and lower water column, and on bottom substrates).

Terrestrial bird species diversity is low but includes diversity of boreal and heathland (subarctic) species. Hence there is an interesting mix of wood warblers, such as Yellow-rumped Warbler, Blackpoll Warbler, Northern Waterthrush with species such as Horned Larks and Willow Ptarmigan, more typical of the open coastal barrens. The Rusty Blackbird is a local breeder along the edges of bogs and wetlands, and Red Crossbills are recorded irregularly in the general area (see Section 6.4).

Birds of prey in the study area include resident Bald Eagles and Osprey (migratory breeder) as well as the resident Goshawk and Great Horned Owls. The Short-eared Owl may be a local breeder and Peregrine Falcons area regular fall migrants (see Section 6.4).

6.3.2.1 Assessment Criteria

Assessment criteria, including boundaries, are described in Section 4.4. Significant environmental effects are those considered to be of sufficient magnitude, duration, frequency, geographic extent, and/or reversibility to cause a change in the birds and bird habitat that will alter its status or integrity beyond an acceptable level. Establishment of the criteria is based on professional judgment, but is transparent and repeatable. In this EPR/EA, a *significant* effect is defined as:

Having a medium or high magnitude for duration of greater than one year and over a geographic extent greater than 100 km^2.

Reversibility is also an important consideration.

6.3.2.2 Issues and Concerns

Four primary concerns are associated with the potential interactions between routine activities of the three phases of the Project and migratory birds:

4. Loss and/or alteration of habitat;
5. Increased suspended sediments; and
6. Discharge of marine effluent into Shoal Cove.
7. Disturbance

The migratory bird VEC could potentially interact with a variety of routine activities associated with the Construction, Operation, and Decommissioning phases of the Project. There are four primary marine activities that will interact with marine birds:

1. Wharf construction;
2. Marine vessel loading; and

3. Marine effluent.

4. Marine traffic

The effects of these and some other routine activities on migratory birds are assessed in the following sections.

6.3.2.3 Effects of Construction on Birds and Bird Habitat VEC

During construction for reactivation of the St. Lawrence Flourspar Mine and the associated marine terminal, there are six main types of activities that may impact birds and bird habitats:

5. Habitat Destruction

6. Noise and Disturbance (including traffic)

7. Presence of Structures

8. Artificial Lighting

9. Run-off and Siltation

10. Air Emissions

Of these construction activities, habitat destruction and noise/disturbance have the greatest potential to impact birds and bird habitat. Noise is defined as a sound of human origin that might significantly disturb animals (Bowles *et al*. 1991), that is, it may have deleterious effects on wildlife. Noise is associated with almost every aspect of the construction phases of the Project and this VEC is known to be sensitive to noise. Data exist for response of some species of birds to noise.

Habitat Effects

Habitat Loss

Species such as waterfowl are thought to saturate the habitats, in this case wetlands, of a given landscape. Loss of habitat is directly linked to loss of carrying capacity of the local or regional landscape hence ‘no net loss’ of wetlands is premised on the negative effects of habitat loss on waterbird populations. Historically, the attitude that animals could simply “go somewhere else” was the fundamental force behind massive habitat loss, especially wetlands such as prairie potholes critical for waterfowl breeding and saltmarshes along the Atlantic Seaboard (North American Waterfowl Management Plan 1986).

Habitat Avoidance

Disturbance is equated to habitat loss that is reversible. Owen (1973) calculated that due to disturbance only half the potential usage by the geese of the Wildfowl Trust refuge at Slimbridge, England was being realized. Animals may distribute themselves more widely in the absence of disturbance (Gerdes and Reepmayer 1983 in Bell and Owen 1990; Mayhew 1985). Disturbance can be equated to lessening of carrying capacity. Some animals may distribute themselves around the landscape in relation to disturbances, implying that birds are being prevented from exploiting areas they would otherwise favour (Bell and Owen 1990). Notwithstanding that disturbance may impact species differentially, it is clear that certain types of disturbance can impact biological communities. For example, Reijnen et al. (1995) determined that twenty-six of forty-three species of songbirds showed reduced densities adjacent to noisy highways.

Change in Distribution

A change in distribution has a number of possible consequences, including restriction in feeding opportunities (time and space), increased energetic costs of moving, and increased concentration of individuals which increases intraspecific competition and/or risk of disease. Such consequences could affect condition of individual animals (e.g. Dzubin 1984; Temple et al. 1996). In Denmark, staging Pink-footed Geese (Anser brachyrhynchus) in undisturbed fields increased their body condition (as measured by Abdominal Profile Indices) whereas birds using disturbed fields did not. Of marked individuals resighted in the subsequent autumn, birds from the undisturbed sites were more successfully at breeding (Madsen 1994). Wildlife densities will rise as habitat is lost. Whether or not this affects the local or global population will depend on whether rates of emigration, mortality and reproduction are already or will become density dependent (Goss-Custard et al. 1994, 1995).

Animals may avoid sites when disturbance events are frequent but subsequently use such sites when less disturbed sites have been depleted of food (e.g. Owens 1977). Some animals may compensate for daytime disturbances by feeding at night (Owen and Williams 1976). Compensatory feeding maybe constrained by the morphology of feeding apparatus or time-activity budgets (Goudie and Ankney 1986). Some animals are able to increase their feeding rate (e.g. Swennen et al. 1989), while other animals do not (e.g. Belanger and Bedard 1989).

Habitat Loss and Carrying Capacity

Disturbance may cause redistribution of wildlife. If animals are displaced from a site, their survival depends on the availability of alternate feeding sites. Displaced individual animals, such as shorebirds and songbirds, may suffer from mutual interference when forced to feed elsewhere under increase densities thereby affecting food intake rate which repeated would affect carrying capacity leading to metapopulation effects and subsequently population effects (Sutherland and Anderson 1993; Goss-Custard et al. 1995). Hill et al. (1997) presented a schematic model of the relationship between disturbance and habitat loss, food supply, intake rate, carrying capacity and importance to metapopulations.

Effects of Noise and Disturbance

Effects of noise and disturbance on wildlife is a very broad subject ranging from impacts on physiology and/or behaviour of the individual animal, through to consequences of noise to populations, to alterations of the communities, landscapes and ecoregions. Disturbance is one of the most important stressors that humans and their devices have impinged upon the natural world (Nisbet 1977, 2000). Arguably, no areas of earth and few wildlife species have escaped the effects of humans on this planet. Effects of disturbance are any consequence of this anthropogenic influence, and are not necessarily biologically significant or negative (Bowles et al. 1991). Noise disturbance may cause stress in animals and this has physiological implications that have received attention in humans (Kryter 1970) and wildlife (Selye 1950, 1976; Welch and Welch 1970, Siegel 1980, Westman and Walters 1981, Wasser et al. 1997,). Noise disturbance stimulates the auditory senses of wildlife, and effects originate from acoustical stimulation of the neuro-physiological system in animals (Welch and Welch 1970). Behavioural responses range from mild annoyance to panic and escape behaviour, and such responses are manifestations of stress. Excessive stimulation of the nervous system can amount to chronic stress, and this has implications to health, growth and reproductive fitness of animals (Fletcher and Bushel 1978, Fletcher 1980).

The concept of disturbance (especially noise) as a stressor is basic to understanding its physiological effects on animals. Altered reproductive behaviour resulting from noise disturbance (e.g. Holthuijzen *et al.* 1986, Anderson *et al.* 1989) is a major area of concern due to possible effects on survival of populations or species (Informatics 1980). Ultimately, all response to disturbance is affected by physiological changes in individual animals.

While stress responses seem maladaptive, they actually perform important functions, such as reducing inflammation and speeding acclimation to environmental stressors (Bowles 1994). When an animal's capacity to adapt is exceeded, it experiences distress (pathological), evidenced by clinical systems of ill health, including such things as neurotic behaviour, reproductive failure, inhibition of growth, and/or disease. Depending on type and intensity of noise disturbance, the same adverse stimulus may affect either the whole body or mainly one part (Selye 1976) because stress involves a number of complex neuro-endocrine interactions.

Noise can be broadly classified as: (i) continuous noise (ii) impulse noise and (iii) impact noise. Continuous noise is seldom encountered by wildlife except when adjacent to human activities. Some animals, such as Harlequin Ducks, live in environments with higher background sound levels. The rapid onset of intense noise, i.e., sudden onset may cause noise of high amplitude to sound less loud than is indicated by its power spectrum, and to act as if it has effects at high frequencies disproportionate to their representation in its spectrum (Larkin 1996). Therefore rapid-onset impulse noise may be potentially more damaging than would be predicted strictly from its physical characteristics. Impulse noise and continuous noise differ both in their potential physical effects, namely hearing damage, and in their sensory-mediated physiological and behavioural effects (Roberto et al. 1985). Animals habituate poorly to high amplitude noise with rapid onset (Korn and Moyer 1966).

Hearing damage from loud noise is a result of physiological change to the auditory system, notably loss or damage to hair cells in the cochlea. Hearing loss or damage can be produced by brief exposure to very loud sound or by prolonged exposure to moderate levels of sound. Animals vary greatly in their sensitivities and susceptibilities to hearing loss. The frequency content of sound is very important because sounds of different spectra affect the auditory system differently; for example, high frequency tones tend to produce localized changes in the inner ear, whereas low frequency tones tend to produce changes throughout the length of the cochleae (Fletcher and Busnel 1978).

Mitigative Actions

Approaches such as determining thresholds of response and discrimination of important explanatory variables are used to develop management recommendations that, if applied, can minimize human impacts, as for example with Bald Eagle (Grubb and King 1991; Grubb and Bowerman 1997). Managers seek to minimize human disturbance on wildlife. Management actions maybe based on empirical data, especially where dose and response are known (e.g. Goudie and Jones 2004) or, in many cases, maybe based on subjective judgments. Bowles (1994) proposed a number of general approaches to help limit important behavioural and physiological responses of wildlife to disturbance.

Hearing Abilities in Birds

Similar to humans, birds are most sensitive to sounds ranging from is approximately 1 kHz to 4 kHz with sensitivity decreasing at lower and higher frequencies. For this reason, birds are more likely to respond to mid-frequency noise. Sound measures are given a frequency weighting in order to account for this, and the most widely accepted is A-weighting for humans and birds. For repetitive or continuous sound, a Sound Pressure Level (SPL, measured in decibels dB) is expressed as an average over a certain period of time of the ratio of the actual sound pressure to a reference sound pressure of 20 μPascal.

Birds possess a highly evolved auditory system and sensitive hearing, and vocal communication plays an important role in many species. The best hearing in birds is in the range of 1 to 4 kHz and there is a steep increase in the threshold up to 10 kHz that is the normal upper limit. In specialized species of birds the upper threshold approaches 20 kHz. (Meyer 1986). Amplitudes of songs at average call frequencies range from - 15 to 50 dB SPL (where 0 dB = 20 μPascal), and at typical frequencies are 5 to 10 dB in most birds. Birds, such as owls, are unique with hearing sensitivity extending to about – 20 dB, and for example, in the pigeon hearing extends into the infrasound range down to 0.1 Hz.

Similar to other mammals and humans, birds discriminate frequency differences and sound intensities. Because of the small head of most birds, sound attenuation between ears is small, and this is important for sound localization (Dooling 1982, 2000; Necker 2000). Sounds separated by a gap are recognized as separate if the gap exceeds 2 to 10 msec (Wilkerson and Howse 1975). Most birds are able to localize sound in the azimuth (horizontal plane) but not in elevation, an exception being owls that are able to localize sound both in the azimuth and in elevation with minimal localization error (Knudson 1980).

Noise varies with disturbance type, and typically there is a threshold beyond which response increases markedly (Pater 2001). For example, adverse outcomes in Harlequin Ducks increased with corresponding increases in the level of exposure to aircraft noise beyond a threshold of about 85 decibels (A-weighted) (dBA) (Goudie and Jones 2004). Responses by birds to noise vary among species (Ryals et al. 1999).

Underwater recordings of both vibratory and impact pile-driving sounds during recent dock modifications in Alaska were made (HDR Alaska et al. 2006). The mean SPLrms at 56 m (average of several 8.5 second samples) from the vibratory pile driver was 164 dB re: 1 μPa at a depth of 10 m and 162 dB re: 1 μPa at a depth of 1.5 m. The mean SPLrms at 62 m (average of several individual pulses) from the impact pile driver was 189 dB re: 1 μPa at a depth of 10 m and 190 dB re: 1 μPa at a depth of 1.5 m. With respect to the impact pile driving, the distances at which the mean SPLsrms decreased below 180 dB were 250 m (10 m depth) and 195 m (1.5 m depth), and the distances at which the maximum SPLsrms decreased below 180 dB were 650 m (10 m depth) and 330 m (1.5 m depth). The mean SEL at 62 m (average of several individual pulses) associated with impact pile driving was 178 dB re: 1 μPa2 · s at a 10 m depth, and 180 dB re: 1 μPa2 · s at a 1.5 m depth. The dominant frequency ranges for vibratory and impact pile driving were 400 to 2,000 Hz and 100 to 2,000 Hz, respectively (HDR Alaska et al. 2006).

Presence of Artificial Structures

Large numbers of birds breed in northern biomes with the extended daylight where it is relatively free of man-made structures, and migrate annually through highly industrialized areas with buildings heavily serviced by power utilities, and with substantial darkness. Birds generally fly at different altitudes and in differing patterns at night than during the day (Gauthreaux 1972). Light conditions depend on latitude and season, and species breeding at high latitudes (especially juveniles such as shorebirds) might suffer higher mortality during migration because of the short daylight periods because they have never experienced night time and structures before undertaking the southward movements (Bevanger 1994).

Some species exploit open habitats (e.g. Short-eared Owls, Northern Harrier), and/or are nocturnal (petrels) which puts them at high risk of collision with structures. Utility structures maybe the highest structures in the landscape, and often attract considerable nesting and roosting of raptors, e.g. Osprey (*Pandion haliaetus*) in Labrador, and Bald Eagles (*Halieetus leucocephalus*) (Bohm 1988). Utility structures can be selectively used by raptors, owls and corvids for nesting, perching and/or roosting. Use of utility structures for perches in an otherwise flat landscape has led to mass electrocutions of vulnerable bird species (Erickson *et al*. 2005; Manville 2005). Birds of prey, corvids and other bird species may be attracted to power lines and utility structures for perching, roosting and/or nesting. These behaviours increase the risk of collisions. Notably, raptors make dramatic stoops when attacking prey e.g. Gyrfalcon (*Falco rusticolis*) (Clausen and Gudmundsson 1981), and at such times their singular focus will not detect an intervening power line.

Bird migration is greatly influenced by weather conditions and atmospheric structure. Weather conditions influence migrant as well as resident species, and it is important to distinguish between the two. Dull overcast weather, fog, drizzle and other forms of precipitation reduce the visibility of structures and power lines as well as generally resulting in birds flying at lower altitudes (Elkins 1988). Some of the most tragic mortalities against man-made structures have occurred under inclement weather conditions (Erickson *et al*. 2005; Manville 2005). Strong wind and inclement weather reduces the manoeuvrability of birds, and/or force birds to fly closer to the ground, and this can increase the risk of collision with structures and power lines. Birds flying into head winds generally fly lower than those on tail winds, and tail winds reduce the ability of some bird species to manoeuvre and avoid collision with power lines (Brown *et al.* 1987). In strong head winds, the wind speed is generally lower near the ground.

Different bird species fly at different heights, and species vary the altitude of flights depending on the activity. For example, during migration waterfowl and cranes reduce energy expenditure by flying higher to take advantage of tail winds (Tucker 1975) where the risk of collisions with structures and power lines is much reduced, whereas when feeding and roosting they may be particularly prone to colliding with structures and wires when they occur between roosting and feeding areas because they undertake shorter flights at lower altitudes (Crevelli *et al.* 1998). Many passerines migrate at night and fly at relatively high altitudes (e.g. 241-1127 m) but may move to within a few metres of the ground in inclement weather (Gauthreaux 1972), and there can be mass mortality due to impacts with anthropogenic structures, e.g. > 100,000 per event (Manville 2005).

Artificial Lighting

Large numbers of birds breed in northern biomes with the extended daylight where it is relatively free of artificial lighting, and migrate annually through highly industrialized areas with substantial artificial lights. Species breeding at high latitudes (especially juveniles such as shorebirds) might suffer higher mortality during migration because of the short daylight periods because they have never experienced night time and artificial light before undertaking the southward movements (Bevanger 1994).

The Leach's Storm Petrel (*Oceanodroma leucorhoa*) is the most abundant breeding seabird in Newfoundland (Lock et al. 1994) and similar to other shearwaters and petrels is active at night, and may be particularly vulnerable (Imber 1975, Bourne 1976). On occasion in severe marine storms and foggy weather, large numbers can be blown inland and over coastal headlands. Ainley *et al.* (2001) reported that in some cases more than 10% of fledging Newell's Shearwaters (*Puffinus auricularis newelli*) were blinded by artificial lighting and collided with utility poles, power lines and other man-made structures. Sometimes a combination of circumstances can precipitate a mortality event, such as strong head winds, a cold front, or artificial lighting that force migrating songbirds or shorebirds to fly closer to the ground. Wires and structures that are otherwise avoided may be particularly deadly when in the presence of artificial lighting. For example, lighting may cause migrating flocks of shorebirds to fly at lower altitudes resulting in collisions with wires (Manville 2005). Birds often collide with power lines during inclement weather, e.g. hundreds of grebes during a snowstorm (Cottam 1929).

Birds when confronted with artificial light can lose their reference to the horizon line (Herbert 1970), or become attracted to lighted areas and become disorientated (Weir 1976). Different types of lighting may affect birds differently, and can create synergistic effects that increase potential for collisions with wires (Erickson *et al*. 2005, Manville 2005). For example, nocturnal migrants displayed more hovering and curving and circling flight behaviour at towers with red lights than those with white strobe lights, and there was more such aberrant behaviour at lit towers than unlit control sites (Gauthreaux 1988). Tall towers with non-blinking lights may be most detrimental to birds (Gehring 2005).

Run-Off and Siltation

Siltation can alter the substrate and/or inundate original terrestrial and estuarine habitats. The altering of the substrate would result in a change in vegetation as different species might be expected to colonize disturbed sites. In other cases invertebrates important as food for species such as shorebirds maybe negative impacted. Often in the context of industrial development, the newly established plant species are invasive and anthropogenic.

Air Emissions and Contaminants

Atmospheric Emissions – Construction Phase

Various emissions will be associated with construction activities, which includes dust from site development, excavation, vehicular traffic and road construction, mobile equipment and vessels loading and offloading, etc.; also emissions from temporary power generators, heaters, storage tanks, mobile equipment, etc. Construction methods and environmental control and mitigation measures considered for each activity have been described in detail in Section 5.2.2.

No unusually high concentrations of toxic emissions are anticipated nor are there potential for cumulative effects. Therefore no negative impacts are predicted for emissions during construction, and effects are not further considered.

Prior to the construction phase, the Proponent will prepare a general program to control atmospheric emissions of major heavy equipment. This program will be incorporated into the contractors' specifications to make sure it is strictly enforced.

Migratory Birds Effects Assessment

Given that all project activities related to construction and operations as they apply to Birds are deemed to be insignificant it is preferable to apply a generic assessment. Birds represent a special case to this application because of their diverse habitat needs and life histories. Specific species of birds are designated as indicator species for the following general activity headings for this project (Table 6.3-9).

Table 6.3-9: Birds and General Habitat Interaction With Project Activities

Bird Species	Habitat	Project Activity
Sanderling	Sandy Beach/estuary Coastline (Shoal Cove)	run-off/siltation and marine effluent, accidental events (non-hydrocarbon releases)
American Golden Plover Greater Yellow-legs	Shoal Cove Pond (upland) Shoal Cove Pond (shallow Water)	Tailings Processing and Storage
Tree Swallows	Low Altitude-Pristine Aerial	air emissions, including dust
Migrating Warblers & Shorebirds Leaches Storm Petrels	Low Altitude Flying	lights
Resident Breeding Songbirds	Project Area	noise
Common Eider, large gulls	Marine coastal	accidental events (hydrocarbon release)
Wood Warblers and Thrushes	Boreal Forest	accidental events (Fire)

<u>Land-based Activities</u>

<u>Construction</u>

During land-based construction, five activities have been identified as having potential to interact with migratory birds. They include (1) run-off/siltation, (2) air emissions, including dust, (3) lights, (4) noise, and (5) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.3-10).

Run-off/Siltation

Run-off and associated siltation could result in increased turbidity and sedimentation in the marine environment, thereby having potential to negatively affect the marine birds, notaby waterfowl and alcids (Black Guillemots) using the inshore area. The mitigations intended to reduce the negative effects of run-off/siltation on marine fish and fish habitat apply to the marine birds as well and will be detailed in the Construction Environmental Protection Plan (EPP).

Table 6.3-10: Potential Interactions between Construction Activities and Migratory Bird

Valued Ecosystem Component: Migratory Birds						
Project Activity	**Feeding**		**Reproduction**		**Adult Stage**	
	Plankton	**Benthos**	**Eggs/ nests**	**Juveniles[1]**	**Migratory**	**Resident**
Construction Activities and Physical Works						
Non-marine						
Run-off/siltation	x	x	x	x	x	x
Air emissions			x	x	x	x
Accidental events	x	x	x	x	x	x
Construction Noise				x	x	x
Artificial Lights				x	x	x
Marine						
Siltation	x	x	x	x	x	x
Noise		x	x	x	x	x
Air emissions			x	x	x	x
Artificial Lights				x	x	x
Accidental events	x	x	x	x	x	x

Notes: [1] Juveniles are young birds that fledged and are often found closely associated with habitats.

Candidate mitigations for run-off and siltation include the use of silt curtains (Table 6.3-11) but these measures will be finalized in the EPP. Regardless of the possibility of continuous run-off/siltation throughout the land-based construction phase, appropriate mitigation measures would minimize the potential effects of this activity on the Migratory Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of run-off/siltation on the Migratory Birds (Waterfowl/sea ducks, seabirds) are negligible, <1 km2, and 13 to 36 months, respectively (Table 6.3-11). Based on these criteria ratings, the residual effects of run-off/siltation associated with land-based construction on Migratory Birds are insignificant (Table 6.3-12).

Air Emissions (including dust)

Air emissions, including airborne dust, could also reduce air quality in the adjacent marine environment, thereby negatively affecting Migratory Birds. An aspect of air quality pertains to chemicals comprising emissions from equipment being used during land-based construction, which could potentially have some negative effects on Migratory Birds (Tree Swallow).

Table 6.3-11: Effects Assessment of Construction Activities on Migratory Birds

Valued Ecosystem Component: Migratory Birds								
Project Activity	Potential Positive (P) or Negative (N) Environmental Effect	Possible Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/ Socio-Cultural and Economic Context
Construction Activities and Physical Works								
Non-marine								
Run-off / siltation	Increased turbidity (N); Sedimentation (N)	Water spray dust suppression; Silt curtains	2	1	6	3	R	2
Air emissions (incl. dust)	Increased turbidity (N); Sedimentation (N); Contamination (N)	Water spray dust suppression; Minimization of material stockpiling; Equipment maintenance	1	1	6	3	R	2
Construction Noise	Disturbance (N)	Minimization of exposure to noise	1	1	1-2	1	R	2
Artificial Lights	Attraction (N)	Equipment types	1	1	1-2	1	R	2
Accidental events	Contamination (N)	Rapid Response Plans	1	1	1	1	R	2
Marine								
Siltation	Increased turbidity (N); Sedimentation (N)	Silt curtains	2	1	6	2	R	2
Noise	Disturbance (N)	Minimization of exposure to noise	1-2	1	6	2	R	2
Air emissions	Contamination (N)	Equipment maintenance	1-2	1	6	2	R	2
Artificial Lights	Attraction (N)	Equipment types	1-2	2	2	2	R	2
Accidental events	Contamination (N)	Rapid Response Plans	2	2	1	1	R	2

Table 6.3-12: Significance of Potential Residual Environmental Effects of Construction Activities on Migratory Birds VEC

Valued Ecosystem Component: Migratory Birds				
Project Activity	Significance of Predicted Residual Environmental Effects		Likelihood[a]	
	Significance Rating	Level of Confidence	Probability of Occurrence	Scientific Certainty
Construction Activities and Physical Works				
Non-marine				
Run-off/siltation	NS	3	-	-
Air emissions (incl. dust)	NS	3	-	-
Noise	NS	3	-	-
Artificial Lights	NS	3	-	-
Accidental events	NS	3	-	-
Marine				
Wharf footprint	NS	3	-	-
Siltation	NS	3	-	-
Noise	NS	3	-	-
Air emissions	NS	3	-	-
Artificial Lights	NS	3	-	-
Accidental events	NS	3	-	-

[a] Only rated if residual environmental effect predicted to be significant

Key:

Residual environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

Mitigations intended to reduce the negative effects of air emissions, including dust, on Migratory Birds will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include water spray dust suppression, the use of silt curtains, and equipment maintenance (Table 6.3-11) but these measures will be finalized in the EPP. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of air emissions on the Migratory Birds (Tree Swallows) are negligible, <1 km2, and 13 to 36 months, respectively (Table 6.3-11). Based on these criteria ratings, the residual effects of air emissions associated with land-based construction on Migratory Birds are insignificant (Table 6.3-12). Regardless of the possibility of continuous air emissions throughout the land-based construction phase, appropriate mitigation measures would minimize the potential effects of this activity on Migratory Birds as exemplified by Tree Swallows..

Noise

There are potential interactions between noise and Migratory Birds (Table 6.3-10). Numerous noise sources will occur continuously in the Project Area during non-marine construction, including heavy equipment associated with work. It is likely that the most intrusive noise source from the perspective of the Migratory Birds will be the equipment related to construction. A review of negative effects of noise on wildlife is presented earlier in this section. The effects of exposure to noise on Migratory Birds (Songbirds) are likely to be negative but minimal. There is some evidence that prolonged exposure to sound with relatively high sound pressure levels (SPL) (e.g., pile driving) could potentially cause negative physiological effects, however, the most likely negative effect will be the displacement of any birds occurring in the immediate vicinity of the noise source as loud noise is expected to attenuate over relatively short distances (< 1 km). Migratory Birds (e.g. Fox Sparrow), if even present in the vicinity of noise could habituate to the anthropogenic noises or temporarily avoid use of the project area.

Mitigations intended to reduce the negative effects of noise on Migratory Birds will be detailed in the Construction Environmental Protection Plan (EPP). Measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of construction noise on Migratory Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on Migratory Birds are low, <1 km2, and 1 to 12 months, respectively (Table 6.3-11). Based on these criteria ratings, the residual effects of noise associated with non-marine construction on Migratory Birds (Songbirds) are insignificant (Table 6.3-12).

Artificial Lights

Birds when confronted with artificial light can lose their reference to the horizon line (Herbert 1970), or become attracted to lighted areas and become disorientated. Different types of lighting may affect birds differently, and can create synergistic effects that increase potential for collisions with wires and structures. Tall structures with non-blinking lights may be most detrimental to birds.

Mitigations intended to reduce the negative effects of artificial lights on Migratory Birds will be detailed in the Construction Environmental Protection Plan (EPP). Measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of artificial lights during construction on Migratory Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on Migratory Birds are low, <1 km2, and 1 to 12 months, respectively (Table 6.3-11). Based on these criteria ratings, the residual effects of artificial lights associated with non-marine construction on Migratory Birds (Songbirds, Shorebirds) are insignificant (Table 6.3-12).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during land-based construction activities could potentially have negative effects on Migratory Birds (Waterfowl and Shorebirds). Potential effects of hydrocarbons on birds are discussed earlier in this section. Mitigations intended to reduce the negative effects of land-based accidental events on Migratory Birds will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.3-11) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of land-based accidental events on Migratory Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of land-based accidental events on the Migratory bird species are low to medium, <1 to 10 km2, and <1 to 12 months, respectively (Table 6.3-11). Based on these criteria ratings, the residual effects of land-based accidental events during construction on Migratory Birds (Waterfowl and Shorebirds) are insignificant (Table 6.3-12).

The program will include among other items:

- A dust control program;
- Heavy equipment specifications to have recent equipment in good condition (to minimize air contaminants emissions);
- Heavy equipment maintenance program;
- Fuel oil specifications.

Marine-based Activities

During marine construction, five activities have been identified as having potential to interact with the migratory birds VEC. They include (1) siltation, (2) noise, (3) air emissions, (4) lights and (5) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.3-10).

Siltation

Run-off and associated siltation could result in increased turbidity and sedimentation in the marine environment, thereby having potential to negatively affect the marine birds of the migratory birds VEC (waterfowl/ sea ducks). The mitigations intended to reduce the negative effects of run-off/siltation on marine fish and fish habitat apply to the migratory birds VEC as well and will be detailed in the Construction Environmental Protection Plan (EPP). Mitigations intended to reduce the negative effects of run-off/siltation on migratory birds VEC apply to marine birds (waterfowl/sea ducks) and will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for run-off and siltation include the use of silt curtains (Table 6.3-11) but these measures will be finalized in the EPP. Regardless of the possibility of continuous run-off/siltation throughout the land-based construction phase, appropriate mitigation measures would minimize the potential effects of this activity on the migratory birds VEC. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of run-off/siltation on the migratory birds VEC (waterfowl/ sea ducks) is negligible, <1 km2, and < 12 months, respectively (Table 6.3-11). Based on these criteria ratings, the residual effects of run-off/siltation associated with land-based construction on migratory birds VEC (waterfowl/ sea ducks) are insignificant (Table 6.3-12).

Noise

There are potential interactions between noise and the migratory birds VEC (waterfowl/ sea ducks) (Table 6.3-10). Numerous underwater noise sources will occur continuously in the Project Area during marine construction, including marine vessels, piling installation, and heavy equipment associated with work. It is likely that the most intrusive noise source in relation to waterfowl/sea ducks will be the equipment used to install wharf pilings. Section 6.3 discusses recent publications on the topic of negative effects of pile driving noise on fish and relative sound pressure and attenuation also applies to the migratory birds VEC. The effects of exposure to noise on migratory birds VEC (waterfowl/ sea ducks) are likely to be negligible because this VEC currently over-winters some 10 to 30 km west of the project area, and waterfowl numbers are sparse in the proposed wharf area. If individual sea ducks during migration were exposed to some anthropogenic noise with relatively high sound pressure levels (SPL) (e.g., pile driving) it is likely they would habituate to any associated underwater noises introduced during marine construction be cause they would be below threshold levels in outer coastal areas where these species occurs.

Mitigations intended to reduce the negative effects of noise on migratory birds VEC will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for exposure to noise caused by marine construction include the use of bubble curtains (Table 6.3-11) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of construction noise on SAR fishes and therefore benefit birds. The predicted magnitude, geographic extent and duration of the potential residual effects of exposure to noise on migratory birds VEC are negligible, <1 km2, and 1 to 12 months, respectively (Table 6.3-11). Based on these criteria ratings, the residual effects of underwater noise associated with marine construction on migratory birds VEC (waterfowl/ sea ducks) are insignificant (Table 6.3-12).

Air Emissions

Air emissions from equipment and marine vessels used during marine construction could potentially have some negative contaminating effects on migratory birds VEC (Swallows). Mitigations intended to reduce the negative effects of continuous air emissions on migratory birds VEC will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include equipment maintenance (Table 6.3-11) but these measures will be finalized in the EPP. Regardless of the possibility of continuous air emissions throughout the marine construction phase, appropriate mitigation measures would minimize the potential effects of this activity on migratory birds VEC. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of air emissions on migratory birds VEC are negligible to low, <1 km2, and 1 to 12 months, respectively (Table 6.3-11). Based on these criteria ratings, the residual effects of air emissions associated with marine construction on migratory birds VEC (swallows) are insignificant (Table 6.3-12).

Artificial Lights

Birds when confronted with artificial light can lose their reference to the horizon line (Herbert 1970), or become attracted to lighted areas and become disorientated. Different types of lighting may affect birds differently, and can create synergistic effects that increase potential for collisions with wires and structures. Tall structures with non-blinking lights may be most detrimental to birds.

Mitigations intended to reduce the negative effects of artificial lights on Migratory Birds VEC (Songbirds, Shorebirds, Leach's Storm Petrel) will be detailed in the Construction Environmental Protection Plan (EPP). Measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of artificial lights during construction on Migratory Birds VEC. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on Migratory Birds are low, <1 km2, and 1 to 12 months, respectively (Table 6.3-11). Based on these criteria ratings, the residual effects of artificial lights associated with non-marine construction on Migratory Birds (Songbirds, Shorebirds, Leach's Storm Petrel)) are insignificant (Table 6.3-12).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during marine-based construction activities could potentially have negative effects on migratory birds VEC (waterfowl, seabirds). Section 5.7 describes some of these potential effects. Mitigations intended to reduce the negative effects of marine-based accidental events on migratory birds VEC will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.3-11) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on migratory birds VEC. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine-based accidental events on migratory birds VEC are low to medium, <1 to 100 km2, and <1 to 12 months, respectively (Table 6.3-11). Based on these criteria ratings, the residual effects of marine-based accidental events during construction on migratory birds VEC (waterfowl, seabirds) are insignificant (Table 6.3-12).

Operations

Land-based Activities

During operations, four activities have been identified as having potential to interact with migratory birds. They include, (1) air emissions, including dust, (2) artificial lights, (3) noise, and (4) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.3-13).

Table 6.3-13: Potential Interactions between Operations Activities & Migratory Birds

Valued Ecosystem Component: Migratory Birds						
Project Activity	Feeding		Reproduction		Adult Stage	
	Plankton	Benthos	Eggs/ Nests	Juveniles[1]	Migratory	Resident
Operations Activities and Physical Works						
Non-marine						
Air emissions			x	x	x	x
Noise				x	x	x
Lights				x	x	x
Accidental events	x	x	x	x	x	x
Marine						
Marine effluent	x	x	x	x	x	x
Vessel loading and off-loading	x	x	x	x	x	x
Noise		x	x	x	x	x
Air emissions			x	x	x	x
Lights	x	x		x	x	x
Accidental events	x	x	x	x	x	x

Notes: [1] Juveniles are young birds that have fledged and are often found closely associated with habitats.

Air Emissions (including dust)

Air emissions, including airborne dust, could reduce air quality in the adjacent terrestrial and marine environments, thereby negatively affecting Migratory Birds. This may pertain to chemicals comprising emissions from equipment being used during land-based activities, which could potentially have some negative effects on Migratory Birds (Tree Swallow). Mitigations intended to reduce the negative effects of air emissions, including dust, on Migratory Birds will be detailed in the Operation Environmental Protection Plan (EPP). Candidate mitigations for this activity include water spray dust suppression, the use of silt curtains, and equipment maintenance (Table 6.3-14) but these measures will be finalized in the EPP. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of air emissions on the Migratory Birds (Tree Swallows) are negligible, <1 km2, and 13 to 36 months, respectively (Table 6.3-14). Based on these criteria ratings, the residual effects of air emissions associated with land-based operations on Migratory Birds are insignificant (Table 6.3-15).

Regardless of the possibility of continuous air emissions throughout the land-based construction phase, appropriate mitigation measures would minimize the potential effects of this activity on Migratory Birds as exemplified by Tree Swallows..

Artificial Lights

Birds when confronted with artificial light can lose their reference to the horizon line (Herbert 1970), or become attracted to lighted areas and become disorientated. Different types of lighting may affect birds differently, and can create synergistic effects that increase potential for collisions with wires and structures. Tall structures with non-blinking lights may be most detrimental to birds.

Mitigations intended to reduce the negative effects of artificial lights on Migratory Birds will be detailed in the Operation Environmental Protection Plan (EPP). Measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of artificial lights during operation on Migratory Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on Migratory Birds are low, <1 km2, and 1 to 12 months, respectively (Table 6.3-14). Based on these criteria ratings, the residual effects of artificial lights associated with non-marine operation on Migratory Birds (Songbirds, Shorebirds) are insignificant (Table 6.3-15).

Table 6.3-14: Effects Assessment of Operations Activities on Migratory Birds

Valued Ecosystem Component: Migratory Birds								
Project Activity	Potential Positive (P) or Negative (N) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects					
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/ Socio-Economic
Operations Activities and Physical Works								
Non-marine								
Air emissions	Contamination (N)	Treatment; Compliance monitoring	1	1	1	5	R	2
Noise	Disturbance (N)	Minimization of exposure to noise	1	1	1	5	R	2
Lights	Attraction (N)	Equipment types	1	1	1	2	R	2
Accidental events	Contamination (N)	Rapid Response Plan	1	1	1	1	R	2
Marine								
Marine effluent	Contamination (N)	Treatment; Compliance monitoring	1	1	1	5	R	2
Vessel loading and off-loading	Increased turbidity (N); Contamination (N)	Enclosed loading/off-loading system	1	1	1	2	R	2
Noise	Disturbance (N)	Minimization of exposure to noise	1	1	1	5	R	2
Air emissions	Contamination (N)	Equipment maintenanc e	1	1	1	5	R	2
Lights	Attraction (N)	Equipment types	1	1	1	2	R	2
Accidental events	Contamination (N)	Rapid Response Plan	1	2	1	1	R	1

Table 6.3-15: Significance of Potential Residual Environmental Effects of Operations Activities on Migratory Birds VEC

Valued Ecosystem Component: Migratory Birds				
Project Activity	Significance of Predicted Residual Environmental Effects		Likelihood[a]	
	Significance Rating	Level of Confidence	Probability of Occurrence	Scientific Certainty
Operations Activities and Physical Works				
Non-marine				
Noise	NS	3	-	-
Air emissions	NS	3	-	-
Artificial Lights	NS	3	-	-
Accidental events	NS	3	-	-
Marine				
Marine effluent	NS	3	-	-
Vessel loading and off-loading	NS	3	-	-
Noise	NS	3	-	-
Air emissions	NS	3	-	-
Artificial Lights	NS	3	-	-
Accidental events	NS	3	-	-

[a] Only rated if residual environmental effect predicted to be significant

Key:

Residual environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

Noise

There are potential interactions between noise and Migratory Birds (Table 6.3-13). Numerous noise sources may occur continuously or with sudden onset in the Project Area during non-marine operations, including heavy equipment associated with work.. Potential negative effects of noise on wildlife are discussed earlier in this section. The effects of exposure to noise on Migratory Birds (Songbirds) are likely to be negative but minimal. There is some evidence that prolonged exposure to sound with relatively high sound pressure levels (SPL) could potentially cause negative physiological effects, however, the most likely negative effect will be the displacement of any birds occurring in the immediate vicinity of the noise source as loud noise is expected to attenuate over relatively short distances (< 1 km). Migratory Birds, if present in the vicinity of noise could habituate to the anthropogenic noises or temporarily avoid use of the project area.

Mitigations intended to reduce the negative effects of noise on Migratory Birds will be detailed in the Operation Environmental Protection Plan (EPP). Measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of operation noise on Migratory Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on Migratory Birds are low, <1 km2, and > 72 months, respectively (Table 6.3-14). Based on these criteria ratings, the residual effects of noise associated with non-marine operation on Migratory Birds (Songbirds) are insignificant (Table 6.3-15).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during land-based operation activities could potentially have negative effects on Migratory Birds (Waterfowl and Shorebirds) notably is pollutants enter the waterways. Some of these potential effects are discussed earlier in this section. Mitigations intended to reduce the negative effects of land-based accidental events on Migratory Birds will be detailed in the Operation Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.3-14) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of land-based accidental events on Migratory Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of land-based accidental events on the Migratory bird species are low, <1 to 10 km2, and <1 to 12 months, respectively (Table 6.3-14). Based on these criteria ratings, the residual effects of land-based accidental events during operation on Migratory Birds (Waterfowl and Shorebirds) are insignificant (Table 6.3-15).

Marine-based Activities

Operations

During marine operation, five activities have been identified as having potential to interact with the Migratory Bird VEC. They include (1) marine effluent, (2) vessel loading and off-loading (3) noise, (4) air emissions, (6) artificial lights and (7) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.3-13).

Marine effluent

Effluent that will be discharged into Shoal Cove via Shoal Cove Pond Brook River will have the potential to affect the Migratory Bird VEC (waterfowl/shorebirds) (Table 6.3-14). Depending on the constituents of the effluent, potential effects relate to chemical contamination and total suspended solids. Mitigations intended to reduce the effects of marine effluent on Migratory Bird VEC will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include treatment and compliance monitoring (Table 6.3-14) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine effluent on Migratory Bird VEC. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine effluent on Migratory Bird VEC are negligible to low, <1 km2, and >72 months, respectively (Table 6.3-14). Based on these criteria ratings, the residual effects of marine effluent associated with mine operations on Migratory Bird VEC (waterfowl/shorebirds) are insignificant (Table 6.3-15).

Vessel Loading and Off-loading

The loading and off-loading of marine vessels at the wharf could potentially result in incidental spillage of fluorspar into the marine environment. This activity will have a frequency of <11 events/yr. Regardless of the amount of fluorspar spilled, there is potential for negative effect on the Migratory Bird VEC (waterfowl/sea ducks) through contamination and increased turbidity (Table 6.3-14). Mitigations intended to reduce the negative effects of vessel loading and off-loading on Migratory Bird VEC will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include the use of an enclosed conveyor system (Table 6.3-14) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of vessel loading and off-loading on Migratory Bird VEC. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine effluent on Migratory Bird VEC are low, <1 km2, and >72 months, respectively (Table 6.3-14). Based on these criteria ratings, the residual effects of marine effluent associated with mine operations on Migratory Bird VEC (waterfowl/sea ducks) are insignificant (Table 6.3-15).

Noise

There are potential interactions between noise and the Migratory Bird VEC (waterfowl/sea ducks) (Table 6.3-13). Numerous underwater noise sources will occur continuously in the Project Area during marine operation, including marine vessels, piling maintenance, and heavy equipment associated with work. The effects of exposure to noise on Migratory Bird VEC are likely to be negligible because sea ducks of this VEC currently over-winter in coastal areas some 10 to 30 km from the project area. Other waterfowl are sparse in the area. Waterfowl and gulls would likely habituate to any associated noises introduced during marine operation because they would be below threshold levels in most coastal areas where these species occurs.

Mitigations intended to reduce the negative effects of noise on SAR Birds will be detailed in the Operation Environmental Protection Plan (EPP). Candidate mitigations for exposure to noise caused by marine operation include the use of bubble curtains (Table 6.3-14) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of operation noise on Migratory Bird VEC and therefore benefit birds. The predicted magnitude, geographic extent and duration of the potential residual effects of exposure to noise on SAR Birds are negligible, <1 km2, and > 72 months, respectively (Table 6.3-14). Based on these criteria ratings, the residual effects of underwater noise associated with marine operation on Migratory Bird VEC are insignificant (Table 6.3-15).

Air Emissions

Air emissions from equipment and marine vessels used during marine operation could potentially have some negative contaminating effects on Migratory Bird VEC. Mitigations intended to reduce the negative effects of continuous air emissions on Migratory Bird VEC will be detailed in the Operation Environmental Protection Plan (EPP). Candidate mitigations for this activity include equipment maintenance (Table 6.3-14) but these measures will be finalized in the EPP. Regardless of the possibility of continuous air emissions throughout the marine operation phase, appropriate mitigation measures would minimize the potential effects of this activity on Migratory Bird VEC. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of air emissions on Migratory Bird VEC are negligible to low, <1 km2, and > 72 months, respectively (Table 6.3-14). Based on these criteria ratings, the residual effects of air emissions associated with marine operation on Migratory Bird VEC are insignificant (Table 6.3-15).

Artificial Lights

Birds when confronted with artificial light can lose their reference to the horizon line (Herbert 1970), or become attracted to lighted areas and become disorientated. Different types of lighting may affect birds differently, and can create synergistic effects that increase potential for collisions with wires and structures. Tall structures with non-blinking lights may be most detrimental to birds.

Mitigations intended to reduce the negative effects of artificial lights on Migratory Birds will be detailed in the Operation Environmental Protection Plan (EPP). Measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of artificial lights during operation on Migratory Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on Migratory Birds are low, <1 km2, and 1 to 12 months, respectively (Table 6.3-14). Based on these criteria ratings, the residual effects of artificial lights associated with marine operation on Migratory Birds (Songbirds, Shorebirds) are insignificant (Table 6.3-15).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during marine-based operation activities could potentially have negative effects on Migratory Bird VEC. Section 5.7 describes some of these potential effects. Mitigations intended to reduce the negative effects of marine-based accidental events on Migratory Bird VEC will be detailed in the Operation Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.3-14) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on Migratory Bird VEC. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine-based accidental events on Migratory Bird VEC are low to medium, <1 to 100 km2, and <1 to 12 months, respectively (Table 6.3-14). Based on these criteria ratings, the residual effects of marine-based accidental events during operation on Migratory Bird VEC are insignificant (Table 6.3-15).

6.3.3 Mitigation Measures

Although the operation of the marine terminal will not likely impact these breeding birds, additional ship traffic, particularly of large vessels, may attract nocturnal birds, particularly Leach's Storm Petrels to lit-up vessels travelling at night. Therefore, the guidelines should specify a requirement for mitigation measures for migratory birds to be included in the EA.

6.3.4 Residual Impacts

As shown above, the predicted residual impacts of the Project activities on Migratory Birds during all phases of the Project is *insignificant*.

6.3.5 Effects of Decommissioning

Considering the predicted insignificant residual effects of the routine activities and accidental events of both construction and operations activities on the migratory bird VEC, the residual effects of decommissioning routine activities and accidental events on the migratory bird VEC are also predicted to be insignificant.

6.4 SPECIES AT RISK

6.4.1 Baseline Conditions

This subsection describes the baseline conditions of Species at Risk as they relate to this EPR/EA. It also includes assessment of the potential effects of Project activities on Species at Risk, including appropriate mitigations required to minimize the residual effects.

For the purposes of this document, the Species at Risk VEC includes those animals designated as endangered, threatened or species of special concern on Schedule 1 of the *Species at Risk Act* (SARA) and by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC), as well as those animals listed as threatened or endangered under the *Newfoundland and Labrador Endangered Species Act*.

Most emphasis is placed on those species designated as either endangered or threatened on Schedule 1 of the *Species at Risk Act*, as these have immediate legal implications.

The *Species at Risk Act* (SARA) was assented to in December 2002 with certain provisions coming into force in June 2003 (e.g., independent assessments of species by COSEWIC) and June 2004 (e.g., prohibitions against harming or harassing listed endangered or threatened species or damaging or destroying their critical habitat). The information provided in this section is current as of October 2009 on the websites for SARA and COSEWIC (http://www.sararegistry.gc.ca/default_e.cfm) (http://www.cosepac.gc.ca/index.htm).

The three cetacean species/populations, five bird species/populations, two fish species/populations and one sea turtle species that are legally protected under SARA and have potential to occur in the Study Area are listed in Table 6.4-1. Atlantic wolffish (*Anarhichas lupus*), the Newfoundland population of banded killifish (*Fundulus diaphanus*), the Atlantic population of fin whales (*Balaenoptera physalus*), the eastern populations of Harlequin Duck (*Histrionicus histrionicus*) and Barrow's Goldeneye (*Bucephala islandica*), and Rusty Blackbird (*Euphagus carolinus*) are designated as special concern on Schedule 1 (Table 6.4-1). Species that potentially occur in the Study Area and are considered at risk but which have not received specific legal protection (i.e., proscribed penalties and legal requirement for recovery strategies and plans) under SARA are also designated in Table 6.4-1 as endangered, threatened or species of special concern under COSEWIC. Species designated as endangered by COSEWIC (excluding those also listed as Schedule 1) include the Newfoundland and Labrador population of Atlantic cod (*Gadus morhua*), porbeagle shark (*Lamna nasus*), and Red Knot (*Calidris canutus rufa*) while those designated as threatened include shortfin mako shark (*Isurus oxyrinchus*) and the Newfoundland and Labrador population of American plaice (*Hippoglossoides platessoides*).

Table 6.4-1: Animal Species Potentially Occurring in the Study Area that are Designated as Endangered, Threatened or Species of Special Concern on Schedule 1 of SARA or by COSEWIC, and as Endangered, Threatened or Vulnerable under the *Newfoundland and Labrador Endangered Species Act*

Species		**SARA Schedule 1**			**COSEWIC**			**NLESA**
Common Name	Scientific Name	Endangered	Threatened	Special Concern	Endangered	Threatened	Special Concern	Endangered Species Act
Blue whale (Atlantic population)	*Balaenoptera musculus*	X			X			
North Atlantic right whale	*Eubalaena glacialis*	X			X			
Northern bottlenose whale (Scotian Shelf population)	*Hyperoodon ampullatus*	X			X			
Leatherback sea turtle	*Dermochelys coriacea*	X			X			
Piping Plover *melodus* subspecies	*Charadrius melodus melodus*	X			X			Endangered
Eskimo Curlew	*Numenius borealis*	X			X			Endangered
Red Crossbill	*Loxia curvirostra percna*	X			X			Endangered
Chimney Swift	*Chaetura pelagica*		X			X		
Peregrine Falcon	*Falco peregrinus anatum*		X					Threatened
Northern wolffish	*Anarhichas denticulatus*		X			X		
Spotted wolffish	*Anarhichas minor*		X			X		
Atlantic wolffish	*Anarhichas lupus*			X			X	
Fin whale (Atlantic population)	*Balaenoptera physalus*			X			X	
Harlequin Duck (Eastern population)	*Histrionicus histrionicus*			X			X	Vulnerable
Barrow's Goldeneye (Eastern population)	*Bucephala islandica*			X			X	Vulnerable
Banded killifish	*Fundulus diaphanus*			X			X	Vulnerable
Rusty Blackbird	*Euphagus carolinus*			X			X	

Species		SARA Schedule 1			COSEWIC			NLESA
Common Name	Scientific Name	Endangered	Threatened	Special Concern	Endangered	Threatened	Special Concern	Endangered Species Act
Atlantic cod (Newfoundland and Labrador population)	*Gadus morhua*				X			
Porbeagle shark	*Lamna nasus*				X			
Red Knot *rufa* subspecies	*Calidris canutus rufa*				X			
Shortfin mako shark	*Isurus oxyrinchus*					X		
American plaice (NL[a] population)	*Hippoglossoides platessoides*					X		
Short-eared Owl	*Asio flammeus*						X	Vulnerable
Sowerby's beaked whale	*Mesoplodon bidens*						X	
Harbour porpoise	*Phocoena phocoena*						X	
Killer whale (Northwest Atlantic/Eastern Arctic populations)	*Orcinus orca*						X	
Blue shark	*Prionace glauca*						X	
American eel	*Anguilla rostrata*						X	
Peregrine Falcon	*Falco peregrinus tundrius*							Threatened

Sources: SARA website (http://www.sararegistry.gc.ca/default_e.cfm) (as of 16 October 2009); COSEWIC website (http://www.cosepac.gc.ca/index.htm) (as of 16 October 2009). Newfoundland and Labrador Department of Environment and Conservation website (http://www.env.gov.nl.ca/env/wildlife/wildlife_at_risk.htm) (as of 16 October 2007)

Short-eared owl (*Asio flammeus*), Sowerby's beaked whale (*Mesoplodon bidens*), harbour porpoise (*Phocoena phocoena*), the Northwest Atlantic/Eastern Arctic population of killer whale (*Orcinus orca*), blue shark (*Prionace glauca*), and American eel (*Anguilla rostrata*) are designated as special concern by COSEWIC.

Under SARA, a 'recovery strategy' and corresponding 'action plan' must be prepared for endangered, threatened, and extirpated species. A 'management plan' must be prepared for species designated as special concern. Finalized recovery strategies have been prepared for four species currently designated as either endangered or threatened under Schedule 1: (1) the leatherback sea turtle (ALTRT 2006); (2) North Atlantic right whale (Brown et al. 2009); (3) the spotted wolffish (Kulka et al. 2007), and (4) the northern wolffish (Kulka et al. 2007). Proposed recovery strategies have been prepared for blue whale (Fisheries and Oceans Canada, 2009) and the Scotian Shelf population of Northern bottlenose whale (Department of Fisheries and Oceans Canada, 2009). Final management plans have also been prepared for the Atlantic wolffish (Kulka et al. 2007) and the eastern population of Harlequin Duck (Environment Canada, 2006a), both species currently designated as special concern on Schedule 1. Canada Fluorspar (NL) Inc. will monitor SARA issues through the law gazettes, the Internet and communication with DFO and Environment Canada, and will adaptively manage any issues that may arise in the future. The company will comply with relevant regulations pertaining to SARA Recovery Strategies and Action Plans. Canada Fluorspar Inc. acknowledges the rarity of the Species at Risk and will continue to exercise due caution to minimize impacts on them during all of its operations. Canada Fluorspar (NL) Inc. also acknowledges the possibility of other marine species being designated as endangered or threatened on Schedule 1 during the course of the Project. Due caution will also be extended to any other species added to Schedule 1 during the life of this Project.

Eight bird species and one freshwater fish that potentially occur in the Study Area are listed under the *Newfoundland and Labrador's Endangered Species Act* (Table 6.4-1). Piping Plover (*melodus* subspecies), Eskimo Curlew, and Red Crossbill are currently designated as endangered while Peregrine Falcon (*anatum* and *tundrius* subspecies) is designated as threatened. Banded killifish, Short-eared owl, and the eastern populations of Harlequin Duck and Barrow's Goldeneye are designated as vulnerable. Provincial management plans have been developed for banded killifish (Osborne and Brazil 2006 – in draft form), Barrow's

Goldeneye (Schmelzer, 2006), Harlequin Duck (Environment Canada, 2006a), and Short-eared Owl (Schmelzer 2005). A recovery strategy has been proposed for Red Crossbill (Environment Canada, 2006b).

The following subsections provide profiles for species listed on Schedule 1 of SARA and on *Newfoundland and Labrador's Endangered Species Act*.

6.4.1.1 Species Profiles

This subsection includes profiles of species listed on Schedule 1 of SARA and on *Newfoundland and Labrador's Endangered Species Act*.

Blue Whale (Atlantic Population)

The Atlantic population of blue whale is designated as endangered on Schedule 1 of SARA.

The blue whale has a cosmopolitan distribution but tends to be a pelagic species that only occurs nearshore to feed and possibly to breed (Jefferson et al., 2008). Blue whales became severely depleted during commercial whaling. They are also designated endangered under COSEWIC (COSEWIC, 2008a) and on the IUCN's Red List of Threatened Species (IUCN, 2009). Up to 1,400 animals are thought to occur in the North Atlantic (NMFS, 1998), and Sears et al. (1987) estimated a total of 308 animals from mark-recapture photo-identification studies in the Gulf of St. Lawrence. Little else is known about population size of blue whales in the North Atlantic, outside of the Gulf of St. Lawrence (Waring et al., 2007). Most sightings of blue whales in Canadian waters include sightings during spring, summer, and fall in the Gulf of St. Lawrence or eastern Nova Scotia, and winter sightings off southern Newfoundland (Waring et al., 2007). They primarily feed on euphausids that are most common near the 100 m contour (Sears et al. 1987).

Blue whales are likely found off southern Newfoundland throughout the year (Sears and Calambokidis, 2002). Sightings were mapped along the south coast of Newfoundland from December through May by Meltzer Research and Consulting (1996).

The Newfoundland Region of Fisheries and Oceans Canada has compiled a database of cetacean sightings in waters around Newfoundland and Labrador, encompassing sightings from

1975-2007 (J. Lawson, DFO Marine Mammal Research Scientist, 2009, pers. comm.). These data can be used to indicate what species can be expected to occur off Newfoundland and Labrador, but they cannot provide fine-scale quantitative representations of marine mammal abundance or distribution in the Study Area, at least not at this point in the development of the database.

Several caveats should be noted when considering these data, and include:

1. The sighting data have not yet been completely error-checked;
2. The quality of some of the sighting data is unknown;
3. Most data have been gathered from platforms of opportunity that were vessel-based. The inherent problems with negative or positive reactions by cetaceans to the approach of such vessels have not yet been factored into the data;
4. Sighting effort has not been quantified (i.e., the numbers cannot be used to estimate true species density or areal abundance);
5. Both older and some more recent survey data have yet to be entered into this database. These other data will represent only a very small portion of the total data;
6. Numbers sighted have not been verified (especially in light of the significant differences in detectability among species);
7. For completeness, these data represent an amalgamation of sightings from a variety of years (e.g., since 1975) and seasons. Effort (and number of sightings) is not necessarily consistent among months, years, and areas. Thus seasonal, depth, and distribution information should be interpreted with caution; and
8. Many sightings could not be identified to species, but are listed to the smallest taxonomic group possible.

There was a single blue whale sighting in the entire historical database compiled by DFO (1975-2007) in the Study Area (Figure 6.4-1). This may suggest that blue whales are likely only very rare visitors to the Study Area.

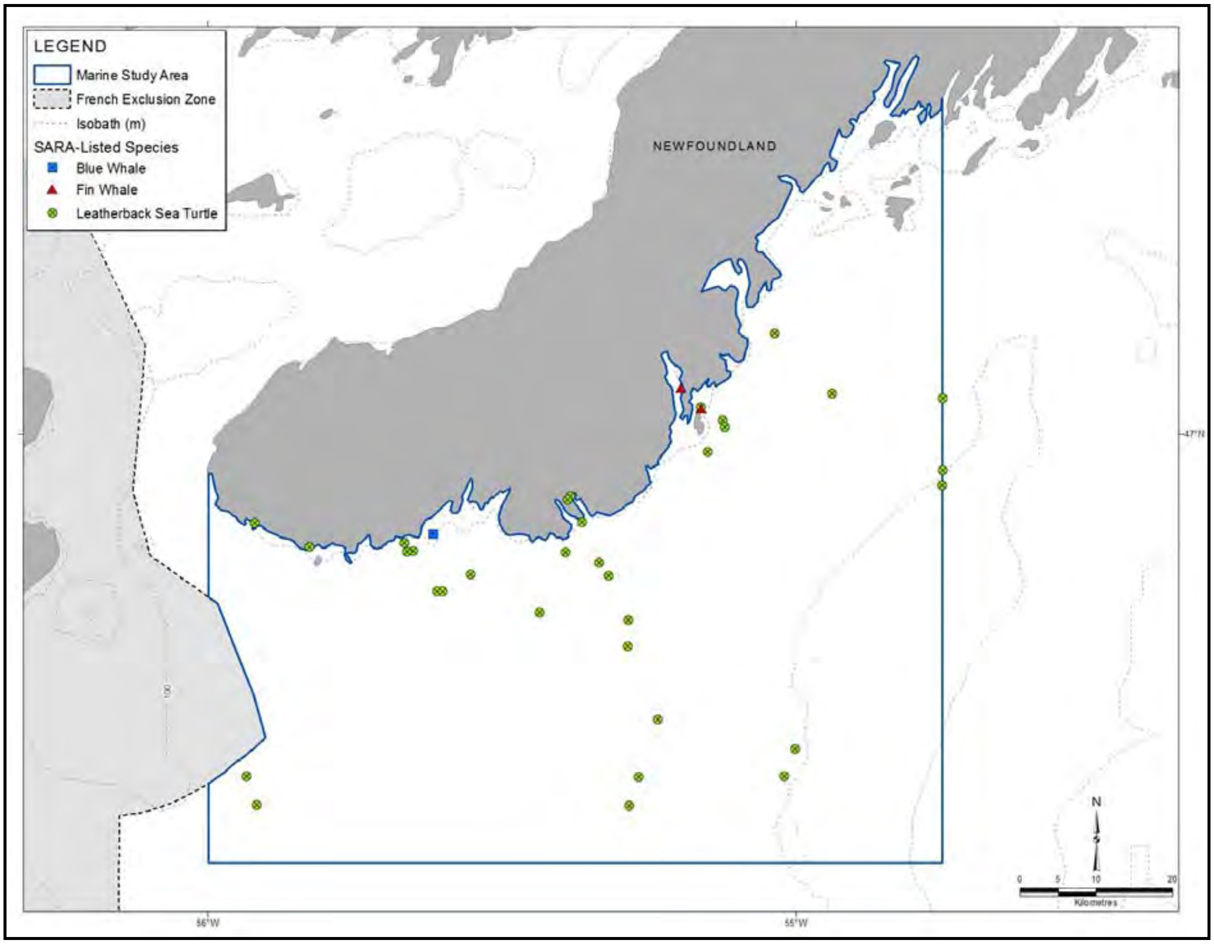

Figure 6.4-1: Blue Whale, Fin Whale, and Leatherback Sea Turtle Sighting in the DFO Sightings Database, 1975 – 2001 Aggregated

North Atlantic Right Whale

The North Atlantic right whale is designated as endangered on Schedule 1 of SARA.

The North Atlantic right whale population is one of the world's most critically endangered large whale populations (Clapham et al., 1999; IWC, 2001). It is also designated as endangered by COSEWIC (COSEWIC, 2008a) and on the 2009 Red List of Threatened and Endangered Species (IUCN, 2009). North Atlantic right whale populations were originally severely depleted by commercial whaling. The population is currently estimated to remain below 350 individuals, and the lack of recovery has been attributed to direct and indirect impacts from human activities, especially collisions with ships and entanglement in fishing gear (IWC, 2001; Brown et al., 2008).

North Atlantic right whales are generally found in continental shelf waters off the eastern U.S. and Canada, but have been known to range as far north and east as Greenland, Iceland, and Norway (Winn et al. 1986; Knowlton et al. 1992). Within Canadian waters, important habitats include summer and fall feeding and nursery grounds in Grand Manan Basin in the lower Bay of Fundy and Roseway Basin on the western Nova Scotian Shelf (Brown et al., 2008). There is a general seasonal north-south migration, but right whales may be seen anywhere within their range throughout the year (Gaskin, 1982). Sparse sightings or information from whaling logbooks include a few winter records from the Gulf of St. Lawrence and coasts of Newfoundland and Labrador (Lien et al. 1989; Knowlton et al. 1992). Historical whaling also occurred during summer in pelagic waters near the eastern edge of the Grand Banks (Reeves and Mitchell 1986). Animals migrate from northern feeding grounds to calving grounds off the southeastern U.S. in late fall to winter and return northward in late winter to early spring. Peak sightings on Canadian feeding grounds occur from August to early October, coinciding with the abundance of their primary prey, calanoid copepods (Baumgartner et al. 2003). Sightings in very deep, offshore waters of the Northwest Atlantic are rare.

Right whales usually occur singly or in small groups, and aggregations are generally associated with feeding (Jefferson et al., 2008). Right whales are slow swimmers and exhibit surface behaviours that make them particularly susceptible to vessel strikes (summarized in Baumgartner and Mate 2003; Brown et al. 2008).

There were no sightings of right whales in the entire historical database compiled by DFO (1975-2007) for the Study Area. While right whales may have historically used portions of the Study Area, they are likely only very rare visitors currently.

Northern Bottlenose Whale (Scotian Shelf Population)

The Scotian Shelf population of northern bottlenose whale is designated as endangered on Schedule 1 of SARA.

Northern bottlenose whales have two primary areas of known concentration in Canadian waters: The Gully just north of Sable Island, Nova Scotia, and Davis Strait off northern Labrador (Reeves et al. 1993). There is currently no abundance estimate for northern bottlenose whales in the Northwest Atlantic (Waring et al. 2007), but there is an estimated 163 whales in the Scotian Shelf population (Whitehead and Wimmer 2005). While the Scotian Shelf population of northern bottlenose whale is also designated as endangered by COSEWIC, northern bottlenose whales are considered data deficient on the Red List of Threatened Species (IUCN 2009). The Scotian Shelf population appears to be highly concentrated in a small region of the eastern Scotian Shelf around the deep waters of three underwater canyons: The Gully, Shortland Canyon, and Haldimand Canyon (Wimmer and Whitehead 2004). The Gully has been designated as a Marine Protected Area in Canada, with a primary goal of protecting this population of bottlenose whales (Harris et al. 2007). Although most sightings occur during the summer, there are winter occurrences and the population presumably remains within this region year-round (Reeves et al. 1993). Current and historical ranges beyond these areas are unknown, but Harris et al. (2007) suggest that potential management plans should limit total allowable human-induced mortality to 0.3 animals per year, maintain at least the current population distribution, and target a stable or increasing population level.

Northern bottlenose whales are deep-divers, and animals tagged off Nova Scotia dove every ~80 min to over 800 m, with a maximum dive depth of 1,453 m (Hooker and Baird 1999a). They forage primarily on large-bodied squid and travel in small groups that may consist of individuals of different age and sex classes, although males appear to form long-term associations with other mature males (Gowans et al. 2001).

Northern bottlenose whales have been detected acoustically between the eastern Scotian Shelf canyons and the Laurentian Channel (Harris et al. 2007). Harris et al. (2007) also report few opportunistic sightings along the southern Grand Banks, but it is unknown to which population these individuals belong.

There were no sightings of Northern bottlenose whales in the entire historical database compiled by DFO (1975-2007) for the Study Area. There were 12 sightings of Northern bottlenose whales off southern Newfoundland in the DFO sightings database; all occurring in offshore slope areas. Sightings occurred in spring and summer, primarily in waters 500-1500 m deep. If Northern bottlenose whales occur in the Study Area, they are likely only very rare visitors.

Leatherback Sea Turtle

The leatherback sea turtle is designated as endangered on Schedule 1 of SARA.

Leatherback turtles are the largest and most widely distributed sea turtle, ranging from sub-polar waters to tropical and subtropical breeding grounds, and are found in all of the world's oceans (Spotila 2004). The worldwide population of leatherback sea turtles is currently estimated at 35,860 females (Spotila 2004). Kenney (1996) estimated that several hundred individuals use the continental shelf waters of the northeast U.S. There is no estimate of the number using Newfoundland waters.

Leatherbacks have wide-ranging oceanic movements and predominantly feed on gelatinous zooplankton (Hays et al. 2004; Eckert 2006). Mating is thought to occur offshore during migrations, although mating has also been observed near nesting beaches. For North Atlantic leatherback turtles, nesting occurs from March–July on sandy beaches of the Caribbean and Central and South America. It is thought that leatherbacks follow the Gulf Stream in the Northwest Atlantic because their primary prey, jellyfish, are concentrated where the Gulf Stream meets the colder waters of the Labrador Current.

Leatherbacks tagged off of Cape Breton and mainland Nova Scotia during summer remained off eastern Canada and the northeastern U.S. coast before most began migrating south in October (James et al. 2005). Some of these tags remained attached long enough to observe subsequent northward migrations, with animals leaving nesting grounds during February–March and typically arriving in the Northwest Atlantic (north of 38ºN) during June. These turtles usually returned to areas within several hundred kilometers of where they were observed in the previous year. At least two of the eight tagged turtles entered the Study Area during their movements in Canadian waters.

Adult leatherbacks are often sighted in the waters off Nova Scotia and Newfoundland from June to October, with peak abundance in August and September. Witzell (1999) described the distribution of leatherbacks incidentally caught in the U.S. pelagic longline fishery; nearly half of the leatherbacks caught between 1992 and 1995 from the Caribbean to Labrador were captured in waters on and east of the 200 m isobath off the Grand Banks. However, it should be noted that effort was also focused in these areas. Incidental catches occurred from June to November but peaked from July to September.

According to the DFO sightings database (1975 – 2007), leatherbacks are the most common of the sea turtles that may occur in the Study Area, perhaps due to the leatherback's ability to maintain a body temperature of 25ºC in sea water as much as 18ºC cooler. Sightings have been reported throughout the Study Area, in both offshore and inshore waters, including near the opening of Great St. Lawrence Harbour and within Little St. Lawrence Harbour. It is expected that adult leatherback turtles will occur in the Study Area, at least occasionally, from June to November.

Piping Plover

The Piping Plover *melodus* subspecies is designated as endangered on Schedule 1 of SARA and *Newfoundland and Labrador's Endangered Species Act*.

The *S. m. melodus* subspecies of the Piping Plover is a shorebird that breeds along the Atlantic coast from Newfoundland to South Carolina. It winters along the Atlantic coast, from South Carolina to Florida, and in the Caribbean (Cuba, Bahamas). In Canada, this subspecies breeds on the Magdalen Islands of Quebec, New Brunswick, Nova Scotia, Prince Edward Island and Newfoundland. About 25% of Canada's Piping Plovers are found in the Atlantic Provinces (the remainder, consisting of the *S. m. circumcinctus* subspecies, occur mostly in the Prairie Provinces). Surveys conducted since 1996 indicate that the population of the *S. m. melodus* subspecies has remained relatively stable, but at a level far below 670 adults, a goal set by the recovery team working on this population. There were approximately 481 adult Piping Plovers (220 pairs, 43 singles) detected in 2001 (Environment Canada 2009).

Piping Plovers nest above the normal high-water mark on exposed sandy or gravelly beaches. On the Atlantic coast they often nest in association with small cobble and other small beach debris on ocean beaches, sand spits, or barrier beaches. They also forage for food on these beaches. In migration, Piping Plovers occur on coastal sandy beaches but also sometimes occur inland on beach habitats associated with lakes and ponds.

The most important factor limiting recovery of Piping Plovers is loss of habitat, mostly caused by human use of beaches, and the consequent human disturbance around nesting sites. Crows, gulls, foxes and raccoons prey on the eggs and young, as can dogs and cats. Predators, such as gulls, can be attracted to the nesting areas by garbage left by picnickers or depredate nests when plovers are flushed by humans. Changes in water levels caused by such events as seasonal storms and spring tides are also detrimental to the nesting efforts of this bird. Global warming may further reduce the habitat of Piping Plovers as sea levels continue to rise and larger scale flooding events become more prominent on the Atlantic coast.

Damage or destruction to the nest includes loss of access, function and/or structure of the nest. Of concern under SARA are direct and indirect anthropogenic effects on the residence. This includes, but is not limited to, water management (flooding), cattle management (trampling nests), recreational activities (e.g. beach activities, pets, all terrain vehicles (ATV) or other motorized or non- motorized vehicles), sand mining and extraction, discharge of oil/effluents, and industrial, cottage and landscape developments and/or modification activities (beach cleaning, trampling, leveling, or dumping) (SARA 2009).

Within the Study Area, Piping Plovers are likely migrant species with some prospecting pairs in spring.

Eskimo Curlew

The Eskimo Curlew is designated as endangered on Schedule 1 of SARA and *Newfoundland and Labrador's Endangered Species Act*.

The Eskimo Curlew is a mottled brownish shorebird with long legs and a fairly long, thin, slightly down-curving bill. It resembles the more common Whimbrel but is much smaller. The Eskimo Curlew was once one of the most numerous birds in Canada. The known breeding range was located entirely within the Mackenzie District of the Northwest Territories, but it probably bred throughout much of the Northwest Territories, possibly in the Yukon and Alaska, and perhaps in extreme western Russia. During migration it was found in all provinces except British Columbia. The species wintered in South America. The historic population was estimated to be in the hundreds of thousands, if not in the millions, before 1860, but declined dramatically in the 1870s to 1890s, and the species was almost extinct by 1900. No positively identified Eskimo Curlew nests or birds behaving as if they had nests or young have been found since 1866, even though searches have been carried out in historical breeding ranges in the 1970s, 1980s, and 1990s. In addition, no Eskimo Curlews were found during extensive searches in historical wintering areas of Argentina and Uruguay in 1992–1993. Population estimates from the 1970s, 1980s, and 1990s varied from 23 to 100 birds; however, these were based on guesswork. It is possible that this species has since gone extinct (Environment Canada 2007).

Eskimo Curlews formerly bred in the tundra and woodland transition zones of the Mackenzie District in the Northwest Territories, and possibly occurred as far west as Alaska or even Siberia. The breeding habitat consisted of treeless upland tundra with dwarf shrubs and grassy tundra meadows. During fall migration, the birds used a variety of coastal and terrestrial habitats. They fed in areas of crowberry, salt marsh, meadows, pastures, old fields, intertidal flats and sand dunes. During the winter in the pampas of Argentina, they used treeless grasslands with wetlands and may have used wetter grasslands and intertidal areas. In spring, the curlews were found in tallgrass and eastern mixed-grass prairies, often in areas disturbed by recent fires, areas near water disturbed by grazing bison, and in cultivated fields.

Eskimo Curlews were hunted extensively because they were considered a delicacy, travelled in large dense flocks. Uncontrolled hunting during spring and fall migration is probably the most important reason for the drastic decline in numbers. In the fall, thousands were shot in Labrador, and many thousands were killed in New England when birds were forced to land by storms. Each spring huge numbers were shot in the Great Plains of the United States by market hunters. The role of habitat loss or of other possible limiting factors cannot be assessed, but habitat loss and alteration (e.g., conversion of grasslands to croplands) at staging sites in Canada and the United States and in wintering areas in South America may have contributed to the species' decline.

It is unlikely that Eskimo Curlew occur in the Study Area.

Red Crossbill

The Red Crossbill is designated as endangered on Schedule 1 of SARA and *Newfoundland and Labrador's Endangered Species Act*.

The crossed tips of the strong bills of Red Crossbills allow them to pry open conifer cone scales to get at the seeds inside, on which they feed. Various types of Red Crossbills are widely distributed in North America, with their range corresponding to that of the boreal forests and other habitats where conifers are found. In Canada, the species ranges from British Columbia to the Maritimes and the island of Newfoundland, but nests of the percna subspecies have been found in Newfoundland only. These birds do seem to leave the island on occasion; a few large-billed birds that may have belonged to this subspecies have been observed and collected in the Maritimes, New England and Quebec. Because this subspecies is hard to identify in the field, it is not certain that all of the Red Crossbills observed in Newfoundland have in fact been of the *percna* subspecies.

Though there are no quantitative data, Red Crossbills were once considered abundant in Newfoundland. Over the past 50 years, the bird has experienced a marked decline. Currently, this species is very rare throughout the island and is observed very infrequently and erratically in both formal and informal surveys. A rough estimate of the current population size - 500 to 1500 individuals - is based on field observations, Christmas bird counts, breeding bird surveys and other surveys, which suggest that the order of magnitude of the population could range from the hundreds to the low thousands (COSEWIC 2004).

Red Crossbills are highly specialized for conifer habitats. Unlogged or mature forests that produce abundant cones are this bird's preferred habitat. Habitats that furnish the Red Crossbill *percna* subspecies with conifer seeds are large, mature black spruce and balsam fir stands and, on smaller scales throughout the island, red pine, white pine, and white spruce stands. In addition to foraging in these stands, the bird also roosts and nests there; however, the foraging sites can be distant from the roosting and nesting sites. When conifer seeds are scarce, Red Crossbills sometimes move into non-coniferous areas in search of food.

The ongoing degradation and modification of the boreal forests pose significant threats to the survival of Red Crossbills in Newfoundland. Insect and fungal infestations and forestry practices, particularly clear-cuts, represent a direct threat that reduces overall cone production on the island. Other threats include potential competition with red squirrels for food (particularly during periods when cones are less abundant) and predation of Red Crossbill nests by red squirrels.

Red Crossbill is possibly an uncommon migrant that may breed on rare occasion in the Study Area.

Chimney Swift

The Chimney Swift is designated as threatened on Schedule 1 of SARA.

The Chimney Swift is a small bird with dark brown, slightly iridescent plumage that is sometimes mistaken for a swallow. It breeds mainly in eastern North America, from southern Canada down to Texas and Florida, and over-winters in the upper Amazon basin in South America (mainly in Peru), southern and north-eastern Ecuador, north-western Brazil, and northern Chile.

The species breeds in east central Saskatchewan, southern Manitoba, southern Ontario, southern Quebec, New Brunswick, Nova Scotia, and possibly in Prince Edward Island and southwestern Newfoundland where its population is estimated at 11,820 breeding individuals: 2,520 in Quebec, 7,500 in Ontario, 900 in the Maritimes, and 900 in the other provinces. Chimney Swift populations are declining in all areas of occurrence. Data from the Breeding Bird Survey indicate that the Canadian population has been declining by 7.8% per year since 1968, which represents a total decline of 95% (COSEWIC 2007a).

The Chimney Swift is a gregarious species that feeds and rests in large flocks on flying insects. Historically, Chimney Swifts nested mainly in the trunks of large, hollow trees, and occasionally on cave walls or in rocky crevices. Today, the species is mainly associated with urban and rural areas where the birds can find chimneys to use as nesting and resting sites.

The Chimney Swift's winter habitat includes forests along the water's edge, the edges of tropical lowland forests, regenerating shrub areas, farmland, suburban areas and city centre zones. It roosts in chimneys, crevices and caves, as well as in the hollow trees that are plentiful in the Amazon forest.

The most significant threats to the Chimney Swift population appear to be the decreasing number of nesting and roosting sites caused by logging operations, the demolition of old abandoned buildings and, especially, the sharp decline in the number of suitable and accessible traditional chimneys, which are this species' main breeding habitat. The growing popularity of electric and gas heating, the renovation of old traditional chimneys, and new fire prevention regulations (installation of metal liners in brick chimneys, and installation of fire-screens, caps and mesh covers to keep animals out of chimneys) have resulted in a decrease in the number of traditional chimneys that could be used by Chimney Swifts.

The Chimney Swift is migrant in the Study Area and has been reported as numerous in the St. Lawrence area in October-November 2005. One Chimney Swift was reported in April 2006 (N. Wilson, pers. comm.).

Peregrine Falcon

The *F.p. anatum* subspecies of Peregrine Falcon is designated as threatened on Schedule 1 of SARA and *Newfoundland and Labrador's Endangered Species Act*. Though not listed under Schedule 1 of SARA, the *F.p. tundrius* is listed as threatened by *Newfoundland and Labrador's Endangered Species Act*.

The Peregrine Falcon is a bird of prey the size of a common crow. It has long, pointed wings that allow it to fly at record speeds of up to 300 km/h in a swoop. The three subspecies that nest in Canada are very similar, with slight differences found in the colouring of the plumage and size of the bird. In Canada it is found in all territories and provinces. It does not breed in Prince Edward Island, Nunavut or the Island of Newfoundland. The number of *F. p. anatum* and *F. p. tundrius* Peregrine Falcons has considerably increased since 1970, especially from 2000 to 2005. Populations increased by 43% in occupied sites in southern Ontario and by 107% in southern Quebec, which suggests that Peregrine Falcon populations are almost as abundant as they were before the collapse resulting from the use of organochlorine pesticides (COSEWIC 2007b).

The Peregrine Falcon is found in various types of habitats, from Arctic tundra to coastal areas and from prairies to urban centres. It usually nests alone on cliff ledges or crevices, preferably 50 to 200 m in height, but sometimes on the ledges of tall buildings or bridges, always near good foraging areas. Suitable nesting sites are usually dispersed, but can be common locally in some areas (COSEWIC 2007b). The Peregrine Falcon primarily feeds on birds that it typically catches in flight. Its prey has also been known to include bats, rodents and other mammals (COSEWIC 2007b).

Reproductive failure caused by exposure to organochlorine pesticides, in particular DDT, is the main factor for the historic decline of North American Peregrine Falcon populations. Use of these pesticides causes a thinning and subsequent breaking of the egg shells during incubation. Since organochlorine pesticides were banned in Canada and the United States in the early 1970s and in Mexico in 2000, there has been a decrease in the levels of these pesticides in Peregrine Falcon tissues, which has been associated with the increase in reproductive success over the last few years. However, pesticide levels still exceed critical limits in some individuals, and organochlorine pesticides are still used in some parts of the wintering grounds of the *anatum* and *tundrius* subspecies. It was recently shown that new pesticides regularly used in the country, i.e., polybrominated odiphenyl ethers, also represent a potential threat for the species. However, the effects of these chemicals, found in high concentrations in the tissues of some Peregrine Falcons, are unknown (COSEWIC 2007b).

The Peregrine Falcon is an infrequent migrant in coastal areas, particularly in the fall. This species was recently observed in and around St. Lawrence area (N. Wilson, pers. comm.).

Wolffishes

Three species of wolffish (i.e., northern, spotted, and Atlantic) are the only fishes currently listed on Schedule 1 of SARA. Both the northern (*Anarhichas denticulatus*) and spotted (*Anarhichas minor*) wolffishes are currently designated as threatened on Schedule 1 of SARA and under COSEWIC. The Atlantic wolffish (*Anarhichas lupus*) is currently designated as a species of special concern on Schedule 1 of SARA and under COSEWIC. A Recovery Strategy for northern and spotted wolffishes and a Management Plan for Atlantic wolffish were recently published (Kulka et al. 2007).

Wolffish, also known as catfish, are solitary bottom-dwelling fish. They typically occur over hard clay and sand substrates (Scott and Scott 1988). Three species of wolffish are found in the Study Area: Atlantic wolffish, spotted wolffish and northern wolffish. These three species have a large distribution in the Northwest Atlantic, inhabiting most of the Labrador and Newfoundland shelves from the Davis Strait south to the Gulf of Maine (Kulka and DeBlois 1996; DFO 2002). Wolffish occur throughout the Study Area as indicated by DFO commercial fisheries data from 1999 to 2008 (Figure 6.4-2).

Tagging studies conducted in the 1960s have shown that wolffish are sedentary and undergo limited migration. Most individuals were recaptured within 8 km of release (Templeman 1984).

Wolffish are bathypelagic and benthic predators, preying on jellyfish, comb jellies, crabs, bivalves, echinoderms and fish (primarily those discarded by trawlers). There are few predators of wolffish species. Northern wolffish have been found in the stomachs of redfish and Atlantic cod. Spotted wolffish have been found in the stomachs of pollock, Atlantic cod, and Greenland sharks (*Somniosus microcephalus*). Predation of Atlantic wolffish has not been observed; however, juveniles have been found in the stomachs of Atlantic cod (Scott and Scott 1988).

Because wolffish are not the direct target of a commercial fishery, there is little information on their life history in Canadian waters. It is known that they have low productivity, with very few sperm and eggs produced per fish when compared with other fish species; although internal fertilization, nesting habits and egg guarding behavior increases the potential for survival of the large (2 cm long) larvae (Pavlov 1994; Keats et al. 1985; Wiseman 1997). As wolffish undergo limited migration, it is likely that they spawn within the Study Area. Information regarding the spawning times and nesting and egg guarding behaviors of all wolffish is limited, but the northern wolffish appears to spawn in the late fall or early winter (Templeman 1985; 1986).

In the mid-1990s, a large decline in wolffish numbers was observed (Kulka and DeBlois 1996). An unpublished COSEWIC report determined northern and spotted wolffish had each declined in abundance by more than 90 percent over three generations and that their geographic distribution had significantly decreased (D. Kulka, pers. comm.). The reasons for decline included mortality as bycatch and habitat alteration by trawlers. The northern and spotted wolffish were designated as threatened by COSEWIC, and were subsequently added to Schedule 1 of SARA, in 2001, legally protecting the species and its critical habitat.

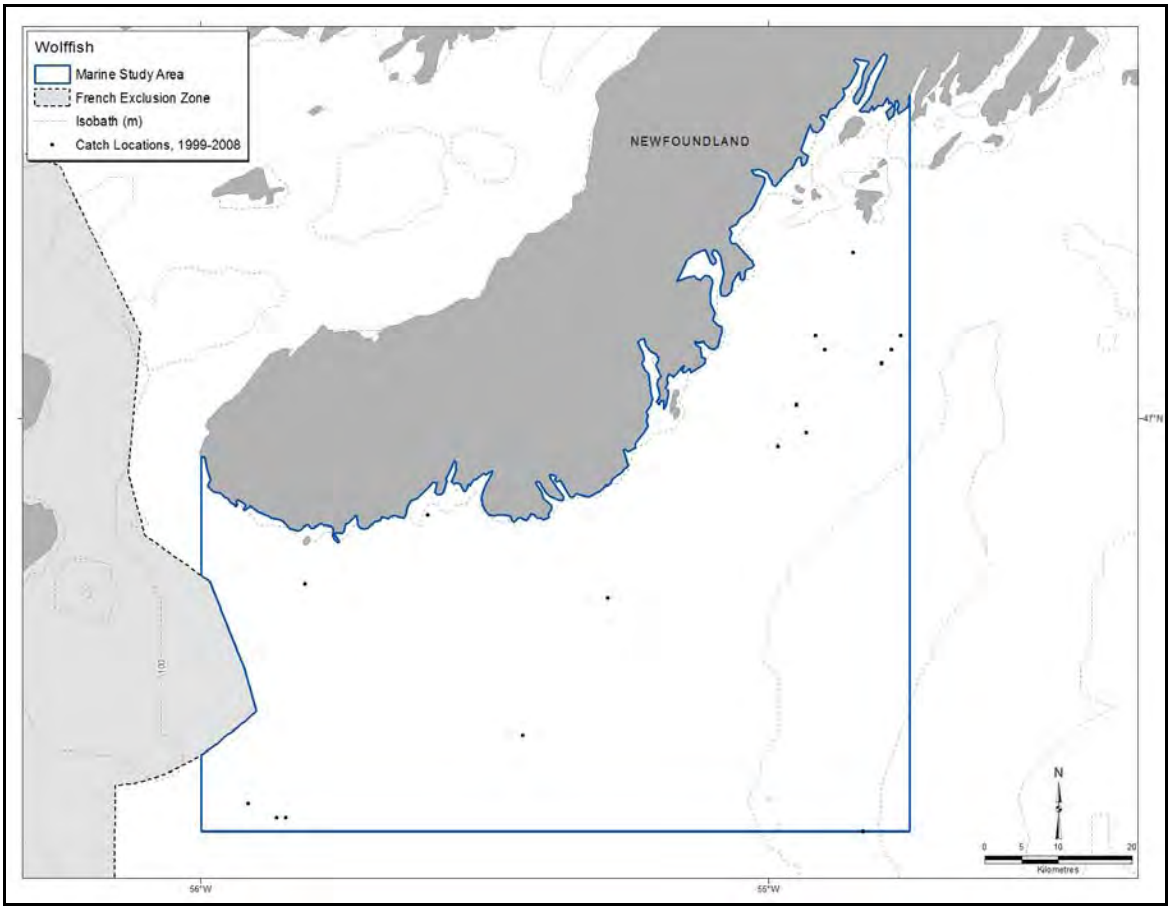

Figure 6.4-2: Unspecified Wolffish Harvesting Locations, All Months, 1999 – 2008 Combined

Fin Whale (Atlantic Population)

The Atlantic population of fin whale is designated as a species of special concern on Schedule 1 of SARA.

The fin whale is found in all of the worlds oceans, typically offshore in temperate to polar regions (Jefferson et al. 2008). It is one of the most commonly observed species in continental shelf waters from the U.S. mid-Atlantic coast to eastern Canada (Waring et al. 2007). There is an estimated 35,500 fin whales in the North Atlantic (IWC 2007b, Waring et al. 2007), with 2269-2814 found in the Northwest Atlantic (COSEWIC 2005; Waring et al. 2007). Fin whales are also considered a species of special concern by COSEWIC (COSEWIC 2008a) and as endangered on the IUCN's Red List of Threatened Species (IUCN 2009).

Fin whales eat euphausids and small fish (Borobia et al. 1995) and tend to concentrate in areas near thermal fronts or shallow areas with high topographic variation that help to mix and stratify the water column (Woodley and Gaskin 1996; Doniol-Valcroze et al. 2007). They can be found as individuals or groups of 2–7 animals, but can form much larger feeding aggregations, sometimes with humpback and minke whales (Jefferson et al. 2008).

Fin whales are common within the Gulf of St. Lawrence and off Nova Scotia during the summer (COSEWIC 2005), primarily nearshore. Fin whales have also been commonly observed on the Grand Banks during summer months (Piatt et al. 1989). Fin whale sightings along Newfoundland's south coast were mapped in Meltzer Research and Consulting (1996) from January through May. There were two sightings of fin whales in the historical database compiled by DFO (1975-2007) for the Study Area, north of St. Lawrence Harbour (Figure 6.4-1).

Harlequin Duck

The eastern Harlequin Duck (*Histrionicus histrionicus*) is currently listed as a species of special concern on Schedule 1 of SARA and vulnerable under the *Newfoundland and Labrador Endangered Species Act*.

In 1990, the eastern population of Harlequin Duck was designated as endangered based on small (< 650 individuals) and declining over-wintering population remaining along the eastern seaboard (Goudie 1991). With cessation of hunting and extensive education programs, the population wintering along the eastern seaboard has recovered to historically high levels. In 2002, the eastern population in Canada was re-designated as a species of special concern although COSEWIC has not recognized the recommended Greenland-wintering and eastern seaboard wintering populations (Thomas and Robert 2002). The longest term monitoring database for the Harlequin Duck and other sea duck species in coastal Newfoundland is the Cape St. Mary's Christmas Bird Count. These data support a strong recovery in wintering numbers for Harlequin Ducks.

The Harlequin Duck is specialized to breeding along fast moving rivers and streams in summer and over-winters along rocky outer coastlines where it feeds in shallow waters (< 10 m) on crustaceans and molluscs (Robertson and Goudie 1999). Its habitat in winter overlaps with that of other sea ducks, notably Common Eiders.

The population of Harlequin Ducks wintering along the eastern seaboard is likely distinct from that wintering in Greenland. The eastern seaboard population is probably in the range of 2,000 to 3,000 individuals, and is concentrated at a small number of traditional wintering sites. Some of these locations, such as Cape St. Mary's, are subjected to chronic oil pollution related to marine vessels transiting the area. Hunting is likely the major cause for historical declines because since cessation numbers recorded on CBC have reached historically high records suggesting that populations are not limited by underlying ecological causes.

Surveys for Harlequin Ducks were completed in Placentia Bay area in winter-spring 2007 of marine archipelago and headland areas in western Placentia Bay and southern Burin Peninsula of Newfoundland included sites that were reported to have wintering Harlequin Ducks in the past (Goudie 1991). All wildlife were recorded, and three to four thousand sea ducks were noticeably concentrated in the area from St. Lawrence west to Point May on the Burin Peninsula. Those surveys confirmed only one isolated group of twelve Harlequin Ducks wintering in proximity to Morgans Island (The Breadbox) adjacent to Allan's Island near Lamaline, Burin Peninsula. The small group of Harlequin Ducks observed by LGL biologists in March and April 2007 was confirmed by CWS during boat surveys in winter of 2007-2008 confirming that the group is resident to this area in winter-spring. Harlequin Ducks are frequently observed in small numbers in the southern Burin Peninsula area in fall-early winter and many may be in migration (P. Thomas, CWS, Pers. Comm.) There is considerable coastal habitat that supports notable populations of over-wintering sea ducks in this area.

Within the Study Area, Harlequin Ducks are migrants in fall with a small remnant wintering population. They may have been more abundant historically in the southern Burin coastal area.

Barrow's Goldeneye

The eastern population of Barrow's Goldeneye is currently designated as a species of special concern on Schedule 1 of SARA and vulnerable under the *Newfoundland and Labrador Endangered Species Act*.

In Canada, most Barrow's Goldeneyes breed and over-winter west of the Rocky Mountains and to a lesser extent in Alberta and southern Yukon. The limits of the range of the eastern population of Barrow's Goldeneye are still unknown. Data indicate that it breeds only in Canada with the only confirmed breeding records are from Quebec. Small numbers of this population winter in the Maritime Provinces and along the northern Atlantic coastline in the United States. About 3,500 to 4,000 birds of this species over-winter in Quebec, 2,500 over-winter along the St. Lawrence Estuary, 1,000 to 1,500 along the Gulf of St. Lawrence, and approximately 400 in the Atlantic Provinces and Maine. Based on this information, the wintering population of Barrow's Goldeneye in eastern Northern America is estimated at about 4,500 individuals or 1,400 pairs (30% of birds are adult females). Specific population trends are unknown but it is believed that the eastern population of the species declined during the 20th Century and that it may still be declining (SAR 2009).

Similar to the more ubiquitous Common Goldeneye, Barrow's Goldeneye nest primarily in tree cavities, more rarely in rock crevices and other cavities, and the species can easily adapt to using nest boxes. The Barrow's Goldeneye feeds in inland waters during the breeding season, where its diet includes aquatic insects and crustaceans. During winter, its diet focuses on the molluscs and crustaceans of coastal waters. At this time it is sometimes observed with flocks of Common Goldeneye.

A large proportion of the eastern population congregates in a few areas along the St. Lawrence River corridor where it is very vulnerable to contamination and pollution. Hunting is of concern because even a low harvest could have a significant impact on this small population. It is very difficult to distinguish this species from Common Goldeneye. Commercial Forest exploitation is a threat to the quality of breeding habitats for this species because clear-cutting removes all trees, and management tends to favour removal of forests before they are old and suitable for nest cavities (e.g. snags). Stocking lakes with trout may reduce the quality of lakes for Barrow's Goldeneye because of increased competition for invertebrate foods.

Barrow’s Goldeneye have not been reported in the Study Area. Common Goldeneye occur in small numbers, and during the non-breeding season it is possible that Barrow’s Goldeneye could be a vagrant.

Banded Killifish

The Newfoundland and Labrador population of banded killifish is designated as a species of special concern on Schedule 1 of SARA and as vulnerable on *Newfoundland and Labrador’s Endangered Species Act*.

The banded killifish is found in eastern North America, with seven documented sites in Newfoundland and Labrador, primarily in clear lakes and ponds with a muddy or sandy bottom in coastal areas in the south and west coasts of the island (Figure 6.4-3) (Chippett 2003; Osborne and Brazil 2006). Within the Study Area, two populations occur on the Burin Peninsula, one population near Winterland and the other in Freshwater Pond, both located north of Great St. Lawrence Harbour (Chippett 2003; Osborne and Brazil 2006).

Schools of banded killifish will stay in the same area for long periods of time (SAR 2009). The smaller fish tend to school in groups of 8 to 12 individuals at the edges of still water where there is abundant riparian vegetation for shelter. Schools of mature fish commonly occur in more open areas at the outflow of streams and brooks (SAR 2009). Although it usually inhabits freshwater streams and lakes, it is infrequently found in estuarine or marine waters (Fritz and Garside 1974). It is unlikely that it would occur in the deeper portions of the Study Area.

Figure 6.4-3: Approximate Distribution of Newfoundland Population of Banded Killfish

In Newfoundland, banded killifish spawn from late June through to the middle of August (SAR 2009). When spawning, males undergo a drastic colour change, with the lower portion of the body, including the area around the anal fin, transforming into a brilliant iridescent blue. Males select breeding areas in quiet weedy pools, and defend them vigorously with circling bouts that can lead to a pursued male being forced out of the water. Similarly sized males and females tend to pair off. The female releases eggs that are attached to individual adhesive threads, which adhere to plants. They hang in clusters of 5 to10 eggs that the male then fertilizes. Evidence indicates that breeding occurs later for the Newfoundland population, and that the females have slightly larger and many more eggs than banded killifish that are found in the United States.

Small banded killifish (from one to two years old) feed on midge (chironomid) larvae, ostracods, water fleas, copepods, and some flying insects (SAR 2009). Once they are from three to four years old, the larger banded killifish swim in smaller schools of three to six individuals. These larger banded killifish supplement the above diet with the nymphs of damselflies, dragonflies, and mayflies as well as molluscs, flatworms (turbellarians), and small crustaceans.

Banded killifish are themselves prey for Atlantic salmon, brook trout, and American eels, as well as Belted Kingfishers and Common Mergansers (SAR 2009).

Rusty Blackbird

The Rusty Blackbird is designated as a species of special concern on Schedule 1 of SARA.

The Rusty Blackbird (*Euphagus carolinus*) is a medium-sized passerine breeding range of 7.6 million km^2, including most Canadian provinces and territories, the state of Alaska, several Great Lakes states and most New England states. The Canadian population, includes approximately 70% of the global breeding population, and is estimated at between 110,400 and 1.4 million individuals. The population of Rusty Blackbirds has declined significantly over the last 40 years at a rate of -5.1%/year since 1966, meaning the population has decreased by approximately 85% since the mid-1960s. Short-term analyses show an annual rate of decline of -2.1% between 1994 and 2003, meaning the population has further decreased by 18.3% over the last 10 years. The winter range of the Rusty Blackbird includes most of the mid- to eastern states of the United States, although it winters irregularly in the southern part of most Canadian provinces (COSEWIC 2006).

The breeding habitat of the Rusty Blackbird corresponds closely to the boreal forest. Within this biome, its habitat is characterized by forest wetlands, such as slow-moving streams, peat bogs, sedge meadows, marshes, swamps, beaver ponds and pasture edges. In winter, it occurs primarily in damp woodlands and cultivated fields

More than 70% of the breeding range of the species is in the boreal forest of Canada. The species has experienced a severe decline that appears to be ongoing, albeit at a slower rate in recent years. There is no evidence to suggest that this trend will be reversed. The primary cause of habitat loss for the Rusty Blackbird, particularly in its winter range, is the conversion of wetland for agriculture and urban development. Known threats include habitat conversion and blackbird control programs in the United States (COSEWIC 2006). The Rusty Blackbird has no protection in Canada under the *Migratory Birds Convention Act* (1994). Blackbirds are considered pests in Canada and the United States, and can be killed during control programs for nuisance birds. In Newfoundland and Labrador, this species would fall under the jurisdiction of Department of Environment and Conservation.

Within the Study Area, the Rusty Blackbird is a sparse breeder in the St. Lawrence area with the odd over-wintering occurrence. The Rusty Blackbird was seen once at the mill site, and most reported sightings were close to the cemetery on the outskirts of St. Lawrence (N. Wilson, pers. comm.).

Short-eared Owl

The Short-eared Owl is designated as vulnerable under *Newfoundland and Labrador's Endangered Species Act*.

The Short-eared Owl is a medium-sized, buffy-white owl with very short ear tufts. In Canada, it breeds in every province and territory, from the southern border to the low Arctic. It is absent from the Boreal Forest and other heavily forested areas. In the winter it withdraws from the northern parts of its range, and remains only in the southern parts of most provinces. The owl now occurs in small numbers throughout its Canadian range. Exact numbers are not known but during the 20th century, population sizes were thought to have decreased (COSEWIC 2008b).

The owl prefers extensive stretches of relatively open habitat. It is primarily a bird of marshland, peatland, and deep grass fields. It likes to hunt and roost in abandoned pastures, fields, open heathlands, airports, young conifer plantations and marshes in the winter. It frequents prairies, grassy plains, alluvial meadows, peatlands or tundra in the summer.

Large-scale destruction of native prairie grasslands has been particularly hard on this species. Natural succession, wetland drainage, urban expansion and increasingly intensive farming have contributed to its decline. The species is exposed to danger from predators and agricultural machinery since it nests on the ground. Collisions with aircraft, trains, cars, barbed wire and farm machinery are known to occur.

Within the Study Area, the Short-eared Owl is an infrequent migrant and possible rare breeder in open heathland and peatland areas. A Short-eared Owl was observed in the Little Lawn area to the west St. Lawrence, and more often it is seen on the barrens north of Lord's Cove (N. Wilson, pers. comm.).

6.4.2 Potential Impacts

Some of the species listed as Species at Risk (SAR) have been indicated in prior background sections on freshwater and marine environments, and migratory birds and all have been discussed more fully in the Species at Risk background section (Section 6.4.1). Marine mammals and the leatherback sea turtle that are considered Species at Risk were not introduced until the background section on SAR.

6.4.2.1 Existing Conditions

Species at Risk are defined broadly here to consider a variety of species that are listed under both federal and provincial lists. Some individual SAR have been described under the previous sections dealing with the terrestrial, freshwater, and marine environments, but they must be assessed as a separate VEC because of their potential legal standing. Consideration was also given to some species not designated as either endangered or threatened (i.e. special concern) on Schedule 1 of the SARA and the provincial ESA. Only the Schedule 1 SARA and ESA species relevant to the Study Area are assessed in this section.

The SAR assessed in this section includes the following:

- Northern wolffish (*threatened* Schedule 1 *SARA*); and
- Spotted wolffish (*threatened* Schedule 1 *SARA*);
- Harlequin Duck (*special concern* Schedule 1 *SARA*);
- Piping Plover, *melodus* subspecies (*endangered* Schedule 1 *SARA* and *ESA*);
- Eskimo Curlew[5] (*endangered* Schedule 1 *SARA* and *ESA*);
- Red Crossbill (*endangered* Schedule 1 *SARA* and *ESA*);
- Peregrine Falcon (*threatened* Schedule 1 *SARA* and *ESA*);
- Chimney Swift (*threatened* Schedule 1 *SARA*);
- Blue whale (Atlantic population) (*endangered* Schedule 1 *SARA*);
- North Atlantic right whale (*endangered* Schedule 1 *SARA*);
- Northern bottlenose whale (Scotian Shelf population) (*endangered* Schedule 1 *SARA*);
- Leatherback sea turtle (*endangered* Schedule 1 *SARA*);

[5] Note that the Eskimo Curlew although listed under Schedule 1 as ‘endangered’ is generally considered to be extinct, has never been documented in the study area, and will not be further treated in this document.

6.4.2.2 Assessment Criteria

Assessment criteria, including boundaries, are described in Section 4.4. Significant environmental effects are those considered to be of sufficient magnitude, duration, frequency, geographic extent, and/or reversibility to cause a change in the Species at Risk VEC that will alter its status or integrity beyond an acceptable level. Establishment of the criteria is based on professional judgment, but is transparent and repeatable.

In this EPR/EA, a *significant* effect is defined as ***one having a medium or high magnitude, duration greater than one year, and geographic extent greater than 100 km^2.***

Reversibility of the effect is also an important consideration.

6.4.2.3 Issues and Concerns

Four primary concerns are associated with the potential interactions between routine activities of the three phases of the Project and the Species at Risk VEC:

1. Loss and/or alteration of habitat;
2. Characterization of effluent discharged into the marine environment;
3. Disturbance; and
4. Marine vessel strikes.

The SAR VEC could potentially interact with a variety of routine activities associated with the Construction, Operation, and Decommissioning phases of the Project. There are three primary marine works activities that will interact with the commercial fishery:

1. Wharf construction in Blue Beach Cove;
2. Discharge of effluent into Shoal Cove;
3. Noise generated by the Project; and
4. Marine vessel traffic associated with the Project

Accidental events (e.g., hydrocarbon release, fluorspar spill, structural failures) could also occur during all three phases of the Project and they too will be considered.

The potential effects of both routine Project activities and accidental events on Species at Risk are assessed in the following sections.

6.4.2.4 Effects of Construction

Potential interactions between construction routine activities/accidental events and Species at Risk are shown in Table 6.4-2. Only those construction activities from the main interactions table (Table 5.10-1 that have reasonable likelihoods of interacting with the Species at Risk VEC are considered in this section.

Species at Risk Fishes

<u>Land-based Activities</u>

During land-based construction, three activities have been identified as having potential to interact with SAR fishes, the northern and spotted wolfishes. They include (1) run-off/siltation, (2) air emissions, including dust, and (3) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.4-2).

Run-off/Siltation

Run-off and associated siltation could result in increased turbidity and sedimentation in the marine environment, thereby having potential to negatively affect the fishes of the Species at Risk VEC, the northern and spotted wolffishes. Section 6.1.3 on the potential effects of run-off and siltation on the marine fish and fish habitat is directly relevant to this section. Mitigations intended to reduce the negative effects of run-off/siltation on marine fish and fish habitat apply to the wolffishes as well and will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for run-off and siltation include the use of silt curtains (Table 6.4-3) but these measures will be finalized in the EPP. Regardless of the possibility of continuous run-off/siltation throughout the land-based construction phase, appropriate mitigation measures would minimize the potential effects of this activity on the SAR fishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of run-off/siltation on the two wolffish species are negligible to low, <1 km^2, and 13 to 36 months, respectively (Table 6.4-3). Based on these criteria ratings, the residual effects of run-off/siltation associated with land-based construction on SAR fishes are insignificant (Table 6.4-4).

Table 6.4-2: Potential Interactions between Construction Activities and the Species at Risk VEC

Valued Ecosystem Component: Species at Risk				
Project Activity	**Fishes**	**Migratory Birds**	**Marine Mammals**	**Leatherback Sea Turtle**
Construction Activities and Physical Works				
Non-marine				
Run-off/siltation	x	x		
Air emissions (incl. dust)	x	x		
Lights		x		
Noise		x		
Accidental events	x	x	x	X
Marine				
Wharf footprint	x			
Siltation	x	x		
Air emissions	x			
Lights		x		
Noise	x	x	x	X
Accidental events	x	x	x	X

Air Emissions (including dust)

Air emissions, including airborne dust, could also cause increased turbidity and sedimentation in the marine environment, thereby negatively affecting SAR fishes in the same way described for run-off and siltation. Another aspect of air emissions pertains to chemicals comprising emissions from equipment being used during land-based construction, which could potentially have some negative effects on SAR fishes, including increased turbidity, sedimentation and contamination. Mitigations intended to reduce the negative effects of air emissions, including dust, on SAR fishes will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include water spray dust suppression, the use of silt curtains, and equipment maintenance (Table 6.4-3) but these measures will be finalized in the EPP. Regardless of the possibility of continuous air emissions throughout the land-based construction phase, appropriate mitigation measures would minimize the potential effects of this activity on SAR fishes.

Table 6.4-3: Effects Assessment of Marine Construction Activities on Fishes of the Species at Risk VEC

Valued Ecosystem Component: Species at Risk (Fishes)									
			Evaluation Criteria for Assessing Environmental Effects						
Project Activity	**Potential Positive (P) or Negative (N) Environmental Effect**	**Possible Mitigation**	**Magnitude**	**Geographic Extent**	**Frequency**	**Duration**	**Reversibility**	**Ecological/ Socio-Cultural and Economic Context**
Marine Construction Activities and Physical Works								
Non-marine								
Run-off/siltation	Increased turbidity (N); Sedimentation (N)	Silt curtains	0-1	1	6	3	R	2
Air emissions (incl. dust)	Increased turbidity (N); Sedimentation (N); Contamination (N)	Water spray dust suppression; Minimization of material stockpiling Equipment maintenance	0-1	1	6	3	R	2
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-2	1	1-2	R	2
Marine								
Wharf footprint	Loss of bottom habitat (HADD) (N)	Habitat compensation	1-2	1	6	2	R	2
Siltation	Increased turbidity (N); Sedimentation (N)	Silt curtains	1	1	6	2	R	2
Noise	Disturbance (N)	Bubble curtains	1	1	6	2	R	2
Air emissions	Contamination (N)	Equipment maintenance	1	1	6	2	R	2
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-3	1	1-2	R	2

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

The predicted magnitude, geographic extent and duration of the potential *reversible* residual effects of air emissions on the two wolffishes are *negligible to low*, *<1 km²*, and *13 to 36 months*, respectively (Table 6.4-3). Based on these criteria ratings, the residual effects of air emissions associated with land-based construction on SAR fishes are *insignificant* (Table 6.4-4).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during land-based construction activities could potentially have negative effects on SAR fishes. Section 5.7 describes some of these potential effects. Mitigations intended to reduce the negative effects of land-based accidental events on SAR fishes will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-3) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of land-based accidental events on SAR fishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of land-based accidental events on the two wolffish species are low to medium, <1 to 10 km^2, and <1 to 12 months, respectively (Table 6.4-3). Based on these criteria ratings, the residual effects of land-based accidental events during construction on SAR fishes are insignificant (Table 6.4-4).

Table 6.4-4: Significance of Potential Residual Environmental Effects of Marine Construction Activities on Fishes of the Species at Risk VEC

Valued Ecosystem Component: Species at Risk (Fishes)				
Project Activity	Significance of Predicted Residual Environmental Effects		Likelihood[a]	
	Significance Rating	Level of Confidence	Probability of Occurrence	Scientific Certainty
Marine Construction Activities and Physical Works				
Non-marine				
Run-off/siltation	NS	3	-	-
Air emissions (incl. dust)	NS	3	-	-
Accidental events	NS	3	-	-
Marine				
Wharf footprint	NS	3	-	-
Siltation	NS	3	-	-
Air emissions	NS	3	-	-
Noise	NS	3	-	-
Accidental events	NS	3	-	-

[a] **Only rated if residual environmental effect predicted to be significant**

Key:

Residual environmental Effect Rating:
S= Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P= Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

Marine-based Activities

During marine construction, five activities have been identified as having potential to interact with the Species at Risk fishes. They include (1) wharf footprint, (2) siltation, (3) noise, (4) air emissions, and (5) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.4-2).

Wharf Footprint

The footprint of the proposed marine wharf at Blue Beach Cove, as determined by Fisheries and Oceans Canada (DFO), is 29,475 m^2. This amount of bottom habitat will be lost due to wharf construction, resulting in a negative effect. DFO also quantified the amount of Habitat Equivalent Units (HEUs) based on the biological and physical characteristics of the bottom habitat that would be lost and determined that 28, 823 m^2 of habitat will require compensation by the proponent. A compensation strategy that outlines what approaches could be used to compensate for the lost bottom habitat, particularly as it relates to lobsters and winter flounder, is currently being prepared and will be completed and deemed acceptable by DFO before the end of the EPR/EA review process. While unlikely, there is chance that northern and spotted wolffishes would use the habitat that will be lost to the wharf footprint. The approach used to compensate for habitat lost due to the wharf footprint will be the mitigation that minimizes the negative effect of the wharf footprint. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of the wharf footprint on the SAR fishes are low to medium, <1 km^2, and 13 to 36 months, respectively (Table 6.4-3). Based on these criteria ratings, the residual effects of the wharf footprint associated with marine construction on SAR fishes are insignificant (Table 6.4-4).

Siltation

Siltation due to construction in or near the marine environment could result in increased turbidity and sedimentation in the marine environment, thereby negatively affecting marine fish and fish habitat, including the northern and spotted wolffishes. Mitigations intended to reduce the negative effects of continuous siltation on the SAR fishes will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for siltation due to marine construction include the use of silt curtains (Table 6.4-3) but these measures will be finalized in the EPP. Regardless of the possibility of continuous siltation throughout the marine construction phase, appropriate mitigation measures would minimize the potential negative effects of this activity on SAR fishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of siltation on the two wolffish species are low, <1 km^2, and 1 to 12 months, respectively (Table 6.4-3). Based on these criteria ratings, the residual effects of siltation associated with marine construction on SAR fishes are insignificant (Table 6.4-4).

Noise

There are potential interactions between noise and the two SAR fish species (Table 6.4-2). Numerous underwater noise sources will occur continuously in the Project Area during marine construction, including marine vessels, piling installation, and heavy equipment associated with work. It is likely that the most intrusive noise source from the perspective of the wolffishes will be the equipment used to install wharf pilings. Section 6.1.3 discusses recent publications on the topic of negative effects of pile driving noise on fish. The effects of exposure to noise on marine fish and fish habitat are likely to be negative but minimal. There is some evidence that prolonged exposure to sound with relatively high sound pressure levels (SPL) (e.g., pile driving) could potentially cause injury to some fishes, however, the most likely negative effect will be the displacement of any wolffishes occurring in the vicinity of the noise source. The wolffishes, if even present in the vicinity of Blue Beach Cove, could also habituate to the underwater noises introduced during marine construction. Mitigations intended to reduce the negative effects of noise on SAR fishes will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for exposure to noise caused by marine construction include the use of bubble curtains (Table 6.4-3) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of construction noise on SAR fishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on northern and spotted wolffishes are low, <1 km^2, and 1 to 12 months, respectively (Table 6.4-3). Based on these criteria ratings, the residual effects of underwater noise associated with marine construction on SAR fishes are insignificant (Table 6.4-4).

Air Emissions

Air emissions from equipment and marine vessels used during marine construction could potentially have some negative contaminating effects on marine fish and fish habitat, including northern and spotted wolffishes. Mitigations intended to reduce the negative effects of continuous air emissions on SAR fishes will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include equipment maintenance (Table 6.4-3) but these measures will be finalized in the EPP. Regardless of the possibility of continuous air emissions throughout the marine construction phase, appropriate mitigation measures would minimize the potential effects of this activity on SAR fishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of air emissions on SAR fishes are negligible to low, <1 km^2, and 1 to 12 months, respectively (Table 6.4-3). Based on these criteria ratings, the residual effects of air emissions associated with marine construction on SAR fishes are insignificant (Table 6.4-4).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during marine-based construction activities could potentially have negative effects on SAR fishes. Section 5.7 describes some of these potential effects. Mitigations intended to reduce the negative effects of marine-based accidental events on SAR fishes will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-3) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on northern and spotted wolffishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine-based accidental events on SAR fishes are low to medium, <1 to 100 km^2, and <1 to 12 months, respectively (Table 6.4-3). Based on these criteria ratings, the residual effects of marine-based accidental events during construction on SAR fishes are insignificant (Table 6.4-4).

<u>Species at Risk Migratory Birds</u>

Given that all project activities related to construction and operations as they apply to SAR Birds are deemed to be insignificant it is preferable to apply a generic assessment. Birds represent a special case to this application because of their diverse habitat needs and life histories. In general SAR Birds are designated as indicator species for the following general activity headings for this project (Table 6.4-5).

Table 6.4-5: Species At Risk (Birds) and General Habitat Interaction With Project Activities

SAR Bird Species	***Habitat***	***Project Activity***
Piping Plover	Sandy Beach Coastline (Shoal Cove)	run-off/siltation
Chimney Swift	Low Pristine Aerial	air emissions, including dust
Chimney Swift, Peregrine Falcon	Low Pristine Aerial	lights
Piping Plover, Peregrine Falcon	Project Area	noise
Harlequin Duck, Piping Plover	Marine coastal	accidental events (hydrocarbon release)
Piping Plover	Beach/estuary (Shoal Cove Brook-Beach)	accidental events (non-hydrocarbon releases)
Red Crossbill	Boreal Forest	accidental events (Fire)

<u>Land-based Activities</u>

During land-based construction, five activities have been identified as having potential to interact with migratory birds designated as Species at Risk. They include (1) run-off/siltation, (2) air emissions, including dust, (3) lights, (4) noise, and (5) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.4-5).

Run-off/Siltation

Run-off and associated siltation could result in increased turbidity and sedimentation in the marine environment, thereby having potential to negatively affect the marine birds of the Species at Risk VEC. The mitigations intended to reduce the negative effects of run-off/siltation on marine fish and fish habitat apply to the marine birds as well and will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for run-off and siltation include the use of silt curtains (Table 6.4-6) but these measures will be finalized in the EPP. Regardless of the possibility of continuous run-off/siltation throughout the land-based construction phase, appropriate mitigation measures would minimize the potential effects of this activity on the SAR Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of run-off/siltation on the SAR Birds (Harlequin Duck) are negligible, <1 km^2, and 13 to 36 months, respectively (Table 6.4-6). Based on these criteria ratings, the residual effects of run-off/siltation associated with land-based construction on SAR Birds are insignificant.

Air Emissions (including dust)

Air emissions, including airborne dust, could also reduce air quality in the adjacent marine environment, thereby negatively affecting SAR Birds. Another aspect of air emissions pertains to chemicals comprising emissions from equipment being used during land-based construction, which could potentially have some negative effects on SAR Birds. Mitigations intended to reduce the negative effects of air emissions, including dust, on SAR Birds will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include water spray dust suppression, the use of silt curtains, and equipment maintenance (Table 6.4-6) but these measures will be finalized in the EPP. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of air emissions on the SAR Birds (Chimney Swifts) are negligible, <1 km^2, and 13 to 36 months, respectively (Table 6.4-6). Based on these criteria ratings, the residual effects of air emissions associated with land-based construction on SAR Birds are insignificant. Regardless of the possibility of continuous air emissions throughout the land-based construction phase, appropriate mitigation measures would minimize the potential effects of this activity on Chimney Swifts.

Noise

There are potential interactions between noise and the SAR Birds (Table 6.4-5). Numerous noise sources will occur continuously in the Project Area during non-marine construction, including heavy equipment associated with work. It is likely that the most intrusive noise source from the perspective of the SAR Birds will be the equipment related to construction. Section 6.3 reviews the topic of negative effects of noise on wildlife. The effects of exposure to noise on SAR Birds are likely to be negative but minimal. There is some evidence that prolonged exposure to sound with relatively high sound pressure levels (SPL) (e.g., pile driving) could potentially cause negative physiological effects, however, the most likely negative effect will be the displacement of any birds occurring in the immediate vicinity of the noise source as loud noise is expected to attenuate over relatively short distances (< 1 km). SAR Birds (e.g. Peregrine Falcon), if even present in the vicinity of noise could habituate to the anthropogenic noises or temporarily avoid use of the project area.

Mitigations intended to reduce the negative effects of noise on SAR Birds will be detailed in the Construction Environmental Protection Plan (EPP). Measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of construction noise on SAR Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on SAR Birds are low, <1 km^2, and 1 to 12 months, respectively (Table 6.4-6). Based on these criteria ratings, the residual effects of noise associated with non-marine construction on SAR Birds are insignificant.

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during land-based construction activities could potentially have negative effects on SAR Birds. Section 5.7 describes some of these potential effects. Mitigations intended to reduce the negative effects of land-based accidental events on SAR Birds will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-6) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of land-based accidental events on SAR Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of land-based accidental events on the SAR bird species are low to medium, <1 to 10 km^2, and <1 to 12 months, respectively (Table 6.4-6). Based on these criteria ratings, the residual effects of land-based accidental events during construction on SAR Birds are insignificant.

Table 6.4-6: Effects Assessment of Construction Activities on Birds of the SAR VEC

Valued Ecosystem Component: Species at Risk (Birds)									
Project Activity	**Potential Positive (P) or Negative (N) Environmental Effect**	**Possible Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**						
			Magnitude	**Geographic Extent**	**Frequency**	**Duration**	**Reversibility**	**Ecological/ Socio-Cultural and Economic Context**
Marine Construction Activities and Physical Works									
Non-marine									
Run-off/siltation	Increased turbidity (N); Sedimentation (N)	Silt curtains	1	1	6	3	R	1
Air emissions (incl. dust)	Increased turbidity (N); Sedimentation (N); Contamination (N)	Water spray dust suppression; Minimization of material stockpiling Equipment maintenance	1	1	6	3	R	2
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1	1-2	1	1-2	R	2
Marine									
Wharf footprint	Loss of bottom habitat (HADD) (N)	Habitat compensation	0	1	6	2	R	2
Siltation	Increased turbidity (N); Sedimentation (N)	Silt curtains	0	1	6	2	R	2
Noise	Disturbance (N)	Bubble curtains	1	1	6	2	R	2
Air emissions	Contamination (N)	Equipment maintenance	1	1	6	2	R	2
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-3	1	1-2	R	2

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Marine-based Activities

During marine construction, five activities have been identified as having potential to interact with the Species at Risk migratory birds. They include (1) siltation, (2) noise, (3) air emissions, (4) lights and (5) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.4-2).

Siltation

Run-off and associated siltation could result in increased turbidity and sedimentation in the marine environment, thereby having potential to negatively affect the marine birds of the Species at Risk VEC. The mitigations intended to reduce the negative effects of run-off/siltation on marine fish and fish habitat apply to the marine birds as well and will be detailed in the Construction Environmental Protection Plan (EPP). Mitigations intended to reduce the negative effects of run-off/siltation on SAR Birds apply to marine birds (Harlequin Ducks) and will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for run-off and siltation include the use of silt curtains (Table 6.4-6) but these measures will be finalized in the EPP. Regardless of the possibility of continuous run-off/siltation throughout the land-based construction phase, appropriate mitigation measures would minimize the potential effects of this activity on the SAR Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of run-off/siltation on the SAR Birds (Harlequin Duck) is negligible, <1 km2, and 13 to 36 months, respectively (Table 6.4-6). Based on these criteria ratings, the residual effects of run-off/siltation associated with land-based construction on SAR Birds are insignificant.

Noise

There are potential interactions between noise and the SAR Birds (Table 6.4-6). Numerous underwater noise sources will occur continuously in the Project Area during marine construction, including marine vessels, piling installation, and heavy equipment associated with work. It is likely that the most intrusive noise source in relation to Harlequin Ducks will be the equipment used to install wharf pilings. Section 6.3 discusses recent publications on the topic of negative effects of pile driving noise on fish and relative sound pressure and attenuation also applies to the SAR Birds VEC. The effects of exposure to noise on marine birds (Harlequin Duck) are likely to be negligible because this VEC occurs some 20 to 30 km west of the project area. If individual Harlequin Ducks during migration were exposed to some anthropogenic noise with relatively high sound pressure levels (SPL) (e.g., pile driving) it is likely they would habituate to any associated underwater noises introduced during marine construction. Mitigations intended to reduce the negative effects of noise on SAR Birds will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for exposure to noise caused by marine construction include the use of bubble curtains (Table 6.4-6) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of construction noise on SAR fishes and therefore benefit birds. The predicted magnitude, geographic extent and duration of the potential residual effects of exposure to noise on SAR Birds are negligible, <1 km^2, and 1 to 12 months, respectively (Table 6.4-6). Based on these criteria ratings, the residual effects of underwater noise associated with marine construction on SAR fishes are insignificant.

Air Emissions

Air emissions from equipment and marine vessels used during marine construction could potentially have some negative contaminating effects on SAR Birds (Chimney Swift). Mitigations intended to reduce the negative effects of continuous air emissions on SAR Birds will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include equipment maintenance (Table 6.4-6) but these measures will be finalized in the EPP. Regardless of the possibility of continuous air emissions throughout the marine construction phase, appropriate mitigation measures would minimize the potential effects of this activity on SAR Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of air emissions on SAR birs are negligible to low, <1 km^2, and 1 to 12 months, respectively (Table 6.4-6). Based on these criteria ratings, the residual effects of air emissions associated with marine construction on SAR Birds are insignificant.

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during marine-based construction activities could potentially have negative effects on SAR Birds (Harlequin Duck). Section 5.7 describes some of these potential effects. Mitigations intended to reduce the negative effects of marine-based accidental events on SAR fishes will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-6) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on marine birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine-based accidental events on SAR birsd are low to medium, <1 to 100 km2, and <1 to 12 months, respectively (Table 6.4-6). Based on these criteria ratings, the residual effects of marine-based accidental events during construction on SAR Birds are insignificant.

Species at Risk Marine Mammals and Sea Turtles

Land-based Activities

During land-based construction, one activity has been identified as having reasonable potential to interact with marine mammals and sea turtles designated as Species at Risk, and that is accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.4-2).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during land-based construction activities could potentially have negative effects on SAR marine mammals and the leatherback sea turtle. Whales may interact with spilled hydrocarbons but are not considered to be at high risk to the effects of hydrocarbons. Whales present in the affected area could experience sublethal effects but these effects are reversible and would not cause permanent damage to the animals. Effects of hydrocarbons on sea turtles would also be reversible, although there is a possibility that foraging abilities may be inhibited by exposure to hydrocarbons. Mitigations intended to reduce the negative effects of land-based accidental events on SAR whales and sea turtles will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-7) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of land-based accidental events on SAR whales and the leatherback sea turtle. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of land-based accidental events on the SAR whales and sea turtle are low to medium, <1 to 10 km2, and <1 to 12 months, respectively (Table 6.4-7). Based on these criteria ratings, the residual effects of land-based accidental events during construction on SAR whales and the leatherback sea turtle are insignificant (Table 6.4-8).

Table 6.4-7: Effects Assessment of Marine Construction Activities on Marine Mammals and Sea Turtles of the Species at Risk VEC

Valued Ecosystem Component: Species at Risk (Marine Mammals and Sea Turtles)								
Project Activity	**Potential Positive (P) or Negative (N) Environmental Effect**	**Possible Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**					
			Magnitude	**Geographic Extent**	**Frequency**	**Duration**	**Reversibility**	**Ecological/ Socio-Cultural and Economic Context**
Marine Construction Activities and Physical Works								
Non-marine								
Accidental events	Health effects (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-2	1	1-2	R	2
Marine								
Noise	Disturbance (N)	Bubble curtains	0-1	2-3	6	2	R	2
Accidental events	Health effects (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-3	1	1-2	R	2

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Table 6.4-8: Significance of Potential Residual Environmental Effects of Marine Construction Activities on Marine Mammals and Sea Turtles of the Species at Risk VEC

Valued Ecosystem Component: Species at Risk (Marine Mammals and Sea Turtles)				
Project Activity	Significance of Predicted Residual Environmental Effects		Likelihood[a]	
	Significance Rating	Level of Confidence	Probability of Occurrence	Scientific Certainty
Marine Construction Activities and Physical Works				
Non-marine				
Accidental events	NS	3	-	-
Marine				
Noise	NS	3	-	-
Accidental events	NS	3	-	-

[a] **Only rated if residual environmental effect predicted to be significant**

Key:

Residual environmental Effect Rating:
S= Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P= Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

Marine-based Activities

During marine-based construction, two activities have been identified as having reasonable potential to interact with marine mammals and sea turtles designated as Species at Risk. They are noise and accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.4-2).

Noise

There are potential interactions between noise and the SAR marine mammals and leatherback sea turtle (Table 6.4-1). Marine mammals rely heavily on the use of underwater sounds to communicate and to gain information about their surroundings. Experiments also show that they hear and may respond to many man-made sounds. Like marine mammals, sea turtles can hear sound associated with ships and other underwater activities. Thus, the potential negative effects caused by human-made sound within the marine environment, including those associated with marine construction activity of this Project should be considered. Reviews of the effects of sound on marine mammals and sea turtles have been provided in numerous environmental assessments recently prepared for proposed projects in Newfoundland waters. Numerous underwater noise sources will occur continuously in the Project Area during marine construction, including marine vessels, piling installation, and heavy equipment associated with work. It is likely that the most intrusive noise source from the perspective of SAR marine mammals and leatherback sea turtles occurring proximate to Greater St. Lawrence Harbour will be the equipment used to install wharf pilings. Mitigations intended to reduce the negative effects of noise on SAR marine mammals and sea turtles will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for exposure to noise caused by marine construction include the use of bubble curtains (Table 6.4-7) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of construction noise on the SAR marine mammals and the leatherback sea turtle. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on SAR marine mammals and the leatherback sea turtle are negligible to low, 1 to 100 km2, and 1 to 12 months, respectively (Table 6.4-7). Based on these criteria ratings, the residual effects of underwater noise associated with marine construction on SAR marine mammals and the leatherback sea turtle are insignificant (Table 6.4-8).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during marine-based construction activities could potentially have negative effects on SAR marine mammals and the leatherback sea turtle (Table 6.4-4). However, as previously discussed in this Section, effects of accidental events on these biota are likely minimal. Mitigations intended to reduce the negative effects of marine-based accidental events on SAR whales and sea turtles will be detailed in the Construction Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-7) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on SAR whales and the leatherback sea turtle. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine-based accidental events on SAR whales and sea turtles are low to medium, <1 to 100 km2, and <1 to 12 months, respectively (Table 6.4-7). Based on these criteria ratings, the residual effects of marine-based accidental events during construction on SAR whales and sea turtles are insignificant (Table 6.4-8).

6.4.2.5 Effects of Operations

Potential interactions between operations routine activities/accidental events and Species at Risk are shown in Table 6.4-2. Only those operations activities from the main interactions table (Table 5.10-1) that have reasonable likelihoods of interacting with the Species at Risk VEC are considered in this section.

Species at Risk Fishes

Land-based Activities

During land-based operations, two activities have been identified as having potential to interact with SAR fishes. They include (1) air emissions, and (2) accidental events (e.g., hydrocarbon and non-hydrocarbon releases, structural failures) (Table 6.4-2).

Table 6.4-9: Potential Interactions between Operations Activities and the Species at Risk VEC

Valued Ecosystem Component: Species at Risk				
Project Activity	**Fishes**	**Migratory Birds**	**Marine Mammals**	**Leatherback Sea Turtle**
Operations Activities and Physical Works				
Non-marine				
Air emissions	x	x		
Accidental events	x	x	x	x
Marine				
Marine effluent	x	x		
Vessel loading and off-loading	x	x		
Noise		x	x	x
Air emissions	x	x		
Lights		x		
Marine traffic			x	x
Accidental events	x	x	x	x

Air Emissions

Air emissions from the mine site during operations could potentially have some negative contaminating effects on SAR fishes, specifically the northern and spotted wolffishes. However, likelihood of this is low. Mitigations intended to reduce the negative effects of continuous air emissions on SAR fishes will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include treatment and monitoring (Table 6.4-10) but these measures will be finalized in the EPP. Regardless of the possibility of continuous air emissions throughout the mine operations phase, appropriate mitigation measures would minimize the potential negative effects of this activity on SAR fishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of air emissions on SAR fishes are negligible to low, <1 km2, and >72 months, respectively (Table 6.4-10). Based on these criteria ratings, the residual effects of air emissions associated with mine operations on northern and spotted wolffishes are insignificant (Table 6.4-11).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases and structural failures during land-based operation activities could potentially have negative effects on SAR fishes. Section 6.1.3 describes some of these potential effects. Mitigations intended to reduce the negative effects of land-based accidental events on SAR fishes will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-10) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of land-based accidental events on the two wolffish species considered to be Species at Risk. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of land-based accidental events on SAR fishes are low to medium, <1 to 10 km2, and <1 to 12 months, respectively (Table 6.4-10). Based on these criteria ratings, the residual effects of land-based accidental events during operations on SAR fishes are insignificant (Table 6.4-11).

Table 6.4-10: Effects Assessment of Operations Activities on Fishes of the Species at Risk VEC

Valued Ecosystem Component: Species at Risk (Fishes)									
Project Activity	Potential Positive (P) or Negative (N) Environmental Effect	Mitigation	Evaluation Criteria for Assessing Environmental Effects						
			Magnitude	Geographic Extent	Frequency	Duration	Reversibility	Ecological/ Socio-Cultural and Economic Context
Operations Activities and Physical Works									
Land-based									
Air emissions	Contamination (N)	Treatment; Compliance monitoring	0-1	1	6	5	R	2
Accidental events	Increased turbidity (N);	Preventative measures;	1-2	1-2	1	1-2	R	2

Valued Ecosystem Component: Species at Risk (Fishes)								
Project Activity	**Potential Positive (P) or Negative (N) Environmental Effect**	**Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**					
			Magnitude	**Geographic Extent**	**Frequency**	**Duration**	**Reversibility**	**Ecological/ Socio-Cultural and Economic Context**
Operations Activities and Physical Works								
	Sedimentation (N); Contamination (N)	Rapid response plan						
Marine								
Marine effluent	Contamination (N)	Treatment; Compliance monitoring	0-1	1	6	5	R	2
Vessel loading and off-loading	Increased turbidity (N); Contamination (N)	Enclosed loading/off-loading system	1	1	1	5	R	2
Noise	Disturbance (N)	Minimization of exposure to noise	0-1	1	1	5	R	2
Air emissions	Contamination (N)	Equipment maintenance	0-1	1	1	5	R	2
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-3	1	1-2	R	2

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Table 6.4-11: Significance of Potential Residual Environmental Effects of Operations Activities on Fishes of the Species at Risk VEC

Valued Ecosystem Component: Species at Risk (Fishes)				
Project Activity	Significance of Predicted Residual Environmental Effects		Likelihood[a]	
	Significance Rating	Level of Confidence	Probability of Occurrence	Scientific Certainty
Operations Activities and Physical Works				
Land-based				
Air emissions	NS	3	-	-
Accidental events	NS	3	-	-
Marine				
Marine effluent	NS	3	-	-
Vessel loading and off-loading	NS	3	-	-
Noise	NS	3	-	-
Air emissions	NS	3	-	-
Accidental events	NS	3	-	-

[a] **Only rated if residual environmental effect predicted to be significant**

Key:
Residual environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

Marine-based Activities

During marine operations, five activities have been identified as having potential to interact with SAR fishes, specifically the northern and spotted wolffishes. They include (1) marine effluent, (2) vessel loading and off-loading, (3) noise, (4) air emissions, and (5) accidental events (e.g., hydrocarbon and non-hydrocarbon releases, including large fluorspar spills at the wharf) (Table 6.4-2).

Marine Effluent

Effluent that will be discharged into Shoal Cove via Shoal Cove Pond Brook River will have the potential to affect SAR fishes (Table 6.4-2). Depending on the constituents of the effluent, potential effects relate to chemical contamination and total suspended solids. Mitigations intended to reduce the effects of marine effluent on SAR fishes will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include treatment and compliance monitoring (Table 6.4-10) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine effluent on SAR fishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine effluent on northern and spotted wolffishes are negligible to low, <1 km2, and >72 months, respectively (Table 6.4-10). Based on these criteria ratings, the residual effects of marine effluent associated with mine operations on SAR fishes are insignificant (Table 6.4-11).

Vessel Loading and Off-loading

The loading and off-loading of marine vessels at the wharf could potentially result in incidental spillage of fluorspar into the marine environment. This activity will have a frequency of <11 events/yr. Regardless of the amount of fluorspar spilled, there is potential for negative effect on the SAR fishes through contamination and increased turbidity (Table 6.4-10). Mitigations intended to reduce the negative effects of vessel loading and off-loading on SAR fishes will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include the use of an enclosed conveyor system (Table 6.4-10) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of vessel loading and off-loading on SAR fishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine effluent on northern and spotted wolffishes are low, <1 km2, and >72 months, respectively (Table 6.4-10). Based on these criteria ratings, the residual effects of marine effluent associated with mine operations on SAR fishes are insignificant (Table 6-4-11).

Noise

There are potential interactions between noise and SAR fishes (Table 6.4-2), especially at times of vessel loading and off-loading. Compared to marine construction, underwater noise produced during operations will be considerably less. Mitigations intended to reduce the negative effects of noise on SAR fishes will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for exposure to noise caused by marine operations include the minimization of noise production (Table 6.4-10) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of operations noise on SAR fishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on northern and spotted wolffishes are negligible to low, <1 km2, and >72 months, respectively (Table 6.4-10). Based on these criteria ratings, the residual effects of underwater noise associated with marine activities during the operations phase on the two wolffish species are insignificant (Table 6.4-11).

Air Emissions

Air emissions from equipment and marine vessels during the marine operations phase could potentially have some negative contaminating effects on SAR fishes (Table 6.4-2). However, as with vessel loading and off-loading and noise, air emissions from marine operations will likely only occur infrequently, not continuously as air emissions associated with land-based operations. Mitigations intended to reduce the negative effects of air emissions on SAR fishes will be detailed in the Operations n Environmental Protection Plan (EPP). Candidate mitigations for this activity include equipment maintenance (Table 6.4-10) but these measures will be finalized in the EPP. Regardless of the possibility of air emissions during the marine operations phase, appropriate mitigation measures would minimize the potential effects of this activity on SAR fishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of air emissions on SAR fishes are negligible to low, <1 km2, and >72 months, respectively (Table 6.4-10). Based on these criteria ratings, the residual effects of air emissions associated with marine operations on the northern and spotted wolffishes are insignificant (Table 6.4-11).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases (including major fluorspar spills at the wharf) during marine-based operations activities could potentially have negative effects on SAR fishes. Section 6.1.3 describes some of these potential effects. Mitigations intended to reduce the negative effects of marine-based accidental events on SAR fishes will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-10) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on SAR fishes. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine-based accidental events on northern and spotted wolffishes are low to medium, <1 to 100 km2, and <1 to 12 months, respectively (Table 6.4-10). Based on these criteria ratings, the residual effects of marine-based accidental events during operations on SAR fishes are insignificant (Table 6.4-11).

Species at Risk Birds

Land-based Activities

During land-based operations, three activities have been identified as having potential to interact with migratory birds designated as Species at Risk. They include (1) air emissions, (2) noise and (3) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.4-2).

Land-based Activities

Table 6.4-12: Potential Interactions between Operations Activities and the Species at Risk VEC

Valued Ecosystem Component: Species at Risk				
Project Activity	**Fishes**	**Migratory Birds**	**Marine Mammals**	**Leatherback Sea Turtle**
Operations Activities and Physical Works				
Non-marine				
Air emissions	x	x		
Noise		x		
Accidental events	x	x	x	x
Marine				
Marine effluent	x	x		
Vessel loading and off-loading	x	x		
Noise		x	x	x
Air emissions	x	x		
Lights		x		
Marine traffic		x	x	x
Accidental events	x	x	x	x

Air Emissions

Air emissions from the mine site during operations could potentially have some negative contaminating effects on SAR Birds (Chimney Swift). However, likelihood of this is low. Mitigations intended to reduce the negative effects of continuous air emissions on SAR Birds will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include treatment and monitoring (Table 6.4-13) but these measures will be finalized in the EPP. Regardless of the possibility of continuous air emissions throughout the mine operations phase, appropriate mitigation measures would minimize the potential negative effects of this activity on SAR Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of air emissions on SAR Birds are negligible to low, <1 km2, and >72 months, respectively (Table 6.4-13). Based on these criteria ratings, the residual effects of air emissions associated with mine operations on SAR Birds are insignificant (Table 6.4-14).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases and structural failures during land-based operation activities could potentially have negative effects on SAR Birds. Section 6.3.2 describes some of these potential effects. Mitigations intended to reduce the negative effects of land-based accidental events on SAR Birds will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-13) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of land-based accidental events on the SAR Birds (Harlequin Ducks and Piping Plover). The predicted magnitude, geographic extent and duration of the potential reversible residual effects of land-based accidental events on SAR Birds are low to medium, <1 to 10 km2, and <1 to 12 months, respectively (Table 6.4-13). Based on these criteria ratings, the residual effects of land-based accidental events during operations on SAR Birds are insignificant (Table 6.4-14).

Table 6.4-13: Effects Assessment of Operations Activities on the Birds SAR VEC

Valued Ecosystem Component: Species at Risk (birds)									
Project Activity	**Potential Positive (P) or Negative (N) Environmental Effect**	**Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**						
			Magnitude	**Geographic Extent**	**Frequency**	**Duration**	**Reversibility**	**Ecological/ Socio-Cultural and Economic Context**
Operations Activities and Physical Works									
Land-based									
Air emissions	Contamination (N)	Treatment; Compliance monitoring	0-1	2	6	5	R	1
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-2	1	5	R	1
Marine									
Marine effluent	Contamination (N)	Treatment; Compliance monitoring	1	2	1	5	R	1
Vessel loading and off-loading	Increased turbidity (N); Contamination (N)	Enclosed loading/off-loading system	1	2	1	5	R	1
Noise	Disturbance (N)	Minimization of exposure to noise	0-1	1	1	5	R	2
Air emissions	Contamination (N)	Equipment maintenance	0-1	1	1	5	R	1
Accidental events	Increased turbidity (N); Sedimentation (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-3	1	5	R	2

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Table 6.4-14: Significance of Potential Residual Environmental Effects of Operations Activities on Bird Species at Risk VEC

Valued Ecosystem Component: Species at Risk (Birds)				
Project Activity	**Significance of Predicted Residual Environmental Effects**		**Likelihood[a]**	
	Significance Rating	**Level of Confidence**	**Probability of Occurrence**	**Scientific Certainty**
Operations Activities and Physical Works				
Land-based				
Air emissions	NS	3	-	-
Noise	NS	3	-	-
Accidental events	NS	3	-	-
Marine				
Marine effluent	NS	3	-	-
Vessel loading and off-loading	NS	3	-	-
Noise	NS	3	-	-
Air emissions	NS	3	-	-
Accidental events	NS	3	-	-

[a] Only rated if residual environmental effect predicted to be significant

Key:
Residual environmental Effect Rating:
S = Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P = Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

<u>Marine-based Activities</u>

During marine operations, five activities have been identified as having potential to interact with SAR Birds (Piping Plover, Harlequin Duck). They include (1) marine effluent, (2) vessel loading and off-loading, (3) noise, (4) air emissions, and (5) accidental events (e.g., hydrocarbon and non-hydrocarbon releases, including large fluorspar spills at the wharf) (Table 6.4-2).

Marine Effluent

Effluent that will be discharged into Shoal Cove via Shoal Cove Pond Brook will have the potential to affect SAR Birds (Piping Plover) (Table 6.4-2). Depending on the constituents of the effluent, potential effects relate to chemical contamination and total suspended solids.

Mitigations intended to reduce the effects of marine effluent on SAR Birds will be detailed in the Operations Environmental Protection Plan (EPP). Environment Canada has requested that a shorebird monitoring protocol be applied at Shoal Cove-Shoal Pond, and this will be detailed in the Operations Environmental Effects Monitoring (EEM). Candidate mitigations for this activity include treatment and compliance monitoring (Table 6.4-13) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine effluent on SAR Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine effluent on SAR Birds (Piping Plover) are negligible to low, <1 km2, and >72 months, respectively (Table 6.4-13). Based on these criteria ratings, the residual effects of marine effluent associated with mine operations on SAR Birds are insignificant (Table 6.4-14).

Vessel Loading and Off-loading

The loading and off-loading of marine vessels at the wharf could potentially result in incidental spillage of fluorspar or vessel fuels into the marine environment. These potential activities will have a frequency of <11 events/yr. Regardless of the amount of fluorspar or fuel oil (e.g. bunker C) spilled, there is potential for negative effect on the SAR Birds (Harlequin Duck, Piping Plover) through contamination as pollutants can drift with ocean currents and unfavourable winds (Table 6.4-13). Mitigations intended to reduce the negative effects of vessel loading and off-loading on SAR Birds will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include the use of an enclosed conveyor system (Table 6.4-13) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of vessel loading and off-loading on SAR Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine effluent on birds (Piping Plover, Harlequin Duck) are low, <10 km2, and >72 months, respectively (Table 6.4-13). Based on these criteria ratings, the residual effects of marine effluent associated with mine operations on SAR Birds are insignificant (Table 6.4-14).

Noise

There are potential interactions between noise and SAR Birds (Peregrine Falcon) (Table 6.4-2), especially at times of vessel loading and off-loading. Compared to marine construction, underwater noise produced during operations will be considerably less. Mitigations intended to reduce the negative effects of noise on SAR Birds will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for exposure to noise caused by marine operations include the minimization of noise production (Table 6.4-13) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential negative effects of operations noise on SAR Birds. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on SAR Birds (Peregrine Falcon) are negligible, <1 km2, and >72 months, respectively (Table 6.4-13). Based on these criteria ratings, the residual effects of underwater noise associated with marine activities during the operations phase on the SAR Birds (Peregrine Falcon) are insignificant (Table 6.4-14).

Air Emissions

Air emissions from equipment and marine vessels during the marine operations phase could potentially have some negative contaminating effects on SAR Birds (Chimney Swift) (Table 6.4-2). However, as with vessel loading and off-loading and noise, air emissions from marine operations will likely only occur infrequently, not continuously as air emissions associated with land-based operations. Mitigations intended to reduce the negative effects of air emissions on SAR Birds will be detailed in the Operations n Environmental Protection Plan (EPP). Candidate mitigations for this activity include equipment maintenance (Table 6.4-13) but these measures will be finalized in the EPP. Regardless of the possibility of air emissions during the marine operations phase, appropriate mitigation measures would minimize the potential effects of this activity on SAR Birds (Chimney Swift). The predicted magnitude, geographic extent and duration of the potential reversible residual effects of air emissions on SAR Birdss are negligible to low, <1 km2, and >72 months, respectively (Table 6.4-13). Based on these criteria ratings, the residual effects of air emissions associated with marine operations on the SAR Birds (Chimney Swift) are insignificant (Table 6.4-14).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases (including major fluorspar spills at the wharf) during marine-based operations activities could potentially have negative effects on SAR Birds (Harlequin Duck and Piping Plover). Section 6.3.2 describes some of these potential effects. Mitigations intended to reduce the negative effects of marine-based accidental events on SAR Birds will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-13) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on SAR Birds.

The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine-based accidental events on SAR Birds (Harlequin Duck and Piping Plover) are low to medium, <1 to 100 km2, and <1 to 12 months, respectively (Table 6.4-13). Based on these criteria ratings, the residual effects of marine-based accidental events during operations on SAR Birds (Harlequin Duck and Piping Plover) are insignificant (Table 6.4-14).

Species at Risk Marine Mammals and Sea Turtles

Land-based Activities

During land-based operations, one activity has been identified as having reasonable potential to interact with marine mammals and sea turtles designated as Species at Risk, and that is accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.4-2).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during land-based operations activities could potentially have negative effects on SAR marine mammals and the leatherback sea turtle. Whales may interact with spilled hydrocarbons but are not considered to be at high risk to the effects of hydrocarbons. Whales present in the affected area could experience sublethal effects but these effects are reversible and would not cause permanent damage to the animals. Effects of hydrocarbons on sea turtles would also be reversible, although there is a possibility that foraging abilities may be inhibited by exposure to hydrocarbons. Mitigations intended to reduce the negative effects of land-based accidental events on SAR whales and sea turtles will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-15) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of land-based accidental events on SAR whales and the leatherback sea turtle. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of land-based accidental events on the SAR whales and sea turtle are low to medium, <1 to 10 km2, and <1 to 12 months, respectively (Table 6.4-15). Based on these criteria ratings, the residual effects of land-based accidental events during operations on SAR whales and the leatherback sea turtle are insignificant (Table 6.4-16).

Table 6.4-15: Effects Assessment of Marine Operations Activities on Marine Mammals and Sea Turtles of the Species at Risk VEC

Valued Ecosystem Component: Species at Risk (Marine Mammals and Sea Turtles)								
Project Activity	**Potential Positive (P) or Negative (N) Environmental Effect**	**Possible Mitigation**	**Evaluation Criteria for Assessing Environmental Effects**					
			Magnitude	**Geographic Extent**	**Frequency**	**Duration**	**Reversibility**	**Ecological/ Socio-Cultural and Economic Context**
Operations Activities and Physical Works								
Land-based								
Accidental events	Health effects (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-2	1	1-2	R	2
Marine								
Marine traffic	Injury and/or mortality (N)	Monitoring by crew	1-2	2-3	1-2	5	R	2
Noise	Disturbance (N)	Minimization of duration of activities creating noise	0-1	2-3	6	5	R	2
Accidental events	Health effects (N); Contamination (N)	Preventative measures; Rapid response plan	1-2	1-3	1	1-2	R	2

Key:

Magnitude:
0 = Negligible, essentially no effect
1 = Low
2 = Medium
3 = High

Frequency:
1 = < 11 events/yr
2 = 11-50 events/yr
3 = 51-100 events/yr
4 = 101-200 events/yr
5 = > 200 events/yr
6 = continuous

Reversibility:
R = Reversible
I = Irreversible
(refers to population)

Duration:
1 = < 1 month
2 = 1-12 months
3 = 13-36 months
4 = 37-72 months
5 = > 72 months

Geographic Extent:
1 = < 1 km^2
2 = 1-10 km^2
3 = 11-100 km^2
4 = 101-1000 km^2
5 = 1001-10,000 km^2
6 = > 10,000 km^2

Ecological/Socio-cultural and Economic Context:
1 = Relatively pristine area or area not adversely affected by human activity
2 = Evidence of existing adverse effects

Table 6.4-16: Significance of Potential Residual Environmental Effects of Marine Construction Activities on Marine Mammals and Sea Turtles of the Species at Risk VEC

Valued Ecosystem Component: Species at Risk (Marine Mammals and Sea Turtles)				
Project Activity	**Significance of Predicted Residual Environmental Effects**		**Likelihood[a]**	
	Significance Rating	**Level of Confidence**	**Probability of Occurrence**	**Scientific Certainty**
Operations Activities and Physical Works				
Land-based				
Accidental events	NS	3	-	-
Marine				
Marine traffic	NS	3	-	-
Noise	NS	3	-	-
Accidental events	NS	3	-	-

[a] **Only rated if residual environmental effect predicted to be significant**

Key:

Residual environmental Effect Rating:
S= Significant Adverse Environmental Effect
NS = Not-significant Adverse Environmental Effect
P= Positive Environmental Effect

Significance is defined as a medium or high magnitude (2 or 3 rating) and duration greater than 1 year (3 or greater rating) and geographic extent >100 km^2 (4 or greater rating).

Level of Confidence: based on professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

Probability of Occurrence: based on professional judgment:
1 = Low Probability of Occurrence
2 = Medium Probability of Occurrence
3 = High Probability of Occurrence

Scientific Certainty: based on scientific information and statistical analysis or professional judgment:
1 = Low Level of Confidence
2 = Medium Level of Confidence
3 = High Level of Confidence

[a] Only applicable to significant effect.

Marine-based Activities

During marine-based construction, three activities have been identified as having reasonable potential to interact with marine mammals and sea turtles designated as Species at Risk. They are (1) marine traffic, (2) noise, and (3) accidental events (e.g., hydrocarbon and non-hydrocarbon releases) (Table 6.4-2).

Marine Traffic

Marine traffic is probably the Project activity that has the most potential to have negative effects on whales and the sea turtle designated as Species at Risk. Strikes of whales and sea turtles by large marine vessels often result in mortality of the animal. Occasionally, large marine vessels specifically associated with the fluorspar mine will be transiting between the primary shipping lanes in the Study Area and Greater St. Lawrence Harbour. The marine mammal and sea turtle species identified as Species at Risk and having reasonable likelihood of occurrence in the Study Area are susceptible to ship strikes during these transits. Mitigations intended to reduce the negative effects of Project-related marine traffic on SAR whales and the leatherback sea turtle will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include monitoring for whales and sea turtles by the ships' crews (Table 6.4-15) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine traffic on SAR whales and the leatherback sea turtle. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine traffic on SAR whales and sea turtles are low to medium, 1 to 100 km2, and >72 months, respectively (Table 6.4-15). Based on these criteria ratings, the residual effects of Project-related marine traffic during operations on SAR whales and sea turtles are insignificant (Table 6.4-16).

Noise

There are potential interactions between noise and the SAR marine mammals and leatherback sea turtle during marine operations (Table 6.4-2). Marine mammals rely heavily on the use of underwater sounds to communicate and to gain information about their surroundings. Experiments also show that they hear and may respond to many man-made sounds. Like marine mammals, sea turtles can hear sound associated with ships and other underwater activities. Thus, the potential negative effects caused by human-made sound within the marine environment, including those associated with marine operations activity of this Project should be considered. Reviews of the effects of sound on marine mammals and sea turtles have been provided in numerous environmental assessments recently prepared for proposed projects in Newfoundland waters. Some underwater noise will occur in the Project Area during marine operations but considerably less than what will occur during marine construction activities. Mitigations intended to reduce the negative effects of noise on SAR marine mammals and sea turtles will be detailed in the Operations Environmental Protection Plan (EPP). Appropriate mitigation measures would minimize the potential negative effects of operations noise on the SAR marine mammals and sea turtle. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of exposure to noise on SAR marine mammals and the leatherback sea turtle are negligible to low, 1 to 100 km2, and 1 to 12 months, respectively (Table 6.4-15). Based on these criteria ratings, the residual effects of underwater noise associated with marine operations on SAR marine mammals and the leatherback sea turtle are insignificant (Table 6.4-16).

Accidental Events

Accidental hydrocarbon and non-hydrocarbon releases during marine-based operations activities could potentially have negative effects on SAR marine mammals and the leatherback sea turtle (Table 6.4-2). However, as discussed in previously in this Section, effects of accidental events on these biota are likely minimal. Mitigations intended to reduce the negative effects of marine-based accidental events on SAR whales and sea turtles will be detailed in the Operations Environmental Protection Plan (EPP). Candidate mitigations for this activity include accident prevention protocols and rapid response plans (Table 6.4-15) but these measures will be finalized in the EPP. Appropriate mitigation measures would minimize the potential effects of marine-based accidental events on SAR whales and the leatherback sea turtle. The predicted magnitude, geographic extent and duration of the potential reversible residual effects of marine-based accidental events on SAR whales and sea turtles are low to medium, <1 to 100 km2, and <1 to 12 months, respectively (Table 6.4-15). Based on these criteria ratings, the residual effects of marine-based accidental events during operations on SAR whales and sea turtles are insignificant (Table 6.4-16).

6.4.2.6 Effects of Decommissioning

Considering the predicted insignificant residual effects of routine activities and accidental events of both marine construction and operations activities on the Species at Risk VEC, the residual effects of decommissioning routine activities and accidental events on the Species at Risk are also predicted to be insignificant.

6.5 HUMAN RECEPTORS

This section provides information to satisfy the socio-economic requirements for the proposed Project. It describes the existing socio-economic environment in the study area. It provides a description of the nearest human receptors to the Project site, an overview of the economy of the area, demographic information, potential human health issues, healthcare and infrastructures, employment job creation and training, quality of life and historic resources.

Project effects on the above socio-economic VECs have also been assessed, mitigation measures and residual impacts determined.

6.5.1 Introduction and Overview

6.5.1.1 Data Collection

The Guidelines document set the parameters for data collection.

Socio-economic baseline information was developed by gathering data from multiple sources, both primary and secondary. First hand data was obtained from local community residents, stakeholders, open houses, etc.

Reports, documents and statistics were reviewed to provide background information. Interviews in person or by telephone and meetings were held with informants and stakeholders St. Lawrence and in Marystown or Burin. Included among those individuals who informed this report are the following:

- Mayor, Deputy Mayor and a Councilor, the Town Council of St. Lawrence,
- Town Clerk of the Town of St. Lawrence,
- Labour Market Analyst, Town of St. Lawrence,
- Town Manager of Marystown,
- Representatives of the Schooner Regional Economic Development Board,
- Officials of Service Canada, the Department of Human Resources, Labour and Employment, The Rural Secretariat, Family Justice Service, Women's Policy Office, Department of Education,
- Administrator of the College of the North Atlantic, Burin campus,
- Vice-President, Business Development, Corona College, Grand-Falls-Windsor,
- Chair, Heritage Run Tourism Association,
- Director of Integrated Health Care, Burin Peninsula Health Centre, Salt Pond,
- Site administrator, US Memorial Health Care Centre, St. Lawrence,
- Social worker, US Memorial Health Care Centre, St. Lawrence,
- Manager of Child, Youth and Family Services, Burin Peninsula Health Centre, Salt Pond,

- Manager of Long-term Care and Community Supports, Burin Peninsula Health Centre, Salt Pond,
- Social Worker, Child Care Program (licensing), Clarenville,
- Regional Manager , Newfoundland and Labrador Housing, and
- Realtors; Sutton Group, and the Property Guys.

A tour of the Miners' Museum was taken guided by the Town Manager. Also, the EA team participated in the public meetings held in February and on October 22, 2009 as required by the guidelines.

6.5.1.2 Overview of the Economy - The Town of St. Lawrence and the Burin Peninsula

St. Lawrence

Historically, the economy of St. Lawrence was based on the inshore fishery and subsistence farming. The fishery was disrupted with the Tsunami in 1929, compounded by the Great Depression (Rennie, n.d.). Activity to develop the St. Lawrence mines in the 1930s was the beginning of a significant development in the local economy and prosperity in the community.

The mine closed in 1990 as other sources of fluorspar were identified at more competitive prices. Since the closure of the mine in 1990 as prices were uncompetitive, the community has experienced out-migration. Skilled workers sought employment where their skills were required, e.g., in Alberta, and they could earn a living.

Ocean Choice International owns a fish plant in St. Lawrence. It operates on a seasonal basis processing crab and whelk. There are a limited number of commercial fishers in the Great St. Lawrence Harbour (Burin Minerals, 2009).

The service sector is a prominent employer in the Town of St. Lawrence. These include the health care services and long-term care delivered by the US Memorial Health Care Centre. St. Lawrence Academy is the school providing primary, elementary and secondary levels of education. There is some small business activity, e.g., hardware store, gas bar, take-out restaurant, to provide goods and services for residents.

Marystown and Burin are the service centres for the region. These towns are approximately 25 km from St. Lawrence.

<u>The Burin Peninsula</u>

The Burin Peninsula was and remains an area with connections to the fishery through fishing and fish processing (Schooner Regional Economic Development Board, 2009). There are other industries that have a presence in marine servicing such as the Marystown Shipyard, metal fabrication for the oil and gas industries, the facilities in Marystown and at Cow Head, construction firms as well as the retail and service sectors (Labour Market Development Division, Department of Human Resources, Labour and Employment, 2007). There are federal and provincial government offices delivering public services. Other sectors that are active include tourism and information technology.

According to the Census 2006 data, the distribution of employment by sector the greater level was in the manufacturing sector (18%), primary resources (14%), retail trade (13%), health care and social assistance (10%) (Department of Finance, Community Accounts, 2005). The levels of manufacturing and primary resources reported on the Burin Peninsula exceeded the provincial percentages of employment.

The level of full-time employment was calculated by the Rural Secretariat Regions. Full-time employment was defined as working 50 weeks or more in 2005. In 2005 the level for the province was 47.3%. The level of full-time employment on the Burin Peninsula was 31.9% (Department of Finance, Community Accounts, 2005).

The people of Marystown and of the Burin Peninsula region are hopeful that the federal government will award work to the shipyard to build vessels as it expands its fleet. Efforts of development agencies and local leaders continue to diversify the economy and attract new industries to the region, including the reactivation of the Fluorspar Mine in St. Lawrence.

6.5.1.3 Demographic Information

According to the projections of the, the population of the province of Newfoundland and Labrador has experienced a decline and is projected to continue to do so (Table 6.5-1).

Table 6.5-1: Population Projection (2025) for the Burin Peninsula and the Province.

Location	Population 1991	Population 2009	Projection 2025
Newfoundland and Labrador	579,518	510,173	498,850
Burin Peninsula	29,072	20,962	17,813

The population statistics for the Burin Peninsula reflects the provincial trend. The population aged 15-64, the cohort from which the workforce is derived, is anticipated to decline between 2009 and 2025 by 28.6%.

As with the remainder of the province, the population on the Burin Peninsula is aging. The median age in the province was 42 years at the Census 2006. On the Burin Peninsula, the average age of residents stood at 43 years. These trends are reflected in a declining population of youth (aged 15-29) and also a declining number of people in child-bearing years that in turn, contributes to a declining birth rate.

A contributor to the decline in population is the out-migration of workers. As employment opportunities diminished with the collapse of the fishery, slowdowns at the Marystown shipyard and the closure of the mine at St. Lawrence in 1993, workers had to seek work outside the region or the province. The challenge for the proponent is to encourage those workers with skilled trades training and experience to return and/or to encourage other workers to join the workforce in St. Lawrence.

6.5.2 Human Health

6.5.2.1 History of the Mine and Impact on the Community

A discussion of human health must proceed with an acknowledgement of the history of the mine. The initial development and operation of the mine had an impact on the health the miners, their families and the community.

The initial mine developed in the 1930s was operated without knowledge of the presence of industrial hazards. The consequence of mining practices (dry drilling) combined with the absence of safeguards (adequate ventilation) was illness and deaths of miners arising from exposure to radon gas. While a definite number of miners have not been confirmed, estimates are that some 400-500 miners were affected (Pers. Comm, Mayor Wade Rowsell).

After the connection was established between illness and deaths and the mining operation, future operators took measures to ensure there was adequate ventilation and monitoring of air quality in the mine. The mine and the industrial illness was the subject of a Royal Commission of Inquiry. The loss of life arising from the initial mining operations has touched the community, as a generation was lost and many families survived without the presence of husbands, fathers, sons and brothers, friends and neighbours. Few households in St. Lawrence have not been touched by these events.

A significant issue for the reactivation of the fluorspar mine in St. Lawrence is this history and the awareness of the potential impact on human health (Pers. Comm, Mayor Wade Rowsell). It was apparent to the Proponent after the research was conducted that there is hope and optimism from the community that the mine will be reactivated. But there is also wariness evident regarding the need to protect human health.

Informants of this report have an expectation that future development and operations will proceed with miners' health and safety as a top priority. The Mayor indicated that the Town Council will be seeking written assurance from the Proponent that this will be the case. The Proponent is aware of the concerns of the community. It has expressed its commitment to "environment and safety first" in designing, developing and operating the mine and disposal of tailings.

6.5.2.2 Existing Baseline Description

Health Information and Health Care Infrastructure

The presence of health infrastructure is an important support for an operation such as a mine and for the labour force it needs to attract.

Health Needs Assessment

The Burin Peninsula is included within the jurisdiction of the Eastern Regional Health Authority ("Eastern Health"). Eastern Health conducted a comprehensive health needs assessment on the Burin Peninsula to gain an appreciation of the health issues in the region. The report released in 2006 was based on the "determinants of health model". The focus is on the underlying factors that contribute to the health status of the population. A key determinant of health in the model is economic status. The results are shown in Table 6.5-2 below.

The researchers conducted a telephone survey to determine the top five problems of concern to residents by area on the Burin Peninsula.

Table 6.5-2: Top Five Areas of Concern for Burin Peninsula Residents (Eastern Health, 2006).

Region	Unemployment	Out-migration	Lack of Health Services	Availability of Rec. Facilities	Cancer	Total
Burin Peninsula N.	32 37.6%	23 27.1%	7 8.2%	8 9.4%	2 2.4%	85
Marystown/Burin area	81 34.5%	41 17.4%	24 10.2%	19 8.1%	20 8.5%	235
Fortune area	53 49.1%	18 16.7%	8 7.4%	3 2.8%	9 8.35%	108
St. Lawrence area	19 32.8%	5 8.6%	7 12.1%	5 5.2%	5 5.2%	58
Total	185 38.1%	87 17.9%	46 9.5%	35 7.2%	34 7.0%	486

Unemployment was the issue of greatest concern for the residents in all areas of the Burin Peninsula, an issue which has an impact on human health. Another concern of note was relative isolation from major centres and its impact on access to services.

Drawing upon the results of the Canadian Health Survey 2003 reported in the Community Accounts, from the perspective of existing health conditions within the residents of the Burin Peninsula, over 20% of the population reported having arthritis, approximately 20% reported experiencing high blood pressure and about 16% reported difficulties with allergies (Department of Finance, Community Accounts, 2005). This pattern is consistent with the total provincial information. The data shows that approximately 2.5% cited cancer as a health condition which was slightly higher than the provincial percentage.

The needs assessment highlighted health practices and lifestyles that have a positive impact on health. Behavioural changes such as quitting smoking and increasing levels of physical activity are to be encouraged by Eastern Health and its community partners.

<u>Health Care Infrastructure</u>

The health care infrastructure serves a population base of approximately 21,000 people dispersed over a relatively large area. The residents of Burin Peninsula are covered by the health care system with three health care facilities in Salt Pond, St. Lawrence and Grand Bank, medical clinics in Terranceville and Bay L'Argent, and community based services.

<u>Health Care and Long-term Care Facilities</u>

The Burin Peninsula Health Centre ("BPHC") is classified as a secondary hospital providing emergency, acute care and secondary health services. There are rehabilitation services available at the site as well as out-patient clinics including a number of visiting specialists. Patients requiring specialty medical services are transferred via road or air ambulance to the tertiary care centre in St. John's.

Table 6.5-3: Burin Peninsula Health Care Centre (Burin Peninsula Health Care Centre and/or programs of Eastern Health, October 2009).

Service	***Details***
Health Centre-referral centre for the Burin Peninsula	
Emergency	24 hour service 2 physicians
Acute care	43 beds
Primary care	Family Practice Physicians
Secondary Care	Medical specialties include general surgery (2), obstetrics/gynecology (2), pediatrics (2), psychiatry (2), internal medicine (3), anesthetics (2), radiologist (1) Visiting specialist clinics
Allied Health include but are not limited to these services	Physiotherapy, occupational therapy, speech language pathology, pharmacy, social work, pastoral care
Community-based services	
Mental Health	1 intake, 2 social workers, 2 registered nurses, I psychologist
Child, Youth and Family Services (As of April 1, 2010, will be part of a separate government department.	Child protection, youth corrections adoption Covers the Burin Peninsula
Child Care Service	Licensed child care centres Explore and Discover, Marystown – 30 spaces maximum New Beginnings, Creston South – 26 spaces maximum Learn and Leisure - Big Salmonier near Lewin's Cove) 6 spaces maximum Family Child Care Centre Lewin's Cove – 6 spaces maximum
Personal Care Homes Level 1 and Level 2	Marystown Retirement Home - 94 beds
Long-term Care Level 3 and Level 4	0

In St. Lawrence, the US Memorial Health Centre provides emergency health services on a 24 hour basis. There are 3 primary care physicians on site and one nurse practitioner. Four beds are available for emergency services, and if patients require hospitalization they are transferred to the Burin Peninsula Health Centre at Salt Pond (Table 6.5-4).

Table 6.5-4: Health Infrastructure – Town of St. Lawrence (Burin Peninsula Health Care Centre and programs of Eastern Health, October 2009).

Service	***Details***
Health Centre	
Emergency Service	24 hour service, 4 short term beds
Primary care	3 physicians, 1 nurse practitioner
Allied health services include but are not limited to	Physiotherapy, occupational therapy, speech language pathology, pharmacy, social work, pastoral care
Community – based services	
Child Care Services	0 licenced child care centres
Personal Care Homes Level 1 and level 2	Mount Margaret Manor 31 beds
Long-term Care Level 3 and Level 4	38 beds 1 respite/protective care 1 respite/palliative care

The Town has care facilities to accommodate seniors. Mount Margaret Manor is a 31 bed personal care facility targeted to seniors who require Level 1 and Level 2 nursing care. For those requiring higher levels of nursing care at Level 3 and Level 4, associated with the US Memorial Health Centre is a long-term care facility with 38 beds plus 1 respite care bed/protective care bed and 1 respite/palliative care bed.

Eastern Health operates a health centre in Grand Bank (Table 6.5-5). There are emergency and primary care services available at the health centre. Specialty health services are accessed at the BPHC in Salt Pond or the tertiary care centre in St. John's.

Table 6.5-5: Grand Bank Community Health Care Centre.

Service	***Details***
Health Centre	
Emergency	24 hour emergency service 4 holding beds for observation
Primary Care	4 family practice physicians
Allied health include but are not limited to	Physiotherapy, occupational therapy, speech language pathology, pharmacy, social work, pastoral care
Community Services	
Personal Care Homes Level 1 and level 2	Grand Bank Retirement Home – 74 beds
Long-term Care Level 3 and Level 4	Blue Crest Nursing Home - 61 beds

<u>Community-Based Health Services</u>

Community-based health services are based in the BPHC and include mental health and addictions, child care services, continuing care, long-term care and community care programs.

There is one private company, Compassionate Home Care based in Marystown, delivering home support services[6] .

There are three child care centres licensed under the provincial regulations on the Burin Peninsula. Eastern Health does not track the number of unlicensed centres as they are not regulated. The point of relevance is that the presence of quality child care spaces may play a role in attracting, recruiting and retaining staff.

Until April 2010, the Child Youth and Family Services program (Child Protection) will be delivered through Eastern Health (pers. comm., Chris Mullett). There are 9 social workers involved with this program. This focus on domestic violence has been attributed, in part, to the pressures on families associated with the work schedules of workers travelling out of province to work while the family remains at home.

As for community-based services in the region, there is an array of services supported by community-based organizations. Brighter Futures is active in the area with programs to support families. There is a transition house in Marystown, known as Grace Sparkes House that accommodates women and children leaving a violent domestic situation. One social worker is assigned to working with clients living with domestic violence. An affordable housing study has recently been completed under a housing and homelessness committee based in Marystown. The Marystown Enrichment Committee was instrumental is advocating for Family Justice Services that is associated with the court system is to assist families going through family breakdown serving residents of the Burin Peninsula.

<u>Health Emergency Planning</u>

Eastern Health is in the process of revising its emergency preparedness and emergency response plans. It was suggested by a health administrator that a representative of Eastern Health be included in any planning committee and response team developed for the Town and for a reactivated mine in St. Lawrence. This way, these key stakeholders will be included in the communications loop when health services are needed.

[6] The consultant has been informed by a representative of Eastern Health that a high proportion of clients of the home support program, approximately 75%, manage their own services rather than rely on a private service.

6.5.2.3 Project Effects

The representatives of the senior management interviewed were confident that the health care system could be positioned to meet the requirements of a reactivated mine in St. Lawrence.

There is a need to extend assurances to the Town Council of St. Lawrence and the residents that human health and safety will be the proponents' top priority.

6.5.2.4 Mitigation Measures

To further support the level of trust and goodwill that the Proponent has developed with the Town of St. Lawrence and its residents, suggestions are offered to reinforce the commitment to protect human health.

Recommendations were offered to the consultant by informants and residents of actions the proponent could take to relieve the concerns of area residents. The suggestions relate to the company engaging with the community. These suggestions include, but are not limited to:

1. Host a public information session in St. Lawrence regarding health and safety to inform residents of how mining practices have changed to protect human health. This session could be organized with the assistance of local leaders who can relay questions and concerns of residents that need to be answered.

2. Canada Fluorspar (NL) Inc. could fund scholarships and sponsor community events aimed at educating local youth and area residents about the positive advances in mining fluorspar. Of particular interest is explaining how human health can and will be protected when extracting and processing fluorspar as well as disposing of tailings. This contributes to raising public education and awareness of up-to-date mining practices.

3. Canada Fluorspar (NL) Inc. could consider introducing a means to establish ongoing community relations with local representatives to enable it to be aware of new and emergent issues and concerns of area residents. This would be a way to be able to proactively respond and/or work with the community to address concerns as they arise. A committee representing a cross-section of interests meeting several times a year could be helpful for this purpose.

The proponent intends to monitor levels of radon gas in the mine. Assurances to the community that the levels are safe, and continue to be safe, could form part of the community relations strategy.

6.5.2.5 Residual Impacts

There are no residual impacts regarding human health anticipated.

6.5.3 Employment / Job Creation

6.5.3.1 Existing Baseline Description

Employment and Community Sustainability

One of the most important issues for a community's health and survival is to have an economic base to sustain its residents. This was a concern raised in the health needs assessment and also in a series of workshops sponsored by the Department of Human Resources, Labour and Employment to prepare the Labour Market Indicators and Trends Report on the Burin Peninsula Region.

Comparing the number of persons employed in the Burin Peninsula region in 1995 (10,935), with 2000 (11,060), and with 2005 (10,990) it appears that the level of employment has been steady in the region (Department of Finance, 2009). When examined for the St. Lawrence area, in 2005, 42.6% of the labour force was employed full-time as compared with 31.9% for the region as a whole.

Also telling are the projections of population change to occur between the years 2009-2025 and its potential impact on the availability of labour in the region. Provincially, it is forecast that there will be a total decline in population of 2.2%, with a decline in youth by 18.7%.

For the Burin Peninsula the total decline in population is projected to be 15.0% with 37.7% of youth leaving the area. Therefore, the high level of support for the reactivation of the mine is understandable as it is a means of contributing to stabilizing the population base and maintaining communities.

Estimated Occupational Requirements and Projected Schedule

As shown in Section 5.6 the Proponent has identified the types of occupations that are required for this project to proceed. This included a listing of jobs in accordance with the National Occupational Code (NOC) classifications. This listing is tentative as the feasibility report for the project is in progress and the occupational requirements may be subject to change.

Based on the estimates presented, requirements include 86 positions in the design phase, peaking at 369 positions during the construction phases, with 178 positions during operations. The deposit is forecast to support an 18-20 year operation.

During the decommissioning phase of the mine it is estimated that 25 positions are needed with a mix of labourers, equipment operators and skilled trade's persons. Decommissioning could involve approximately a 2 year period. To comply with environmental regulations, monitoring will be ongoing for several years after site closure to monitor dam integrity and water quality for discharge from tailings facility. One position is required to perform these functions.

The list of occupations by phase (including NOC codes) and projected schedule can be found in Sections 5.6.1 and 5.6.2.

A number of skilled trade's persons, professionals, semi-skilled persons and labourers will be required. Mining is not classified as a skilled trade. Training, knowledge, and experience gained on the job are critical for proper execution of tasks and in a way that safeguards the health and safety of all who are employed on the job site.

Source of the Workforce

Among its corporate objectives, CFI indicated that it will draw upon local workers.

There is a significant mining sector in the province with average employment levels that have increased from 1996- when there were 3,026 persons employed to 2008 when 3,673 were recorded (Department of Natural Resources, 2009). According to information from the Census 2001 linking education with occupation for the Burin Peninsula, 4,025 residents reported completing a post-secondary diploma or certificate program. Of these, 1,200 reported they were associated with construction and related industries. There was a pool of skilled labour in the region. The Burin Peninsula is an industrialized region. Its workers are in demand across Canada.

The immediate aim is to attract skilled workers from St. Lawrence and surrounding communities to return home to work in the mine. The next catchment area would be the Burin Peninsula and areas within 100 kms, representing a reasonable daily commuting distance. After that, the provincial labour market could be a source and then the rest of Canada.

6.5.3.2 Project Effects

In anticipation of this project proceeding, the Town Council of St. Lawrence has secured funding from Human Resources Development Canada to complete a labour market study in the Town of St. Lawrence and on the Burin Peninsula. The study is related to the mine and mill operations. It commenced in August 2009 and is anticipated to be completed by August 2010. Questionnaires have been distributed to all households on the Burin Peninsula. Efforts are also being made to distribute the questionnaire to skilled tradespersons from the region who are living outside the region. The goal is to alert skilled workers of the possibility of the reactivation of the mine and to determine if they could be enticed to return and, if so, under what conditions.

Though the results of the labour market study are not yet available to assist with this report, the results of the labour market study should prove to be very helpful to Canada Fluorspar Inc. in its planning for its labour force. It is clear that there is a skilled workforce that originated on the Burin Peninsula. By many accounts, many people from the region are working elsewhere and are anxious to return home.

The use of multiplier effects on employment in the mining sector was the subject of a report prepared for the Department of Natural Resources (Department of Natural Resources, Mineral Development Division, 2008).

"Information supplied to the Mineral Development Division by the Economics and Statistics Branch of the Department of Finance provides employment multipliers for five sub-sectors of the mining industry. The average employment multiplier for these five sub-sectors is 2.22." p. 4.

To gain an appreciation of the range of potential employment created by the Project, the multiplier applied to the mining operation phase of this project is 1.787, based on classification as non-metallic mineral mining and quarrying. Based on the potential range of multipliers by each phase of the project, the employment produced could be projected as follows (Table 6.5-6):

Table 6.5-6: Potential Long-Term Employment Effect

Phase	Person years of employment	Multiplier	
		1.787	2.2
Mine Operation	44	78.6	96.8
Mill Operation	125	223.4	275.0
Administration	9	16.1	19.8
Total	178	318.1	391.6

The multiplier effect during the design and construction is based on a different set of assumptions for direct, indirect and induced employment. A study by Syndor (Syndor, 1979) indicated the multiplier applied to non-residential construction (1.95) in the Atlantic Provinces is estimated as 2.02. This is comparable to the implicit construction employment multiplier in the Voisey's Bay EIS as communicated to The Institute for the Advancement of Public Policy, Inc. in June 2007.

Table 6.5-7: Potential Short-Term Employment Effect

Phase	Person years of employment	Multiplier	
		1.95	2.02
Design	81	157.95	163.62
Construction	369	719.55	745.38
Total	450	877.50	909.00

Discussions with professionals involved in delivering services within the social sector have revealed that out-migration from the region is producing high incomes but also having negative consequences on family life.

The mine reactivation offers hope to resolve some of the social issues associated with out-migration by offering employment locally. Local employment has the potential to alleviate the effects of the "turn-around syndrome". The "turn-around syndrome" describes work schedules where workers are away from home on the work-site (e.g., 20 days or 4 weeks) then home (e.g., 8 days or 2 weeks) and then the cycle continues again. According to these professionals, there is evidence that this is placing pressure on both spouses and their children and is disruptive to family life. The prospect of the mine reactivation project is viewed as positive, as it offers hope of restoring balance in the lives of the affected families.

Employment is a means to sustain the community of St. Lawrence and surrounding areas. It will provide a means for workers to return to the region.

This project will have a significant positive impact on the area.

6.5.3.3 Mitigation Measures

None required; however, to maximize local employment and to meet employment equity objectives, the proponent will engage in targeted training programs. The Proponent is committed to maximizing local employment.

6.5.3.4 Residual Impacts

Increase in direct and indirect employment in the region short and long-term. The redisual effect on employment is *positive and significant*.

6.5.4 Training

6.5.4.1 Existing Baseline Description

The representatives of Canada Fluorspar (NL) Inc. have stressed their commitment to developing a professionalized workforce. The intent of the company is to develop a workforce that will be trained in the operations of the mine and mill with opportunities to use their skills across the operation. A goal is to rely on a local labour force with a connection to the area so that there would be attachment formed with the mine. The longer-term objective is to retain workers in the long-term so that a trained and committed workforce and contribute to stability.

Already the seriousness of the proponent's commitment has been demonstrated through a program it delivered with funding provided by Service Canada[7] . This program was delivered after the mine closure and needed to be followed-up with hands-on experience. It was intended to provide knowledge of mining. The opportunity for hands-on application was not possible as the mine has not re-opened since 1993.

The proponent is aware that it must become engaged in training the workforce. It intends to use up-to-date mining technology using specialized equipment. The workers will require training to use this equipment.

The College of the North Atlantic (CNA) has capacity to develop and deliver programs in response to the training requirements of the mine. There are well equipped shops and labs, some of which have been reported to be among the best in the province, e.g. welding, instrumentation. The CNA has delivered programs in St. Lawrence and is willing to enter into negotiations to do so in the future. As for other private colleges, Keyin Tech has a campus in Burin.

[7] In 1993 to extend support under the Industrial Adjustment Services program when the mine shutdown, Service Canada conducted a needs assessment of the members of the workforce seeking assistance. A range of program offerings were accessed from Adult Basic Education to carpentry courses. The information is dated for the purposes of this report.

Of particular interest is Corona College in Grand Falls-Windsor which offers a program in hard rock mining. The institution has been in business for 21 years and delivering this program for the past 6 years. Graduates are certified to work underground. They are trained to use modern technology.

The Schooner Regional Economic Development Board has developed a strategic plan for 2008-2011, in which the mining sector has been identified as one of the strategic sectors for growth (Schooner Regional Economic Development Corporation (2008). With this evidence of support for the sector, potential workers are likely to be able to access funding programs available through Service Canada and/or the Department of Human Resources Labour and Employment.

There is capacity within the province to assist with training and development in the region. To compliment this advantage, there are funding sources that could be accessed to assist in developing and training the labour force.

6.5.4.2 Potential Effects

The benefit is the opportunity for workers to upgrade or develop new skills which are transferable. This can be helpful for the proponent in maximizing resources within its workforce.

This could prove beneficial for the individual workers as additional training opens up greater opportunities both within the mine operation.

6.5.4.3 Mitigation Measures

None required.

6.5.4.4 Residual Effects

An investment in training and development is beneficial to the individual and the proponent. It benefits the Town through employment and a sound tax base. Also, the community benefits through involved and engaged citizens.

6.5.5 Business Opportunities

6.5.5.1 Existing Baseline Description

Canada Fluorspar (NL) Inc. will require access to goods and services if the Project proceeds. The company intends to rely on local contractors and suppliers to meet its requirements. It is anticipated that demand will be generated for a range of services during the design, construction and operation phases of the project.

The proponent is supportive of benefitting the local business community. It is interested in ensuring the extent possible that local enterprises will provide good and services. The proponent will find ways to inform local suppliers of its requirements, e.g., meetings with local businesses, requests posted on its web-site. Entrepreneurs can be informed of the needs and respond accordingly.

The local community leaders and the Schooner Regional Economic Development Board have indicated an interest in seeing the mine reactivated. The partners expressed a willingness to support the proponent as it establishes and operates it s business.

6.5.5.2 Potential Effects

The reactivation of the fluorspar mine will produce *significant positive* economic benefits for the Town of St. Lawrence, the community, the region and the entire province.

Based on the Proponent's knowledge of the business and the area, the direct opportunities that could develop or require enhancement of existing businesses through the provision of goods and services include:

- Office supply agencies and support services;
- Commercial printing services;
- Courier services;
- Heavy equipment rental services;
- Auto rental, sales and repair services;
- Environmental monitoring;

- Bed and breakfasts;
- Excavation services;
- Snow clearing services;
- Wholesale trade;
- Commercial food services and catering;
- Commercial cleaning services;
- Transportation services;
- Construction services;
- Engineering services;
- Computer sales and service;
- Industrial product sourcing services; and
- Legal services.

The influx of workers and the associated increase in population resulting from the project will provide businesses that provide goods and services to the local population with a significant new market. This should in turn contribute to the expansion of operations and increase overall capacity.

Businesses that will be most likely to experience indirect business opportunities include, among others:

- Accommodation services and real estate;
- Auto sales and services;
- Retailers;
- Personal services providers;
- Entertainment industries;
- Personal finances and other like services;
- Health care goods and service providers (e.g., Chiropractic services);
- Restaurants and beverage providers;

- Bakeries;
- Household and commercial cleaning services; and
- Child care providers.

The project will also support new business opportunities. As an example, it will create tourism-related opportunities similar to those generated by other large industrial projects such as Offshore Oil and Gas, as people are interested in observing the construction of large-scale projects and key project milestones. This in turn, will provide stimulus to local tourism-related businesses such as accommodations, and food and beverage providers in the community and region.

Goods and services to the mine and its employees, will lead to an increased capacity of the area, including the Burin Peninsula region and the province.

The increase in business will help to diversify the provincial economy by strengthening other industries, resulting in a more sustainable economy as businesses grow. They can meet the demands within the region to ensure they are able to provide services to other firms and industries. "

6.5.5.3 Mitigation Measures

None required.

6.5.5.4 Residual Effects

The Town of St. Lawrence, the towns in the region and the entire province will benefit through an increased tax base to support improvements in public infrastructure and services.

As noted in the section related to human health, employment is one if the greatest determinants of a positive health status for individuals and for the community at large.

6.5.6 Community Economic Development

6.5.6.1 Existing Baseline Description

Based on interviews with local leaders, the Town of St. Lawrence was at one time a relatively wealthy community when compared with other communities in the region. The availability of cash provided a base for the establishment of small businesses, e.g., grocery stores, nightclubs. This changed with the closure of the mine. At the present time there are 18 business listings on the Town's tax rolls, 4 of which are associations or enterprises providing supportive employment. The existing business community is relatively small in St. Lawrence, although there is a base upon which to build.

Currently there are ninety-three businesses that are members of the Marystown-Burin Chamber of Commerce. This organization is in the process of creating the Burin Peninsula Chamber of Commerce. The expansion of the base is intended to include all communities south of Swift Current. The rationale for this development is to enable the organization to legitimately work for the benefit of the business community in the Burin Peninsula region.

Based on data of 2004, from the perspective of a region within the province, there were 3.4% of all businesses located on the Burin Peninsula (Department of Human Resources, Labour and Employment (2007). This is comparable to the distribution of the provincial population on the Burin Peninsula vis-à-vis the Provincial population as a whole.

The Schooner Regional Economic Board includes among its partners, agencies with a stake in economic development. The Board is very interested and will assist in developing the business capacity of the region, e.g., Canadian Business Development Corporation, Department of Innovation and Rural Development.

There are opportunities presented by the business development and expansion of the mine reactivation project. With a solid infrastructure in the region in place to enhance business capacity, the opportunities presented by such a project can be realized.

The proponent has demonstrated its willingness to act as good corporate citizen and contribute to the Town of St. Lawrence and its residents. Canada Fluorspar (NL) Inc. has been providing raw materials to Island Rock Jewelry and Crafts to create products for sale at the Miners' Museum and other locations in the area. This business is operated under Three L Training and

Employment Board, an organization providing opportunities for persons with disabilities to become engaged in meaningful activities[8] .

The opportunity to expand the economic base to include new services and suppliers is present with the reactivation of the mine. As previously noted, there are support services available in the region to promote and facilitate business development.

6.5.6.2 Project Effects

The increased economic activity has the potential to further enhance community economic development. New opportunities are more likely to be presented in an area with a vibrant and growing economy.

6.5.6.3 Mitigation Measures

None required.

6.5.6.4 Residual Impacts

The enhanced exposure and development of economic capacity can assist the area in the medium and long term with new enterprises and needs emerging. For example, opportunities can be seized with use of the new marine terminal.

The Burin Peninsula region, as a whole, stands to benefit from the reactivation of the fluorspar mine.

6.5.7 Fisheries & Aquaculture

6.5.7.1 Existing Baseline Description

Historically, the economy of St. Lawrence was linked with the fishery (The St. Lawrence Fluorspar Mines: A Brief History (n.d.).

A fish plant owned and operated by Ocean Choice International is based in St. Lawrence (pers. comm., Greg Hardy). The plant is a seasonal operation, processing crab and whelk. The plant

[8] The business has been inactive as it requires ventilation equipment.

in St. Lawrence operates on a seasonal basis, 14-17 weeks per year. During this past season, efforts to secure an additional shift to work at night were not successful.

Further, it is estimated that 25% of the workforce at the Marystown plant, a full-time operation, originates from the St. Lawrence-Lawn area.

The Department of Fisheries and Aquaculture (DFA) is responsible for the issuance of fish plant licences and for aquaculture operations.

The St. Lawrence Harbour Authority has responsibility for the management of the facilities of the harbour. There are an estimated 12-20 small boats (less than 35 feet) owned by fishers using the harbour.

The Department of Fisheries and Oceans (DFO) has confirmed that there are 15 Registered Commercial Licensed fishers with a home port identified as St. Lawrence. (This does not include crew members.) These fishers hold the following licences:

- 15 Groundfish Licences;
- 11 Snowcrab Licences;
- Lobster Licences;
- 6 Whelk Licences;
- 5 Squid Licences;
- Bait Licences;
- Mackeral Licences;
- 3 Herring Licences;
- 3 Capelin Licences; and
- 1 Scallop Licence.

6.5.7.2 Project Effects

It is anticipated that the reactivation of the mine will have an impact for the fish plant. The mine is likely to increase competition for labour in the area.

A representative of DFA confirmed that the mine activation project is not anticipated to have an impact on the fisheries and aquaculture interests of concern to the Province.

The Chair of the St. Lawrence Harbour Authority confirmed that it does not anticipate an impact on those who use the facilities. He stated that he cannot see that the mine will have an effect on the current users of the harbor. Further, he indicated that the fishers have no involvement on Blue Beach.

According to DFO representatives fishers use the area near St. Lawrence and Blue Beach for bait and capelin, although this use has been limited in recent years. The informant noted that the effect of the construction of the wharf and its operations may impact the pattern of activity of fishers, e.g., placement of nets.

DFO is reviewing information respecting the potential destruction of habitat in the area of the marine terminal to determine if a compensation strategy is needed (see section 6.1.4 for more details).

With respect to freshwater fish, an agreement was negotiated between DFO and the mine owners in 1996 with respect to diverting the fish to Salt Cove Brook (see section 6.1.2 for more details on freshwater fish and fish habitat).

6.5.7.3 Mitigation Measures

The impact of the wharf is under consideration by DFO. It may disrupt or create new habitat that could benefit fishers. Until this issue is settled, the extent of the need for mitigation measures is unknown.

A representative from DFO based in St. John’s advised that CFI is to provide assurance that the environment for freshwater fish as per the arrangement made under the HADD Compensation Plan will remain in effect.

6.5.7.4 Residual Effects

The residual effect of the Project on Commercial Fisheries and Aquaculture is *Not Significant*.

6.5.8 Tourism & Recreation

6.5.8.1 Existing Baseline Description

The provincial government is targeting resources to develop the tourism industry in Newfoundland and Labrador (Department of Finance, 2009). Tourists are classified as either resident or non-resident travelers, the latter arriving by air, by car or cruise ship. Despite the economic downturn, there was slight increase in tourism experienced in 2008 and 2009 to date.

The tourism operators of the Burin Peninsula benefit from inclusion in the efforts of Destination St. John's, a destination marketing organization that promotes tourism throughout eastern Newfoundland. The Heritage Run Tourism Association, a volunteer organization of operators, seeks to promote the region (pers. comm., Mary Hurley).

There is an evident interest in "geo-tourism", that is tourism associated with geography and geology. The Burin Peninsula is attractive for those with this interest. Tourists are reported to be extremely interested in "experiencing" a location. They are directed to the tourism resources of the area, including those in St. Lawrence.

The Town of St. Lawrence has some tourism infrastructure in place, namely the Miner's Museum, a hotel, hiking trails and bird watching. There is pride and interest in the heritage of the area as evidenced by a Heritage Association in St. Lawrence. Residents have interesting stories to relay such as the rescue of Americans from two sinking ships, US Prollux and US Truxton, from the frigid Atlantic Ocean. All of this indicates that there is a base around which tourism enterprises can further develop and expand.

There are recreation facilities in the town, including two soccer pitches and an active soccer association. Other recreation facilities include an outdoor swimming pool, curling rink, basketball court, track complex, gymnasium in the school, and recreation centre. It was noted by representatives of the Town Council that these facilities are maintained by the Town.

For those who enjoy the outdoors, hiking trails are accessible to enable excursions to the ocean. Bird watching, berry-picking and camping are among the activities enjoyed by those visiting and living in the area. The town has access to beach front at Sandy Cove Beach. An ATV trail is being developed simultaneously with a network of walking trails which is an attraction to tourists.

It should be noted that tourists are particularly interested in fluorspar, its uses and an opportunity to visit a mine. The products of Island Rock Jewelry and Crafts are in demand by visitors, apparently all the more so as they have not been producing over the past couple of years.

St. Lawrence is the site of one of two windmill farms in the province. The energy generated from the 9 windmills is diverted to the provincial power grid. The wind mill farm is also an attraction.

6.5.8.2 Potential Effects

The reactivation the mine will bring more visitors to the area. They will need to be accommodated, provided with food and other items during their stay as well an entertainment. This offers entrepreneurs who have an interest in tourism to consider the need for a range of services and to seek to satisfy the demands.

6.5.8.3 Mitigation Measures

None required.

6.5.8.4 Residual Effects

An increased number of visitors will improve the existing services available as establishments compete with one another to attract the attention of visitors. The Project will have a positive impact on Tourism.

6.5.9 Municipal Infrastructure and Services including Housing

6.5.9.1 Existing Baseline Description

The Town of St. Lawrence benefitted from the tax base generated by the mine when it was in operation. It had water and sewer services in place for over thirty years. Currently the system is in need of maintenance and upgrading. The Town Council is challenged by its diminished tax base. The Town clerk has confirmed that there are no capacity issues associated with adding these sites to the existing Town water system.

The mill and two of the mine sites, Blue Beach North and Director, are situated so that it is possible to access the town water service. At the Tarefare mine site, it is anticipated that a water purification system will be required to clean surface water. Septic tanks either are in use, or will be used, at the mill site and mine sites.

The Town owns and maintains streets within the municipality. It also has ownership and responsibility for the recreational facilities within the Town. Ongoing maintenance is an issue for the Town given the tax base.

The Town of St. Lawrence has a municipal dump. Based on current provincial policy directions, it is anticipated that there will a move toward a regional landfill site within the next few years. This will be a decision influenced by the Department of Municipal Affairs.

Housing

Based on the tax rolls of the Town of St. Lawrence, there are 636 households in the town. There are 21 apartments with one apartment building of 5 units. Real estate agents who have a presence in the Burin Peninsula region, confirmed that there are few houses on the market to buy or to rent in St. Lawrence.

There is a greater supply in Marystown-Burin where there are houses and some building lots for sale. The rental market is active with competitive rents.

The private rental market is limited in St. Lawrence and there is some, but not an overwhelming demand for social housing for families in need. The regional manager for Newfoundland and Labrador Housing advised that there are 19 social housing units targeted for families in St. Lawrence. There are 3 vacancies. There are also 6 cottage style units for seniors which are occupied.

The Town Council of St. Lawrence has been proactive with regard to anticipated demand for housing. Firstly, the Town has prepared a conceptual plan. It has made application to the Crown Lands Division to access land for the development of a subdivision intended to accommodate 64 serviced lots for single family dwellings. Though it sought interest from developers to move the project forward, it has not met with success to date. Meanwhile the application is being processed by Crown Lands to secure the property should it be required.

In addition, an area has been identified for use as a RV park. Town water and sewer are nearby for connections to servicing. If developed, it could accommodate 20 units. A thought is that, if need be, it could be used for trailers to accommodate workers.

Education

St. Lawrence Academy offers programming from Kindergarten to Grade 12. The school was built to accommodate 580 students. The enrolment is declining. In 2008, there were 228 students (pers. comm., Jim Sinnott). Therefore the school has capacity to accommodate additional students should there be families with children arriving in St. Lawrence.

The College of the North Atlantic (CNA) offers post-secondary programs and the transition year program for Memorial University.

There is one private college, Keyin College operating from Burin.

High-speed internet services are available on the Burin Peninsula. This infrastructure facilitates the delivery of distance learning programs.

Churches

There is a Roman Catholic Church and an Anglican Church in the Town of St. Lawrence. Churches of other denominations are located in larger towns such as Marystown and Burin.

Churches of the Pentecostal Assembly, Salvation Army Citadel and the United Church are located within driving distance from St. Lawrence, though may not be as convenient as if they were located in St. Lawrence.

6.5.9.2 Potential Impacts

The reactivation of the mine will enhance the tax base of the Town. The Mayor and Council are optimistic that the project will proceed as the employment and activity will produce beneficial effects for the Town.

The availability of housing to accommodate workers at the mine site was identified as an issue that should be considered in the registration document.

The limited supply of housing, either for sale or for rent, has been raised as a concern if there is an influx of workers coinciding with the mine reactivation. Developing a work camp is not being contemplated by the proponent.

The issue of housing was discussed with the Town Manager of Marystown. Similar issues were confronted when the platform for White Rose project was constructed in the area. There were approximately 1400 workers who required accommodation during the construction phase. The demand was met primarily by the private sector as apartment buildings were upgraded, vacant public housing units were leased from Newfoundland and Labrador Housing and renovated, or area residents leased all or part of their houses[9]. An evaluation of the White Rose project and its impact on the town confirmed that though rents were increased, the private sector responded to the need for housing.

Based on the White Rose Project experience, given that the highway system is developed and maintained year round, there were people commuting to the job site from other towns and locations. Housing was not an obstacle, as was anticipated in the first instance of the White Rose project. There is a responsive private sector in the area as was proven by the White Rose project.

No reasons have been presented to CFI to suggest there would not be a similar response to the demand for private market rental housing generated by a mine reactivation project in St. Lawrence. There is an apparent shortage of affordable housing which may influence rental rates if the project proceeds.

6.5.9.3 Mitigation Measures

None required.

6.5.9.4 Residual Effects

The services will be improved as a result of the mine activity and enhanced tax base.

[9] An affordable housing study has been prepared for the Marystown area. As it has not been released to the public, the consultant has not been able to access a copy of the final report. However, from the discussions held in the area it appears that the rental market is tight and given the demand, rents are rising in Marystown.

The housing market could benefit from the presence of the mine. The housing stock could improve with the greater availability of financial resources.

6.5.10 Quality of Life

6.5.10.1 Existing Baseline Description

Quality of life is sometimes measured by the overall level of economic activity and availability of employment. This measure does not seem to capture the breadth and depth of the quality of life in the St. Lawrence area. Generally, a widely used measurement of the quality of life is based on the determinants of health.

“Health is not merely the absence of disease. Health is defined as a physical, mental and social resource for everyday living. It is reflected in the extent to which individuals and communities are able to function optimally in their environments.” (Newfoundland and Labrador Heart Health Program, 1995).

Health is determined by inter-related factors that enable individuals to perform activities of daily living and includes twelve indicators, the first being income and social status (Public Health Agency of Canada, n.d.). This is interesting as the first determinant highlights the importance of employment to creating and maintaining good health.

The people of St. Lawrence, as in many small communities in the province have close connections with the land. It is a source of food, e.g., wild game, berries. It is a source of health and spiritual well-being, e.g., enjoying the trails for hiking and ATVs, camping, bird-watching. Access to hiking trails to take residents and visitors alike to points of note, e.g., Cape Chapeaurouge, are also important for tourism and recreation. While these are intangible features, they are of value and cannot be easily replaced.

The community of St. Lawrence is adjacent to the sea in a rural setting which contributes to defining the lifestyle of its people. Also, although the mine has been closed for almost two decades, there is still a connection to mining. It has its own identity as being a mining town.

The determinants of health model also highlights the importance of social networks, literacy and education, culture and the environment. It is known for its role in provincial sports, notably soccer. The community of St. Lawrence is an established community with tight connections between families.

One informant described the people as "resilient" referencing the fact the people were tested with the industrial illnesses and deaths arising from the mine. The community survived. There is a willingness to see the mine reactivated, so long as health and safety are the priority of the Project.

6.5.10.2 Project Effects

The health of the residents and of the community will benefit through the creation of employment and the establishment of a tax base. The growth in personal income and municipal revenues will contribute to maintenance and enhancement of existing services and supports in the town and surrounding areas.

The reactivation of the mill and mine will mean that areas once abandoned and used by residents will not be as accessible as they are now. This is due to health and safety concerns with a working mine and mill site in close proximity.

Extracting fluorspar, processing the material in the mill and transferring the ore from the mine to the mill is expected to generate dust and noise.

6.5.10.3 Mitigation Measures

CFI is aware that the reactivated mine will mean that access to the Project area by residents will be restricted. Access to open lands used by area residents will be accommodated where possible.

The Proponent is prepared to work with the community to ensure there is access to important locations, e.g., Cape Chapeau Rouge. There is a willingness to respect the needs and wishes of the company and to maintain the goodwill earned to date as a good corporate citizen.

CFI has indicated its willingness to replace walking trails that are removed due to the mine reactivation. This will enable residents and visitors to enjoy the land while the economic activity of the mine can proceed.

With respect to mitigation of the dust and noise from the mine and mill site, Canada Fluorspar (NL) Inc. has designed the site and marine terminal to be as least intrusive as possible for the residents of the Town of St. Lawrence.

The mine will use up-to-date technology to minimize dust and noise.

A new road will be built away from the Town between the mill and the marine terminal to transport processed fluorspar instead of relying on the existing road system.

6.5.10.4 Residual Effects

The residual effects of the porposed Project on the quality of life of the St. Lawrence citizens is expected to be *negative, but not significant*.

6.5.11 Historic Resources

6.5.11.1 Existing Baseline Description

CFI engaged an independent consultant to assess historic resources in the area of the mine and related port.

The assessment identified remains of shipwrecks on the shoreline of Blue Beach. Underwater investigations by another consultant found there was no evidence of the shipwrecks.

The independent consultant identified no other historic resources in the area.

6.5.11.2 Project Effects

The historic resources could be damaged if disturbed by contractors during the mine reactivation. Canada Fluorspar (NL) Inc. has no reason to undertake excavation or other activities in the area of the identified historic resources.

6.5.11.3 Mitigation Measures

Canada Fluorspar (NL) Inc. will ensure its contractors and employees are advised that the remains of the shipwrecks are not to be disturbed.

6.5.11.4 Residual Effects

Not significant.

6.6 SUMMARY OF ENVIRONMENTAL EFFECTS

6.6.1 Residual Effects

The predicted residual environmental effects of the proposed Fluorspar Mine Reactivation Project, including possible accidental events, on marine fish, fish habitat, and the commercial fishery during construction, operations, and decommissioning are assessed as negative, but *not significant,* provided that CFI and DFO have entered into a formal marine fish habitat compensation agreement prior to the start of construction, and that a compensation plan is developed and implemented by CFI in accordance with this agreement.

The predicted residual effects, including those resulting from accidental events of the Project on freshwater fish and fish habitat are assessed to be negative, but *not significant,* provided that the freshwater fish habitat compensation agreement executed in 1996 by CFI and DFO is complied with, including implementation of the compensation plan forming part of this agreement.

The predicted residual environmental effects on migratory birds of the Project's routine activities during construction, operations, and decommissioning are assessed to be negative, but *not significant*. The predicted residual environmental effect of an accidental event, such as a tailings dam failure, on migratory birds is also assessed to be negative, but *not significant*.

The predicted residual effects, including those resulting from accidental events, of the Project on species at risk are assessed as negative, but *not significant*.

The predicted effects of the Project on the socio-economic environment are generally assessed as *positive.* The predicted positive effects on local communities in form of job creation and employment, training, business opportunities and community development are assessed as *significant* benefits The predicted residual effects of the Project on human health, including those resulting from accidental events, are assessed as *negative*, but *not significant.*

In summary, after mitigation measures have been implemented, the overall predicted negative effects of the proposed Project on the biophysical environment, fishery, human and socio-economic environment are assessed as *not significant*.

6.6.2 Cumulative Effects

6.6.2.1 Within-Project

The within-project cumulative effects are integrated into the effects assessment of the individual activities that comprise the various phases of the Project. The residual effects of all routine activities with potential to interact with freshwater and marine fish and fish habitat (including fisheries), migratory birds, species at risk, and human environment were predicted to be *not significant*, the within-project cumulative effects are also predicted to be *not significant*.

6.6.2.2 With Other Projects

As mentioned previously, other projects and activities within the region, including Placentia Bay and the Burin Peninsula, have been considered in the cumulative effects assessment for the Project. Other projects are listed as follows:

- St Lawrence Wind Power Project;
- Burin Peninsula ship yards;
- Commercial fishing industry;
- Recreation, hunting and trapping;
- Whiffen Head Oil transhipment facility;
- Come By Chance oil refinery;
- Vale Inco's Long Harbour Commercial Nickel Processing Plant;
- Marine transportation;
- Proposed Southern Head Oil Refinery; and
- Forestry.

With the exception of marine shipping and commercial fisheries, there is essentially no overlap or interaction with the various activities and projects identified for cumulative effects assessment with respect to marine and freshwater fish and fish habitat, migratory birds, species at risk, and human environment.

Any added effects on the ecosystem from routine activities associated with the proposed Project will likely not change the effects predictions when viewed on a cumulative basis. Therefore, the cumulative effect of the Project, in association with the effects of other projects and activities in the region, including marine shipping and commercial fisheries, is predicted to be not significant.

6.6.3 Monitoring and Follow-up

Predictions of environmental effects of the Project on identified VECs are based on available literature and professional judgment. 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 throughout various phases of site/mine development, operations, and decommissioning.

7 PROJECT-RELATED DOCUMENTS

7.1 RELATED DOCUMENTS

1. Guidelines for both the Environmental Preview Report (pursuant to Part X of the Environmental Protection Act) and the Federal Environmental Assessment Report (pursuant to the Canadian Environmental Assessment Act). St. Lawrence Fluorspar Mine Reactivation (Burin Peninsula, Newfoundland and Labrador). September 10, 2009. As Proposed by Canada Fluorspar (NL) Inc.

2. Burin Minerals Ltd. Reactivation of the St. Lawrence Fluorspar Mine - Project Registration / Project Description Document. April 2009. (Prepared for Burin Minerals Ltd. by SNC-Lavalin Inc.)

3. Blue Beach Mine and Tarefare 2 Mine Pre-feasibility Study. Sept. 1998. (Prepared for Burin Minerals Ltd. by BLM Bharti Engineering Inc.)

4. Authorization for Works or Undertakings Affecting Fish Habitat. Fisheries and Oceans Canada. March 1997.

5. CEAA Screening Report: Shoal Cove Pond Tailings Project. Department of Fisheries and Oceans. February 1997.

6. Fish Habitat Compensation Agreement – Shoal Cove Pond Tailings Project. January 1997.

7. Proposed No Net Loss Compensation, Shoal Cove Pond Tailings Project. Burin Minerals Ltd. July 1996.

8. Fish Habitat Survey Salt Cove Brook. St. Lawrence, Newfoundland. July 1996. (Prepared for Burin Minerals Ltd. by ADI Nolan Davis)

9. Shoal Cove Pond Tailings Disposal site Environmental Preview Report Erratum Sheet. February 1996. (Prepared for Burin Minerals Ltd. by ADI Nolan Davis)

10. Shoal Cove Pond Tailings Disposal site Environmental Preview Report. November 1995. (Prepared for Burin Minerals Ltd. by ADI Nolan Davis)

11. Prefeasibility Evaluation Tarefare No. 2 and Blue Beach North Deposits. October 1995. (Prepared for Burin Minerals Ltd. by Davy International Canada Ltd.)

12. Shoal Cove Pond Tailings Disposal Site Environmental Preview Report. October 1990. (Prepared for Burin Minerals Ltd. by ADI Nolan Davis)

13. Site Investigation of Clarke's Pond – Shoal Cove Area: Regarding the Reactivation of the St. Lawrence Fluorspar Mine Marsh 21-24, 1985.

14. Scott Wilson (2009). Technical Report on the St. Lawrence Fluorspar Project, St. Lawrence Nl. NI 34-101 Update Report, April 30, 2009.

15. Scott Wilson (2009). St. Lawrence Fluorspar Project, Pre-Feasibility Study – Hydrological Aspects for EPR, October 2009.

16. J. Kelly, R. Power, L. Noble, J. Meade, K. Reid, S. Kuehnemund, C. Varley, C. Grant, M. Roberge, E. Lee, M. Teasdale. (2009). "A System for Characterizing and Quantifying Coastal Marine Habitat in Newfoundland and Labrador", April 2009.

17. SNC-Lavalin Inc. (July 2009). Freshwater Quality Evaluation Program – Fluorspar Mine Reactivation, St. Lawrence, NL. Report Prepared for Canada Fluprspar (NL) Inc.

18. Jacques Whitford Stantec Limited (2009). Geotechnical Investigation – St. Lawrence Fluorspar Mine. Report Prepared for SNC-Lavalin Inc., April 29, 2009.

19. AMEC Earth & Environmental (2009). Water Quality and Fish Habitat Program in St. Lawrence – Proposed Reactivation of Fluorspar Mine. Report Prepared for SNC-Lavalin Inc. / BAE-Newplan Group Limited, Report # 9116559, September 2009.

20. Gerald Penny Associates Limited (2009). Historical Resources Impact (Stage I), Canada Fluorspar Inc., St. Lawrence, NL. Report Prepared for Provincial Archeology Office and Canada Fluorspar Inc., 20 May 2009.

8 APPROVAL OF THE UNDERTAKING

Canada Fluorspar (NL) Inc. will require authorizations from the Federal, Provincial and municipal governments for all stages of this project (construction, operations, and decommissioning). Following environmental assessment approvals, applications for specific permits will be obtained prior to start of construction.

CFI has identified two "triggers" which would prompt a federal EA: the *Fisheries Act*, and the *Navigable Waters Protection Act*. Canada Fluorspar (NL) Inc. will work closely with CEAA, the Responsible Authorities (RAs), additional Federal Authorities (FAs), and various stakeholders throughout the federal EA process.

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.

Provincial legislation requires approval for activities associated with site preparation, mine development, and construction and operations. Socio-economic aspects of this project (such as potential impacts on the community, employee health and safety, and local benefits) will also be taken into consideration throughout the EA process.

Project components are located within the municipal limits of the Town of St. Lawrence. Municipal bylaws will be abided by throughout all stages of the project.

8.1 LIST OF MAIN PERMITS, LICENSES & APPROVALS

Table 8.1-1: Potentially Applicable Provincial and Municipal Authorizations

Government Agency	Permit, Authorization, Approval	Activity Requiring Compliance
DEPARTMENT OF ENVIRONMENT AND CONSERVATION		
Environmental Assessment Division	Release from Environmental Assessment	General
Water Resources Division	Alteration to a Body of Water (Schedule A to H). This application form is required as well as the appropriate Schedule application form (see below).	Any activity in or near any body of water Permit required for any infilling of any water bodies including marine infilling.
Water Resources Division	Schedule A - Environmental Approval of Culverts	New road construction
Water Resources Division	Schedule B - Environmental Approval of Bridges	New road construction
Water Resources Division	Schedule C - Environmental Approval of Dams	

Government Agency	Permit, Authorization, Approval	Activity Requiring Compliance
Water Resources Division	Schedule D - Environmental Approval of Fording	
Water Resources Division	Schedule E - Environmental Approval of Pipe Crossing – Water Intake	
Water Resources Division	Schedule F - Environmental Approval of Stream Modification or Diversion	New road construction
Water Resources Division	Schedule G - Environmental Approval of Small Bridges	New road construction
Water Resources Division	Schedule H - Environmental Approval of Other Alterations	Other works within 15 meters of a Body of Water.
Water Resources Division	Certificate of Approval for Site Drainage	Water run-off from the project site.
Water Resources Division	Water Use Authorization	
Water Resources Division	Certificate of Approval – Water & Sewer Distribution System	
Water Resources Division	Certificate of Approval for Temporary AGM (ARD) Storage	
Pollution Prevention Division	Certificate of Approval for Industrial Facilities or Processing Work	A certificate of Approval may be required for any industrial or processing works. (Sedimentation Pond)
Pollution Prevention Division	Certificate of Approval – Waste Disposal Facility	
	Environmental Protection Plan (EPP) – Construction	General
	Emergency Response Plan	General
	Environmental Effects Monitoring Plan	Also has to be submitted to Department of Fisheries and Oceans.
DEPARTMENT OF NATURAL RESOURCES		
Forestry Resources Branch	Commercial Cutting/ Operating Permit	
Forestry Resources Branch	Burning Permit	
Mines and Energy Branch	Surface Lease	
Mines and Energy Branch	Mining Lease	
Mines and Energy Branch	Magazine Licence	
Mines and Energy Branch	Application for Exploration Approval and Notice of Planned Mineral Exploration Work	Geotechnical Program
Mines and Energy Branch	Quarry Permit	
Mines and Energy Branch	Reclamation Plan (Including Financial Assurance)	
DEPARTMENT OF GOVERNMENT SERVICES		
Government Services	Licence to Occupy Crown Land	
Government Services	Certificate of Approval – Storage and Handling of Gasoline and associated products.	
Government Services	Permit for Flammable and Combustible Liquid Storing and Dispensing (Above or Below Ground) and for Bulk Storage (above ground only)	

Government Agency	Permit, Authorization, Approval	Activity Requiring Compliance
Government Services	Storage Tank System Application	All Storage Tanks on Site Including Waste Oil Tanks.
Government Services	Compliance Standards – National Fire Code, National Building Code and Life Safety Code	All Buildings on Site.
Government Services	Building Accessibility Exemption	All Building on Site
Government Services	Statutory Declaration for Registration of Boiler and Pressure Vessel Fittings Fabricated in Newfoundland and Labrador	
Government Services	Certificate of Plant Registration for Power, Heat, Refrigeration, Compressed Gas or Combined Plant	
Government Services	Contractor's Licence – Pressure Piping System	
Government Services	Examination and Certification of Welders and Blazers	
Government Services	Examination and Certification of Propane System Installers	
Government Services	Food Establishment Licence	If a cafeteria is located on site.
Government Services	Waste Management Plan	General
DEPARTMENT OF TRANSPORTATION AND WORKS		
Transportation and Works	Compliance Standard – Storing, handling and transporting dangerous goods	General
DEPARTMENT OF HUMAN RESOURCES LABOUR AND EMPLOYMENT		
Human Resources Labour and Employment	Compliance Standard – Occupational Health and Safety	Project-related employment
DEPARTMENT OF TOURISM, CULTURE AND RECREATION		
Tourism, Culture and Recreation	Compliance Standard – Historic Resources Act	Construction and operation.
Tourism, Culture and Recreation	Archaeological Investigation Permit	
DEPARTMENT OF HUMAN RESOURCES, LABOUR AND EMPLOYMENT		
Human Resources, Labour and Employment	Occupational Health and Safety Manual	General
TOWN OF ST. LAWRENCE		
Town of St. Lawrence	Compliance Standard/ Development Plan	Project Construction and Operation

Table 8.1-2: Potentially Applicable Federal Authorizations

Government Agency	Permit, Authorization, Approval	Activity Requiring Compliance
TRANSPORT CANADA		
Transport Canada	Explosives Transportation Permit	
Transport Canada	Permit to Store, Handle and Transport Dangerous Goods	
Transport Canada	Navigable Waters Protection Act (NWPA)	Wharf Construction or any activity affecting navigable waters.
Transport Canada	Letter of Assessment for Stream Crossings (NWPA)	Stream crossings.
DEPARTMENT OF FISHERIES AND OCEANS		
Marine Environment and Habitat Management Division	Authorization for Harmful Alteration, Disruption of Destruction (HADD) of Fish Habitat	Marine - Wharf construction and marine infilling. Freshwater - any pond/stream work that will impact fish habitat.
Marine Environment and Habitat Management Division	Letter of Advice	
Marine Environment and Habitat Management Division	Project Referral	
DFO	Environmental Effects Monitoring Plan	Also has to be submitted to Department of Environment and Conservation.
ENVIRONMENT CANADA		
Environment Canada	Compliance Standard – Fisheries Act, Section 36(3), Deleterious Substances	Any project-related water run-off
Environment Canada	Scientific Research Permit (Wildlife Permit)	
Canadian Wildlife Service	Compliance Standard, Migratory Birds Convention Act and Regulations	Any activities that could result in the mortality of migratory birds and endangered species and any species under federal authority.
INDUSTRY CANADA		
Industry Canada	Communications Licence	General
Industry Canada	Radio Station Licence	Use of radios on site
CANADIAN NUCLEAR SAFETY COMMISSION		
Canadian Nuclear Safety Commission	Nuclear Substances and Radiation Devices	General

9 FUNDING

The founders of Canada Fluorspar (NL) Inc. will fund their fluorspar project through private financing. The company's founders have a long history of raising and funding successful projects in the resource field. The company will be publicly traded and will access its major funding through available private and public equity investments and bank and private debt.

Canada Fluorspar (NL) Inc. currently has no plans to request Federal funding to support development of this project. Financial assistance (in the form of an interest-free loan) will be provided by the Government of Newfoundland and Labrador in support of the construction of the deep-water port.

10 PUBLIC PARTICIPATION

10.1 PUBLIC CONSULTATIONS

CFI recognizes the importance of public consultations throughout the entire environmental assessment process. Various methods of public participation have been implemented to ensure open lines of communication have been maintained. Significant effort has been made to provide stakeholders with information regarding the project, and encourage them to discuss the Project, ask questions, and seek answers to any project-related questions. Additional information regarding Issues Scoping is provided in the next section.

10.2 PRELIMINARY ISSUES SCOPING

10.2.1 Project Feedback

Table 10.2-1 identifies key points and concerns brought to the attention of CFI during the two public consultation meetings, the first held before project registration with the provincial and federal EA process (in February 2009) and the second before submission of the EA document (in October 2009). Meetings have also been held with government departments, municipal councils and community groups, and various other stakeholder groups. Below is a summary of these consultations:

- Residents of St. Lawrence are generally positive about the potential economic benefits of this project. Local businesses are also interested in potential spin-off opportunities.
- During meetings and public consultations, questions were raised regarding historical health impacts associated with working in the St. Lawrence mine. CFI has reassured the public that all necessary mitigation measures will be taken and proper protective measures implemented. CFI views worker health and safety as a top priority. CFI has also indicated that significant Health and Safety issues associated with previous operations were resolved in the 1960s and 1970s. In a survey completed at the second open house meeting, participants identified worker health and safety as their number one priority.
- Participants at the second open house rated local employment and training as their second priority. Questions were raised regarding use of a local workforce and

opportunities for training. CFI is committed to hiring skilled workers in the immediate area of St. Lawrence and the Burin Peninsula, and has expressed a commitment to engage residents in training programs.

- No major concerns have been identified with respect to project-related shipping. Given the proximity of St. Lawrence (on the southern tip of the Burin Peninsula) to international shipping routes and the small number of shipments required per year (18-20), very little interaction with other marine-users is anticipated.
- FFAW has made an inquiry with respect to the constituents of water leaving the polishing pond of the tailings management facility. CFI will ensure that effluent leaving the TMF will be monitored and, if required, treated to comply with all regulatory effluent discharge requirements. Water quality monitoring/treatment stations and spillways will be included in the final design.
- Schooner Regional Economic Development Board and the Town of St. Lawrence has commissioned a labour market analysis of the Burin Peninsula Region. This study will allow identification of occupations in which there is a deficiency of workers. CFI has committed to maximizing local benefits through the process of hiring employees from the project area. A labour market analysis will also allow the College of the North Atlantic (Burin campus) to assist in responding to gaps in required occupations.
- Some questions 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. CFI has reassured the public and the Town Council of St. Lawrence that the road will be rerouted to allow continued use by the public.

Table 10.2-1: Summary of Public Consultations

GROUP	DATE	KEY POINTS AND ISSUES
Canadian Environmental Assessment Agency (CEAA)	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 Assessment Division	November 20, 2008	Proper consideration to alternatives should be provided.
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 project.

GROUP	DATE	KEY POINTS AND ISSUES
		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 & 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 deep-water port (safety concerns at previous used wharf, need 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	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 Council	February 23, 2009	Provided summary of proposed project, discussion of previous efforts to reactive 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	February 24, 2009	Proposed timeline was discussed.

GROUP	DATE	KEY POINTS AND ISSUES
Development Association		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 – Open House #2	October 22, 2009	Many participants expressed support for the 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.

10.2.2 Water Valuation

Following requests from the Water Resources Division of NL DOEC, CFI investigated the social value placed on Shoal Cove Pond by community residents. Engaging the public is very important and provides many benefits throughout decision-making processes, as is identified in the Canadian Council of Minister's of the Environment Report entitled "Analysis of Economic Instruments for Water Conservation" (2005).

In order to determine the value placed on Shoal Cove Pond, Open House attendees at the first open house meeting were asked to place a value on the Shoal Cove Pond area and to indicate how frequently they use the area.

Attendees were asked to rate their value of Shoal Cove Pond where:

- 1 = "I place very little value on Shoal Cove Pond and rarely use the area around the Pond";

- 5 = “I place a high level of value on Shoal Cove Pond and use the area around the pond frequently”.

Of the 155 exit surveys completed, 123 attendees rated their value of Shoal Cove Pond between 1-3, with an average rating of slightly over 2. Only 13 people reported that they placed a high level of value on Shoal Cove Pond and used the area frequently.

When asked to identify the types of activities (if any) in the Shoal Cove Pond area, the most common response (with 36 votes) was Walking / Running / Hiking / Cross-Country Skiing. 101 people did not respond to this question.

These responses support the general attitude expressed throughout the community (also expressed by the Town’s mayor at the February 23rd meeting with council) that this area has been used by the mining industry for many decades, and is therefore considered a brownfield industrial area and is not frequently used by most community residents.

At the second open house meeting, CFI presented the various TMF alternatives, and the attendees were then asked questions regarding the preferred TMF location (Shoal Cove Pond). 72 of 75 responses were in support of using Shoal Cove Pond as a TMF. Several participants expressed their understanding that there would be less of an impact on the freshwater aquatic environment by using Shoal Cove Pond, due to the fact that the pond has been impacted by historical mining practices.

10.2.3 Marine Terminal Preferred Location

During the second open house meeting, participants were presented with two options for the proposed location of the marine terminal; the north location and the south location. 60 of 75 participants were in favour of the north wharf location. Reasons given behind this preference were mostly associated with this location having less of an impact on the marine fish habitat. Only one survey respondent supported the south option, and the reason given for this was that it would not interfere with capelin that is in the area. Overall, attendees were pleased with the preferred options and seemed comfortable with the information presented.

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Section 6.5 – Human Receptors

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Personal Communications

Wade Rowsell, Mayor	Town of St. Lawrence
Deputy Mayor	Town of St. Lawrence
Councillor	Town of St. Lawrence
Town Clerk	Town of St. Lawrence

Labour Market Analyst	Town of St. Lawrence
Town Manager	Marystown
Representatives	Schooner Regional Economic Development Board
Department Officials	Service Canada
Department Officials	Department of Human Resources, Labour and Employment
Department Officials	The Rural Secretariat
Department Officials	Family Justice Services–Burin Peninsula
Department Officials	Women’s Policy Office
Department Officials	Department of Education
Administrator	College of the North Atlantic, Burin campus
Vice-President of Business Development	Corona College, Grand-Falls-Windsor
Mary Hurly, Chair	Heritage Run Tourism Association
Director of Integrated Health Care	Burin Peninsula Health Centre, Salt Pond
Site administrator	US Memorial Health Care Centre, St. Lawrence
Social worker	US Memorial Health Care Centre, St. Lawrence
Manager of Child, Youth and Family Services	Burin Peninsula Health Centre, Salt Pond
Manager of Long-term Care and Community Supports	Burin Peninsula Health Centre, Salt Pond
Social Worker	Child Care Program (licensing), Eastern Health, Clarenville
Regional Manager	Burin Peninsula Newfoundland and Labrador Housing
Realtors	Sutton Group and the Property Guys
Greg Hardy, Manager	Ocean Choice International, Marystown Plant
Chris Mullett, Manager	Child, Youth and Family Services
Jim Sinnott, Director of Policy and Planning	Eastern School District

Websites

Community Accounts, www.gov.nl.ca