FINAL REPORT

LIST OF TABLES

LIST OF APPENDICES

6.1 GEOLOGY

6.1.1 Analysis, Mitigation and Environmental Effects Evaluation

Geology has been identified as a VEC due to the potential for disturbance of acid generating rocks and potential consequences of acid rock drainage (ARD) on resources. Acid generating rocks are a group of mineralized geologic materials that contain various sulphides. When these minerals are disturbed and come into contact with water, oxygen, and iron reducing bacteria, the sulphide minerals, become oxidized and acid is generated in the process. The presence of iron reducing bacteria serves as a catalyst that accelerates acid production and the potential for generation of ARD. Carbonate minerals, where present, serve to buffer acid generation. The NSE and EC jointly prepared *Guidelines for Development on Slates in Nova Scotia* (April, 1991) and the provincial *Sulphide Bearing Materials Disposal Regulations* (April, 1995) regulate the management of materials with potential for ARD. To determine if a particular rock can be considered acid producing the total sulphide content must exceed 0.4 percent and the rock does not contain sufficient minerals such as calcium to neutralize or consume the acid. The guidelines are specifically targeted towards slate bedrock, particularly the Halifax Formation, yet the guidelines are also applicable to other sulphide-containing bedrock.

Based on available regional maps (Section 5.1) there are no known occurrences of acid generating rocks in the project area. Furthermore, there would be no correlation between any potential effects and any alteration of the geology in the area. Any effect would be reflected in the groundwater, surface water, or soil geology as discussed below. Precautionary measures will be applied during the construction phase and will relate to the monitoring for the presence of acid generating rocks and mitigation measures should such rock types be encountered. These measures are discussed in the applicable sections of potentially affected VECs (Section 6.2 Soils; Section 6.7 Surface Water; Section 6.9 Freshwater Environment).

6.1.2 Summary of Significant Environmental Effects

No adverse environmental effects have been identified. None of the Project phases is expected to interact with the geological environment in a way that adverse effects would be likely. Potential effects on soils and aquatic environments as a consequence of disruption of acid generating rock are addressed in the Section related to the respective VECs.

6.2 SOILS

6.2.1 Analysis, Mitigation and Environmental Effects Evaluation

During the initial stages of the construction phase there will be extensive ground works including blasting, cut and fill, and contouring to achieve the desired grade levels at the terminal, the logistics park, and the rail and transmission corridors. In this context, soils have been identified as a VEC due to the potential for

- Soil erosion during construction activities; and
- Changes in soil chemistry due to acid rock drainage.

Soil Erosion

Soil erosion is primarily of concern from a surface water quality and aquatic habitat quality perspective as eroding soil particles may be washed into near-by water courses, potentially altering water quality, increasing sediment loadings, and degrading fish habitat quality. Effective mitigation measures are available to avoid and minimize soil erosion through the implementation of site-specific erosion and sediment control plans and corresponding monitoring. This is being addressed in the Effects Assessment for Surface Water, Freshwater Water, and Marine Environments (Section 6.7, 6.8, 6.9).

Changes in Soil Chemistry

As discussed in Section 6.1, existing geological conditions suggest that the proposed earth works are unlikely to disrupt acid generating rock. Therefore, the likelihood of ARD is very low. Nevertheless, as a precautionary measure, monitoring for acid generating rock will be undertaken. If required an acid rock management plan will be implemented during construction.

6.2.2 Summary of Significant Environmental Effects

No adverse environmental effects have been identified for soils per se. However, soil erosion is of concern from a surface water quality and aquatic habitat quality perspective. Effects of erosion on these environments are discussed in the respective sections of the effects assessment (Section 6.7, 6.8, 6.9).

6.3 AIR QUALITY

6.3.1 Boundaries

6.3.1.1 Temporal Boundaries

The temporal boundaries include all three phases of the Project; construction, operation, and decommissioning. However, no specific work was conducted related to the decommissioning phase as these works are expected to remain within the air impacts associated with the construction phase.

6.3.1.2 Spatial Boundaries

The spatial boundaries include the Project site (marine terminal, intermodal rail yard, logistics Park) and the proposed rail line as discussed in Section 2. Adjacent lands were taken into consideration with respect to potential receptor locations.

6.3.1.3 Administrative, Legislative, Technical Boundaries

Table 6.3-1 shows the applicable federal and provincial objectives relating to ambient air quality.

The Government of Canada (2004) NAAQO are based on a three-tier structure and are defined as follows:

- The **Maximum Desirable Level** is the long-term goal for air quality and provides a basis for an anti-degradation policy for unpolluted parts of the country and the continuing development of control technology.
- The **Maximum Acceptable Level** is intended to provide adequate protection against effects on soil, water, vegetation, materials, animals, visibility, personal comfort, and well-being.
- The **Maximum Tolerable Level** denotes time-based concentrations of air contaminants beyond which, because of a diminishing margin of safety, appropriate action is required to protect the health of the general population.

CCME have developed a Canada-Wide Standard for $PM_{2.5}$ which is 30 µg/m^3, based on a 24-hour average over three consecutive years. This standard is to be achieved by 2010 (CCME 2000).

NSE has established maximum permissible ground level concentrations for ambient air quality in Nova Scotia. All approvals issued by the Minister of Environment contain provisions to ensure that the maximum permissible ground level concentrations are not exceeded. Table 6.3-1 provides a list of these criteria.

Table 6.3-1: Federal and Provincial Ambient Air Quality Criteria

Pollutant	Averaging Time Period	NOVA SCOTIA	CANADA			
		Maximum Permissible[a]	Canada-Wide Standards[b] (Pending)	Ambient Air Quality Objectives[c]		
				Maximum Desirable	Maximum Acceptable	Maximum Tolerable
Nitrogen Dioxide (µg/m^3)	1 hour	400	-	-	400	1000
	24 hour	-	-	-	200	300
	Annual	100	-	60	100	-
Sulphur Dioxide	1 hour	900	-	450	900	-

Table 6.3-1: Federal and Provincial Ambient Air Quality Criteria

Pollutant	Averaging Time Period	NOVA SCOTIA	CANADA			
		Maximum Permissible[a]	Canada-Wide Standards[b] (Pending)	Ambient Air Quality Objectives[c]		
				Maximum Desirable	Maximum Acceptable	Maximum Tolerable
($\mu g/m^3$)	24 hour	300	-	150	300	800
	Annual	60	-	30	60	-
Hydrogen Sulphide ($\mu g/m^3$)	1 hour	42	-	1	15	-
	24 hour	8	-	-	5	-
Total Suspended Particulate Matter ($\mu g/m^3$)	24 hour	120	-	-	120	400
	Annual	70	-	60	70	-
PM10 ($\mu g/m^3$)	24 hour	-	-	-	-	-
PM2.5 ($\mu g/m^3$)	24 hour	-	30	-	-	-
Carbon Monoxide (mg/m^3)	1 hour	34.6	-	15	35	-
	8 hour	12.7	-	6	15	20

Sources:
[a]Government of Canada 2004
[b]CCME 2000
[c]NSEL 2007b

6.3.2 Threshold for Determination of Significance

A significant adverse air quality effect has been determined to represent a condition where regulatory objectives are regularly exceeded.

6.3.3 Air Quality Effects

6.3.3.1 Construction Air Quality Impacts

The use of equipment to construct the Terminal will result in temporary, short-term emissions of air pollutants that will be restricted to the construction period for the Terminal and will terminate once construction has been completed. These emissions will likely not result in significant adverse impacts to the air quality within the vicinity of the Project Area. Fugitive dust control measures to be implemented, if required.

Terminal construction activities can generally be categorized into site preparation, terminal process construction, and marine pier construction activities. During construction activities associated with the Terminal, the use of internal combustion engines in various cranes, backhoes, dozers, loaders, pavers, trucks, welders, generators, air compressors, pumps, pile drivers, miscellaneous heavy construction equipment, and worker commuting vehicles will result in emissions of NO_X, SO_2, CO, PM_{10}, $PM_{2.5}$, and VOCs.

Fugitive dust emissions from activities such as demolition, site preparation, grading and vehicle traffic, will occur during construction periods. Prior to paving or revegetation of disturbed soil areas within the Project Area, wind erosion of displaced soil may also generate fugitive dust emissions. MITI will use mitigation measures to minimize the fugitive dust emissions associated with construction of the Terminal. These measures may include the application of water or dust suppressants, covering of haul trucks, use of paved roads to the extent possible, limiting vehicle speed, and stabilizing disturbed areas.

6.3.3.2 Operational Air Quality Impacts

In general, emissions from the operation of the Terminal will be conducted in a manner to meet ambient air quality objectives that fall under the Nova Scotia Department of Environment (NSE) Guidelines for Environmental Air Measurement and Assessment (Section 6.4.1.3).

The assessment of air emissions from the operation of the Terminal included the following:

1. An inventory of all combustion emissions was developed and compared to the emissions inventory for the Province of Nova Scotia;
2. An air dispersion modeling study was performed to predict the impacts on air quality at the two residential properties located closest to the Terminal property.

6.3.3.2.1 Inventory of Melford Terminal Air Emissions

The following sections provide an assessment of air emissions projected to be generated from the operation of the proposed Melford Terminal. The approach developed to assess the impact of air emissions from the project is based on the following documents:

- White Paper #3 – Port Emission Inventories and Modeling of Port Emissions for Use in State Implementation Plans (SIPs), prepared by ICF Consultants for USEPA, May 4, 2004;
- Current Methodologies and Best Practices for Preparing Port Emission Inventories – ICF Consulting and USEPA ; and
- Air Quality Report: EIS for the Proposed Marine Container Terminal at the CNC – prepared for the USACE Charleston District and the South Carolina State Ports Authority (SCSPA), September 2005.

Air emissions for the project were assessed based on the following activities:

- Docking and hoteling of container ships;
- Use of tugboats during docking;
- Transporting containers using trucks; and
- Transporting containers using locomotives.

It should be noted that MITI has recently confirmed that onshore cargo handling equipment and cranes will be powered by electricity, and thus such equipment is not included in the following analysis. Two scenarios, a 600,000 TEU Start Up scenario and a 1,500,000 TEU Build Out scenario, were assessed. The following sections provide an inventory of emissions estimated to be generated from these activities.

6.3.3.2.2 Container Ship Emissions

Container ships are typically powered by large diesel engines. The United States Environmental Protection Agency has developed three categories for large diesel engines based on their size. There categories are summarized in Table 6.3-2.

Table 6.3-2: Categories of Marine Diesel Engines (EPA 2003)

Category	Typical Uses	Displacement per Cylinder	Power Range (kW)	RPM Range
1	Propulsion engines on harbor craft and fishing vessels	Displacement <5 liters (and power ≥37 kW)	37-2,300	1,800 – 3,000

Table 6.3-2: Categories of Marine Diesel Engines (EPA 2003)

Category	Typical Uses	Displacement per Cylinder	Power Range (kW)	RPM Range
2	Propulsion engines on tugs and push boat; auxiliary engines on ocean-going marine vessels	5 liters ≤ Displacement <30 liters	1,500 – 8,000	750 – 1,500
3	Propulsion engines on ocean-going marine vessels	Displacement ≥ 30 liters	2,500 – 80,000	60 – 900

Source: USEPA: Port Emission Inventories and Modeling of Port Emissions for use in State Implementation Plans – White Paper #3, 2004

Large container ships have multiple diesel engines that are used to propel the ship and to generate electrical power for auxiliary purposes. Typically, the propulsion engine is a Category 3 engine, while the auxiliary engines that are used for electrical power generation are Category 1 or 2 engines.

Table 6.3-3 provides a summary of the engine characteristics of the average type of Container Ships that are expected to arrive at the Melford Terminal. During full operation, it is estimated that the Melford Terminal will receive in the range of 188 - 260 vessels a year. The best estimate of the frequency of the types of vessels to supply the Terminal, used for this modeling, is predicted as 40% Panamax, 40% Post-Panamax and 20% Super Post-Panamax. This can be considered a “worst case” scenario, given the trend towards the larger and more fuel-efficient Super Post-Panamax vessels. This trend may imply that most if not all vessels supplying the Terminal as it reaches full capacity will be in that category.

Table 6.3-3: Engine Characteristics for Container Ships Serving Melford

Engine Type	Engine Category	Vessel Type	Average Power (kW)	Average Power Rating (hp)
Main Engine (used for propulsion)	Category 3	Panamax	41,000	54,940
		Post Panamax	66,000	88,440
		Super Panamax	85,700	114,838
Auxiliary Engine (used for propulsion or power generation)	Category 1 or 2	Panamax	9,020	12,087
		Post Panamax	14,520	19,457
		Super Panamax	18,854	25,264

Note: Power rating information obtained from MAN B&W Diesel A/S document Propulsion Trends in Container Vessels.

Category 3 marine engines generally fall into one of two distinct types, as shown in Table 6.3-4. Based on the power rating of container ships expected to serve the Melford Terminal, along with knowledge of the types of engines currently used in container ships, it is assumed in this study that ships’ engines have Slow Speed, 2-stroke engines.

Table 6.3-4: General Characteristics of Category 3 Marine Diesel Engines (EPA 2003)

Engine Type	Fuel Type	Size Range (Liters/Cyl)	Rated Speed Range (rpm)	Stroke/Bore Ratio	Number of Cylinders	Power Range (Total kW)
Slow Speed, 2-Stroke	Residual	57 - 2,006	54 - 250	2.38 – 4.17	4 - 14	1,100 – 103,000
Medium Speed, 4-Stroke	Residual, Distillate	30 - 290	327 - 750	1.15 – 1,171	5 - 20	1,000 – 18,100

The emissions from marine diesel engines vary with the speed underwater which the engine is operating. The operation of container Ships can be grouped into four main operating modes as listed in Table 6.3-5.

Table 6.3-5: Vessel Operating Modes

Operating Mode	Description	Load Factor (fraction of rated power)
Cruising (1)	Vessel is approaching the port, but has not yet been required to reduce its speed.	80%
Reduced Speed Zone (RSZ) (1)	Vessel is approaching the port and is required to reduce speed.	15 – 35% (can be as high as 70%)
Maneuvering (1)	Vessel movements within port, including berthing and moving between berths.	10 – 12%
Hoteling (2)	Time spent at berth, also called dwelling. Category 3 engines are typically only used for hoteling on refrigerated and cruise ships due to the larger power demand of these vessels. Container ships typically use Category 1 or 2 diesel engines for hoteling. During hoteling the Category 3 engine is assumed to be operating at ten percent of design capacity, and the Category 2 engine is assumed to be operating at 80 percent of design capacity.	10%

Source: Air Quality Report: EIS for Proposed Marine Container Terminal at the CNC, Pinnacle Consulting Group, 2005

Container Ship Emission Factors

Emission Factors were obtained from literature sources to estimate the emissions of criteria air pollutants associated with operation of the proposed terminal. The emissions estimates provided in this document represent the increase in criteria pollutant emissions that will result from the Terminal Operation. EPA found that emission factors tend to be relatively steady at loads greater than 20 percent; however, at low loads the emission factors increase (EPA, 2003). Table 6.3-6 presents the emission factors used for cruising and Reduced Speed Zone (RSZ) modes. These factors were adjusted for low loads in the maneuvering mode (The Pinnacle Consulting Group, 2005). The adjustment ratios and the adjusted emission factors for the maneuvering mode are presented in Table 6.3-7. The emission factor adjustment ratios were not applied during hoteling mode because the Category 3 engine is idling while the container ship is in hoteling mode; therefore the emissions are expected to be lower than in maneuvering mode.

Based on the power rating, the emission factors for Slow Speed engines were used for calculating emissions.

Table 6.3-6: Emission Factors for (g/hp-hr) Category 3 Marine Diesel Engines in Cruising, RSZ and Hoteling Modes (EPA 2003)

Engine Type	CO	NO_X	PM	SO_2	HC
Slow Speed	0.82	17.60	1.29	9.56(1)	0.395
Medium Speed	0.52	12.38	1.31	9.56(1)	0.395

Note: (1) Based on sulfur content in fuel of 30,000 ppm.

Table 6.3-7: Adjustment Ratios and Emission Factors for Category 3 Marine Diesel Engines in Maneuvering Mode (EPA 2003)

Adjustment Ratio for Low Load					
Engine Type	**CO**	**NO_X**	**PM**	**SO_2**	**HC**
Slow Speed	8.52	1.36	1.69	1.57(1)	5.28
Medium Speed	7.41	1.36	1.68	1.55(1)	5.50
Adjusted Emission Factors for Maneuvering Mode (g/hp-hr)					
Engine Type	**CO**	**NO_X**	**PM**	**SO_2**	**HC**
Slow Speed	6.99	23.94	2.18	7.50(1)	2.09
Medium Speed	3.85	16.84	2.20	7.51(1)	2.17

Note: (1) Based on sulfur content in fuel of 30,000 ppm

In addition to the main propulsion engine, marine container ships typically have a smaller Category 2 Diesel engine that is used to provide electrical power to the ship while in hoteling mode. During this period, the Category 2 engine is used to meet the electrical demand, and the Category 3 engine is assumed to remain running in an idle mode. The emission factors for the Category 2 engine used during hoteling are presented in Table 6.3-8.

Table 6.3-8: Emission Factors for Category 2 Marine Diesel Engines in Hoteling Mode (g/hp-hr)

Engine Type	**CO**	**NO_X**	**PM**	**SO_2**	**HC**
Slow Speed	1.85	9.96	0.239	1.07(1)	0.1
Medium Speed	1.85	9.96	0.239	1.07(1)	0.1

Note: (1) Based on sulfur content in fuel of 330 ppm

Container Ship Emissions Calculations

Emissions from container ships can be estimated using the following equation:

Emissions = Trips x Power x LF in Mode x EF

Where: Trips = number of trips or vessel calls by vessel and engine type
Power = Rated power of propulsion engine by vessel and engine type
LF = Load factor (fraction of rated power) by mode
Time = average time in each mode by vessel and engine type
EF = Emission factor in mode and by engine type (Tables 6.3-6, 6.3-7, and 6.3-8)

Assumptions for the average length of time each container ship spends in each operating mode were made based on past operations at other ports and knowledge of local and regional conditions. This information is presented in Table 6.3-9.

Table 6.3-9: Operating Time for Propulsion Engine at Melford Terminal

Mode	Average Operating Time (hours/call)	
	Start Up	Build Out
Cruising	1.0	1.0
Reduced Speed	1.0	1.0
Maneuvering	0.5	0.5
Hoteling	18.0	18.0

Source: Air Quality Report: EIS for the Proposed Marine Container Terminal at the CNC, The Pinnacle Consulting Group, 2005.

Table 6.3-10 presents the estimated emissions of criteria air pollutants associated with container ships servicing the proposed Melford Terminal.

Table 6.3-10: Estimated Annual Emissions from Container Ships at Proposed Melford Terminal. (TPY)(1)

Year	Operating Mode	CO	NO_X	PM	SO_2	HC
Start Up	Cruising	0.80	19.04	2.02	54.19	0.61
	Reduced Speed	0.37	8.77	0.93	6.77	0.28
	Maneuvering	2.46	8.38	0.77	2.66	0.74
	Hoteling	51.98	448.03	21.82	145.94	7.28
TOTAL		**55.61**	**484.22**	**25.54**	**209.56**	**8.91**
Build Out	Cruising	8.69	206.83	21.89	159.71	6.60
	Reduced Speed	1.09	25.85	2.74	19.96	0.82
	Maneuvering	7.26	24.69	2.28	7.83	2.18
	Hoteling	153.22	1320.51	64.30	430.15	21.46
TOTAL		**170.26**	**1577.88**	**91.21**	**617.65**	**31.06**

Note: tonnes per year

6.3.3.2.3 Calculation of Emissions From Smaller Harbor Vessels

Emissions from smaller harbor vessels can be estimated using the following equation:

Emissions = Power x LF in Mode x Operating Time x EF

Where:
Power = Rated power of propulsion engine by vessel and engine type
LF = Load factor (fraction of rated power)
Operating Time = Annual operating time by vessel type
EF = Emission factor by engine type (Table 6.3-12)

Table 6.3-11 provides a summary of power rating and projected operating hours for the tugboats. Based on discussions with a professional mariner, it is estimated that two tugboats will be required for berthing and sailing of vessels.

Table 6.3-11: Engine Power Rating and Operating Hours for Harbor Vessels

Vessel Type	Engine Power Rating		Projected Operating Hours	
	kW	hp	Start Up	Build Out
Tug Boats	2,741	3,676	440	1300

Table 6.3-12 lists the emission factors for tugboat engines.

Table 6.3-12: Estimated Factors for Category 2 Marine Diesel Engines (g/hp-hr)

Vessel Type	CO	NO_X	SO_2	TSP	HC
Tug Boats	1.85	9.96	1.07[1]	0.239	0.10

Note: (1) Based on sulfur content in fuel of 330 ppm

The estimated emissions from the tugboat operations are presented in Table 6.3-13.

Table 6.3-13: Estimated Emissions from Container Ships at Proposed Melford Terminal (TPY)[1].

Scenario	CO	NO_X	PM	SO_2	HC
Start Up	1.50	8.05	0.87	0.19	0.08
Build Out	4.42	23.80	2.56	0.57	0.24

Note (1) tonnes per year

6.3.3.2.4 Trucking and Motor Vehicle Emissions

Emissions from motor vehicle traffic approaching, departing and idling at the terminal were estimated using the U.S. EPA MOBILE6 emission factor model, vehicle fleet characteristics, distance traveled, operating speeds, vehicle count, and time at idle.

As per information provided by the client, it is estimated that approximately 2% of the containers entering the Melford Terminal will be moved by truck. At full production, an estimated 12 transport trucks per day, will visit the site on an annual basis.

MOBILE6 is an emission factor model for predicting gram per mile emissions from cars and trucks under various operating conditions, and takes into account a timeline of regulatory programs effecting vehicle emission reductions and cleaner burning fuels. For this study, the model was set up to estimate emission factors for two vehicle classes, Light Duty Gas Vehicles (LDGV) and Heavy Duty Diesel Vehicles (HDDV), two road types (Freeway and Arterial), and at three operating speeds (55 mph, 25 mph, and at idle).

Calculation of emissions from moving vehicles along the main access routes requires information about the miles traveled by vehicle type within the study area. Only the increase in traffic that results directly from the terminal operation and only along the access route was considered. MOBILE6 provides emission factors in gram per vehicle mile, by vehicle class and speed. Therefore, vehicle miles traveled at different speeds are needed for each vehicle class. The primary vehicle types associated with the terminal operations include light duty gas vehicles (LDGV) and heavy duty diesel vehicles (HDDV). Other vehicle types are not anticipated to contribute significantly to the total, and are not included. Total vehicle miles were distributed into two road types and speed categories: freeway@55 mph and arterial@25 mph. This distribution was applied for each analysis year.

For each vehicle class and roadway type/speed, the annual emission rates, in tonnes per year, are calculated with the following equations:

Emission Rate (g/yr) = Emission Factor (g/mi) x Vehicle Miles Traveled (mi/yr) x Vehicle Fraction

Vehicle information and assumptions used in the calculation of emissions from motor vehicles are presented in the following tables.

Table 6.3-14: MOBILE6 Average Emission Factors

Scenario	CO (g/mi)	NOx (g/mi)	$PM_{2.5}$ (g/mi)	PM_{10} (g/mi)	SO_2 (g/mi)	VOC (g/mi)
LDGV on Arterial @ 25 mph – Average Emission Factor						
Start Up	9.82	0.581	0.0114	0.0249	0.0068(1)	0.770
Build Out	8.13	0.368	0.0113	0.0248	0.0068(1)	0.501
HDDV on Arterial @25 mph – Average Emission Factor						
Start Up	1.881	5.845	0.165	0.2043	0.0168(2)	0.462
Build Out	0.854	2.799	0.078	0.1104	0.0096(3)	0.353
LDGV on Freeway @ 55mph – Average Emission Factor						
Start Up	11.79	0.589	0.0113	0.0248	0.0068(1)	0.626
Build Out	9.61	0.372	0.0112	0.0248	0.0068(1)	0.408
HDDV on Freeway @ 55mph – Average Emission Factor						
Start Up	1.265	8.705	0.165	0.2043	0.0168(2)	0.260
Build Out	0.574	4.163	0.078	0.1104	0.0096(3)	0.198

Source: Air Quality Report: EIS for Proposed Marine Container Terminal at the CNC, Pinnacle Consulting Group, 2005
Note: (1) Based on sulfur content in fuel of 30 ppm
(2) Based on sulfur content in fuel of 43 ppm
(3) Based on sulfur content in fuel of 11 ppm.

Table 6.3-15 provides an estimate of vehicle miles traveled along with the fraction of miles by road type and speed.

Table 6.3-15: Regional Increase in Vehicle Miles Traveled and Fraction of Vehicle Miles by Road Type and Speed

Vehicle Class	Vehicle Class Description	Increase in Vehicle Miles Traveled (miles/year)		Fraction of Vehicle Miles	
		Start Up	Build Out	Arterial @ 25mph	Freeway @ 55mph
LDGV	Light-Duty Gas Vehicles (Passenger Cars)	1,619,688	3,136,718	0.50	0.50
HDDV	Heavy Duty Diesel Vehicles (>8500 lb)	47,125	136,500	0.10	0.90

Table 6.3-16 provides an estimate of the quantity of annual vehicle emissions for vehicles traveling to the Site.

Table 6.3-16: Annual Vehicle Emissions (TPY)(1).

Scenario	CO (ton/yr)	NOx (ton/yr)	$PM_{2.5}$ (ton/yr)	PM_{10} (ton/yr)	SO_2 (ton/yr)	VOC (ton/yr)
LDGV @ 25 mph – Annual Off-Site Vehicle Emissions						
Start Up	7.95	0.47	0.009	0.020	0.006	0.62
Build Out	15.40	0.911	0.018	0.039	0.011	1.21
HDDV @25 mph – Annual Off-Site Vehicle Emissions						
Start Up	0.009	0.028	0.001	0.001	0.0001	0.002

Table 6.3-16: Annual Vehicle Emissions (TPY)[(1)].

Scenario	CO (ton/yr)	NOx (ton/yr)	$PM_{2.5}$ (ton/yr)	PM_{10} (ton/yr)	SO_2 (ton/yr)	VOC (ton/yr)
Build Out	0.026	0.080	0.002	0.003	0.0002	0.006
LDGV @55mph – Annual Off-Site Vehicle Emissions						
Start Up	9.55	0.477	0.009	0.020	0.006	0.507
Build Out	18.49	0.924	0.018	0.039	0.011	0.982
HDDV @ 55mph – Annual Off-Site Vehicle Emissions						
Start Up	0.054	0.369	0.007	0.009	0.0007	0.011
Build Out	0.155	1.069	0.020	0.025	0.002	0.032

Note (1) tonnes per year

Calculation of emissions form idling vehicles at the terminal requires information about the number of vehicles entering the site and idling time per vehicle. Since MOBILE6 does not directly provide emission factors for idling, general U.S. EPA guidance is to use the gram/mile emission factors for a vehicle speed of 2.5 mph (The Pinnacle Consulting Group, Sept.2005). Then, multiplying the emission factor by 2.5 mile/hour results in an emission factor of gram/hour that can be applied to the idling time of the vehicle.

For each vehicle class, the annual emission rates, in tons per year, from idling are calculated with the following equations:

Emission Rate (g/yr) = Emission Factor (g/hr) x Vehicle Count (veh/yr) x Idling Time (hr/veh)

Table 6.3-17 provides a summary of idling emission factors.

Table 6.3-17: MOBILE6 Average Emission Factors @ Idle

Scenario	CO (g/hr)	NOx (g/hr)	$PM_{2.5}$ (g/hr)	PM_{10} (g/hr)	SO_2 (g/hr)	VOC (g/hr)
LDGV @ Idle – Average Emission Factor						
Start Up	75.99	2.910	0.0103	0.0110	0.0168[(1)]	14.357
Build Out	61.63	1.856	0.0100	0.0108	0.0168[(1)]	9.043
HDDV@ Idle – Average Emission Factor						
Start Up	19.399	27.079	1.0469	1.1380	0.0419[(2)]	3.032
Build Out	8.798	12.915	0.9433	1.0253	0.0241[(3)]	2.318

Note: (1) Based on sulfur content in fuel of 30 ppm
(2) Based on sulfur content in fuel of 43 ppm
(3) Based on sulfur content in fuel of 11 ppm.

Table 6.3-18 provides a summary of estimated vehicle count and idling times for the project.

Table 6.3-18: On-Site Vehicle Count and On-Site Idling Time

Vehicle Class	Vehicle Class Description	On-Site Vehicle Count (vehicles/year)		On-Site Vehicle Idling Time (hour/vehicle)	
		Start Up	Build Out	Start Up	Build Out
LDGV	Light-Duty Gas Vehicles (Passenger Cars)	51830	100375	0.2	0.2
HDDV	Heavy Duty Diesel Vehicles (>8500 lb)	1508	4368	1.5	1.5

Table 6.3-19 lists the estimated emissions from the idling of light duty gasoline vehicles and heavy duty diesel vehicles.

Table 6.3-19: Annual On-Site Vehicle Emissions @ Idle (TPY)(1).

Scenario	CO	NOx	$PM_{2.5}$	PM_{10}	SO_2	VOC
LDGV @ Idle – Annual On-Site Vehicle Emissions						
Start Up	0.79	0.03	0.0001	0.0001	0.0002	0.15
Build Out	1.53	0.06	0.0002	0.0002	0.0003	0.29
HDDV @ Idle – Annual On-Site Vehicle Emissions						
Start Up	0.04	0.06	0.002	0.003	0.0001	0.007
Build Out	0.13	0.18	0.007	0.007	0.0003	0.020

Note (1) tonnes per year

Table 6.3-20 provides an estimate of the total emissions expected to be generated from the transport of containers by truck along with the use of motor vehicles for the site.

Table 6.3-20: Total Annual Emissions from Motor Vehicles (TPY)(1).

Scenario	CO	NOx	$PM_{2.5}$	PM_{10}	SO_2	VOC
LDGV plus HDDV – Total Annual Vehicle Emissions						
Start Up	18.39	1.43	0.003	0.05	0.012	1.30
Build Out	35.73	3.22	0.065	0.114	0.024	2.54

Note (1) tonnes per year

6.3.3.2.5 Locomotive Emissions

Table 6.3-21 presents average power ratings and load factors for each type of locomotive at the Melford Terminal.

Table 6.3-21: Average Power Rating and Load Factor for Cargo Handling Equipment

Container Handling Equipment	Average Power Rating (hp)	Average Load Factor (percent of available power)
Locomotive	4300	50%
Switcher	1750	20%

Table 6.3-22 lists the emission factors for locomotives obtained from the USEPA document Final Emissions Standards for Locomotives.

Table 6.3-22: Average Emission Factors for Locomotives

Scenario	Tier	CO (g/bhp-hr)	NOx (g/bhp-hr)	PM (g/bhp-hr)	SO_2 (g/bhp-hr)	HC (g/bhp-hr)
Locomotive	Tier 2	1.5	5.5	0.2	0.93	0.3
Switcher	Tier 2	2.4	8.1	0.24	0.93	0.6

Source: USEPA Final Emissions Standards for Locomotives, EPA420-F-048, Dec. 1997

These adjusted emission factors were then used to estimate the emissions of CO, NO_x, PM, and VOCs using the following equation:

Emissions = Power x LF x Operating Hours x EF

Where:

Power = Rated power of engine by engine type (hp)
LF = Load factor (fraction of rated power)
Operating Hours = Annual operating time for each equipment type (hours)
EF = emission factor (g/hp-hr)

Emission factors for SO_2 are not included in the NONROAD document; therefore, SO_2 emission factors were obtained from AP-42 Section 3.3, Gasoline and Diesel Industrial Engines, Table 3.3-1.

Table 2.3-23 provides a summary of annual criteria pollutant quantities estimated to be emitted from the use of locomotives.

Table 6.3-23: Summary of Criteria Pollutant Emission from Locomotives (TPY)(1).

Year	CO	NOx	PM	SO_2	HC
Start Up	20.4	71.9	2.4	10.34	4.6
Build Out	27.5	97.8	3.3	14.7	6.0

Note (1) tonnes per year

6.3.3.2.6 Inventory of Project Emissions

Table 6.3-24 provides a summary of the annual air emissions estimated to be produced by the operation at full production of the proposed Melford Terminal.

Table 6.3-24: Estimated Annual Emissions at Proposed Melford Terminal.

Year	Operating Mode	CO	NO_X	PM	SO_2	HC
Build Out	Container Ship	170.26	1577.88	91.21	617.65	31.06
	Smaller Harbor Vessels	4.42	23.26	2.56	0.57	0.24
	Trucking / Motor Vehicles	35.73	3.22	0.065(1)	0.114	0.024(2)
	Locomotives	27.47	97.85	3.34	14.75	5.98
TOTALS		**237.9**	**1702.2**	**97.2**	**633.1**	**37.3**

Notes: (1) PM fraction included in the Table is PM_{10}
(2) Value represents VOCs emitted from vehicles.

It is estimated that the operation of the Terminal will produce 237.9 tonnes of carbon monoxide, 1702.2 tonnes for NOx, 97.2 tonnes of particulate matter, 633.1 tonnes of SO_2, and 37.3 tonnes of hydrocarbon emissions.

6.3.3.2.7 Greenhouse Gas Emissions

Table 6.3-25 provides a summary of greenhouse gas emissions for the proposed Melford Terminal project.

Table 6.3-25: Estimated Annual Greenhouse Gas Emissions at Proposed Melford Terminal.

Year	Operating Mode	CO_2
Build Out	Container Ship	56355.4
	Smaller Harbor Vessels	1089.6
	Trucking / Motor Vehicles	1504.7
	Locomotives	7231.8
TOTALS		**66181.6**

In 2004 the estimated GHG emissions generated in Nova Scotia was 24,000 kt CO_2e. The Melford Terminal project is expected to generate an estimated 66.2 kt of carbon dioxide, which would result in an increase in carbon dioxide emissions of 0.28 % to the 2004 Provincial levels.

6.3.3.2.8 Comparison of Project Inventory with Provincial Inventory

Table 6.3-26 provides a summary of CAC emissions for all sources in Nova Scotia compared to the total estimated CAC emissions for the proposed Melford Terminal.

Table 6.3-26 Comparison of Project Emissions with Nova Scotia Emissions

Category	TPM	SO_2	NOx	VOC	CO
Total Project Emissions for Melford	97.18	633.08	1702.21	37.30	237.88
Nova Scotia Total CAC Emissions	357,864	126,431	71890	45,594	258,704

Note: (1) Value represents estimated hydrocarbon emissions from the proposed project.

A comparison of total CAC emissions in the Province with estimated emissions from the Melford Terminal determined that the operation of the Terminal will increase provincial emissions of particulate matter by 0.027%, SO_2 by 0.5%, NOx by 2.4%, VOCs by 0.08% and carbon monoxide by 0.09%.

6.3.3.3 Air Dispersion Modeling Methodology

Air quality impacts to both environment and human health are assessed by comparing ground level concentrations of priority pollutants to Nova Scotia ambient air quality objectives. Nova Scotia provides objectives for nitrogen dioxide, sulphur dioxide, total suspended particulate and carbon monoxide for different averaging periods including 1 hour, 24 hour and annual. The emission rates developed in the previous sections were used in an air dispersion model computer simulation program to predict ground level concentrations at the two closest residential receptors, England Property and Residence #5879. Air quality impacts from the operation of the Terminal were assessed by comparing the predicted results to the Nova Scotia ambient air quality objectives. The computer simulation model selected for the assessment was the United States Environmental Protection Agencies (USEPA) Industrial Source Complex Short Term 3 (ISCST3) model. The ISCST3 model is a stationary source Gaussian plume model that is widely used to assess pollution concentrations at receptors from a wide variety of sources. The model was configured to assess the operation of the facility at full build out capacity. The operations modeled included the following:

- Hoteling of two container vessels, one Super Panamax and one Post Panamax docked at the terminal;
- The operation of cargo handling equipment, including top picks, side picks and hustlers to handle the containers from the two docked vessels;
- The operation of the switching locomotives;
- The idling of transport trucks onsite waiting to have containers loaded; and
- The idling of employee vehicles.

The ISCST3 model was set up to run using the following options:

- Regulatory default settings;
- 1-hr, 24-hr and annual averaging periods (as applicable);
- Rural dispersion coefficients;
- No terrain elevations;
- Area and point source groups;
- Discrete receptors.

Five years of sequential hourly meteorological data were used in the ISCST3 modeling. A five-year dataset of meteorology statistically covers all wind speed and stability conditions that are anticipated to occur in the modeled area. The dataset used for the modeling is from the Sydney Airport weather station for the years from 1987 to 1991.

6.3.3.3.1 Air Dispersion Modeling Results

Table 6.3-27 provides a summary of predicted air dispersion modeling results compared to the Nova Scotia ambient air quality objectives.

Table 6.3-27: Dispersion Modeling Results

Pollutant	Averaging Time Period	England Property	Residence #5879	Nova Scotia Objectives
Nitrogen Dioxide (μg/m^3)	1 hour	888	574	400
	Annual	1.2	2.6	100
Sulphur Dioxide (μg/m^3)	1 hour	101	84	900
	24 hour	14	17	300
	Annual	0.2	0.5	60
Total Suspended Particulate Matter (μg/m^3)	24 hour	6.3	1.5	120
	Annual	0.05	0.1	70
Carbon Monoxide (μg/m^3)	1 hour	65	56	34, 600

A comparison of results indicates that with the exception of the 1 hour nitrogen dioxide results, all other results are well within the Nova Scotia objectives. The 1 hour objective of 400 μg/m^3 for nitrogen dioxide is exceeded at both residential properties with predicted concentrations of 888 μg/m^3 at the England property and 574 μg/m^3 at residence #5879. It should be noted that the number of hours over regulatory guidelines are minimal (6 hours over an annual period at the England property). The concentration predicted at the England property for the longer averaging period of one year is 1.2 μg/m^3 at the England property, well within the Nova Scotia Objective of 100 μg/m^3 for an annual averaging period.

6.3.3.4 Cumulative Impacts Assessment

An assessment of cumulative impacts on air quality was performed by adding the predicated dispersion modeling results from the Residence #5879 to the annual air monitoring data obtained from both the Port Hawkesbury area for the sulphur dioxide and total suspended particulate matter parameters and the remainder of the Province for the nitrogen dioxide parameter, and then comparing the calculated values to the Nova Scotia ambient air quality objectives. Baseline concentrations were obtained from the Port Hawkesbury Landrie Lake monitoring location for sulphur dioxide and the Post Office Location for total suspended particulate. Since nitrogen dioxide monitoring was not performed in the past in the Melford region, the closest provincial location (downtown Halifax) with recent data was used. It is noted that the long term averages were used to assess cumulative impacts since these values would average the variability for short term concentrations and are therefore considered more representative of typical concentrations at the receptor locations. Refer to Table 6.3-28 for a summary of estimated cumulative impacts for Residence #5879.

Table 6.3-28: Assessment of Cumulative Effects

Pollutant	Averaging Time Period	Port Hawkesbury Monitoring Results (A)	Residence #5879 (B)	Cumulative Impacts (A) + (B)	Nova Scotia Annual Objectives
Nitrogen Dioxide (µg/m3)	Annual	37.8[(3)]	2.6	40.4	100
Sulphur Dioxide (µg/m3)	Annual	6.5	0.5	7.0	60
Total Suspended Particulate Matter (µg/m3)	Annual	24	0.1	24.1	70
Carbon Monoxide (mg/m3)	1 hour	NA[(4)]	-	NA	NA

Note : (1) Sulphur dioxide annual value was obtained from the Port Hawkesbury Landrie Lake monitoring location for the year 1995.
(2) TSP annual value was obtained from the Port Hawkesbury Post Office monitoring location for the year 2002.
(3) Nitrogen dioxide annual value was obtained from the downtown Halifax location for the year 2001.
(4) NA denotes not available.

A comparison of the calculated cumulative impact numbers indicate that all values are lower than the Nova Scotia annual objectives.

6.3.4 Mitigation

Fugitive dust emissions from activities such as site preparation, grading and vehicle traffic will occur during construction periods and similar emissions will occur during the decommissioning phase, which will also include demolition activities. Operation of the Terminal will result in impacts to the airshed from exhaust emissions from container ship vessels, cargo handling equipment, locomotives, transport trucks and personal vehicles. The potential adverse effects from the construction and operation phases have been identified as:

<u>Construction Phase:</u>
In conducting site construction operations, MITI will:

- Require contractors meet all provincial air quality regulations and emission standards applicable to their equipment. All construction equipment should be properly maintained to ensure exhaust emissions are typical for each piece of equipment; and Apply water or dust suppressants to disturbed areas, as necessary, to reduce vehicle traffic dust;

- Cover open hauling trucks with tarps, as necessary;
- Use paved roads for construction vehicle traffic, wherever practical;
- Limit vehicle speeds as required to reduce dust generation;
- Respond promptly to any significant particulate emission concerns that occur during construction by evaluating the source of emissions and ensuring all practicable mitigation measures are being implemented; and
- Upon completion of construction activity, stabilize disturbed areas.

Operation Phase:

During operation of the facility, MITI will implement the following measures to minimize air quality effects:

- All equipment used onsite is to be properly maintained to ensure exhaust emissions are typical for each piece of equipment;
- Conform to current and future regulated emissions standards for state of the art combustion engines;
- Conform to normal industry practices that are known to reduce emissions such as the use of auxiliary engines for container vessel hoteling.

The above measure will also contribute to minimizing GHG emissions. Further, and more specifically related to the objective of minimizing GHG emissions, MITI has incorporated with the Facility development and design:

- Electrically powered gantry cranes;
- Rail transport to and from the site (as oppsed to road–based transport);
- Employment of the latest in automation technology of both terminal equipment and operating systems to minimize equipment moves and lessen emissions.
- All mobile equipment to be new purchase and thus the most energy efficient efficient available.

MITI, in addition to adhering to all present and future legislation relevant to climate change mitigation/adaptation, will continue to examine evolving technologies and methodologies which may assist in reducing or offsetting its GHG emissions. MITI's first priority would be to further reduce its actual emissions through energy conservation and/or the use of alternative energy sources. For example, MITI will undertake a future assessment of the feasibility of using biodiesel fuel in fossil fuel powered its equipment. This assessment will consider equipment maintenance factors, availability of biodiesel supplies, and the overall financial impacts of such a plan.

Decommissioning

Air impacts during decommissioning would be expected to be comparable to construction-related air impacts. Mitigation measures proposed for the construction phase therefore generally also apply to the decommissioning phase.

6.3.5 Monitoring

Construction Phase

Respond promptly to any significant particulate emission concerns that occur during construction by evaluating the source of emissions and ensuring all practicable mitigation measures are being implemented.

Operation Phase

Dispersion modeling results predicted exceedances for the nitrogen dioxide parameter for a 1 hour averaging period at the two closest residential receptors. It should be pointed out that air dispersion computer simulation models in general are conservative and are known to over predict results, and this may be the case in this instance. Predictions for annual nitrogen dioxide concentrations at the two residential receptors are well below the annual Nova Scotia objective. Given the low number of predicted exceedances for nitrogen dioxide, it is not considered necessary to implement an air quality emissions monitoring program.

Decommissioning

The approach to noise monitoring during the decommissioning phase will be similar to that proposed for the construction phase.

6.3.6 Residual Effects

Overall effects on air quality during the Project's construction and operation phase are not expected to be significant. Over the last 20 years regulations on internal combustion engines have become increasingly stricter, resulting in a significant lowering of priority pollutants in engine exhaust. This trend is expected to continue. The project will use state of the art equipment that will conform to industry emissions standards; it will also seek to conform with these standards as they are developed in the future, with the intention to further reduce emissions as new emissions reducing technologies become available.

FINAL REPORT

Table 6.3-29 Residual Environmental Effects Summary for Air Quality

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Nor reversible	Ecological/Social-cultural and Economic Context			
Construction										
Emissions of gaseous pollutants from the use of internal combustion engines in various equipment and worker commuting vehicles	A	• Maintaining vehicles and equipment in good working condition; • Maintaining speed restrictions on roads;	Low	Construction envelope plus adjacent lands and transport routes	Construction Phase	R	Rural setting; sparsely populated; nearest residential receptors at 300 to 500 m off-site; residences near rail line concentrated in Frankville	Not significant		
Fugitive dust emissions from activities such as demolition, site preparation, grading and vehicle traffic. Wind erosion of displaced soil may also generate fugitive dust emissions prior to paving or re-vegetation	A	• Application of water or dust suppressants; • Covering of haul trucks, • Use of paved roads to the extent possible; • Limiting vehicle speed; • Stabilizing disturbed areas.	Low	Construction envelope plus adjacent lands	Construction Phase	R	Rural setting; sparsely populated; nearest residential receptors at 300-500 m off-site; residences near rail line concentrated in Frankville	Not Significant		

Table 6.3-29 Residual Environmental Effects Summary for Air Quality										
Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Nor reversible	Ecological/Social-cultural and Economic Context			
Operation										
Generation of combustion emissions from container ships, tugboats, container handling equipment, locomotives, and trucks visiting the Terminal	A	• Maintaining regulated operating conditions for efficient combustion • Maintaining vehicles and equipment in good operating condition, emission control components equivalent to original conditions • Compliance with provincial ambient air quality objectives (annual maximum) for TSP, NO2, SO2 and CO • Adherence to MARPOL 73/78/97 shipping emissions regulations • Conform to normal industry practices that are known to reduce emissions such as the use of auxiliary engines for container vessel hoteling • Conform to current and future regulated emissions standards for combustion engines	Low (with the exception of the 1 hour nitrogen dioxide results, all other results are well within the Nova Scotia Objectives	Nearest receptor	Operation phase; infrequent occurrences; short duration	R	Rural setting; sparsely populated; nearest residential receptors 300 to 500 m off site; designated and approved industrial reserve	Not significant		

Table 6.3-29 Residual Environmental Effects Summary for Air Quality

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Nor reversible	Ecological/Social-cultural and Economic Context			
Cumulative Impacts on air quality from MIT and other developments in the locale	A	• Mitigation measures are the same as those listed for other potential air quality impacts during operations	Low (levels all within applicable regulatory standards)	Regional	Operation phase	R	Rural setting; sparsely populated; nearest residential receptors 300 to 500 m off site			
Project contribution to greenhouse gas emissions (CO_2)	A	• Mitigation measures are the same as those listed for other potential exhaust emission impacts during operations.	Represents increase of provincial emissions by 0.28%.	Global	operation phase	R	Greenhouse gasses already represent a significant impact due to large contributions by industrialized countries, and particularly the United States.	Minor		

* (for Magnitude): For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 4.
** (for Likelihood of Occurrence; Level of Confidence): Only addressed for significant effects

6.3.7 References

Man B&W Diesel A/S: Propulsion Trends in Container Vessels, Copenhagen, Denmark.

SCSPA and USACE: Air Quality Report: EIS for the Proposed Marine Container Terminal at the CNC.USACE Charleston District and the South Carolina State Ports Authority (SCSPA), Pinnacle Consulting Group. Sept., 2005.

USEPA: AP-42, Gasoline and Diesel Industrial Engines (section 5.3)

USEPA: Current Methodologies and Best Practices for Preparing Port Emission Inventories. ICF Consultants, January 4, 2006.

USEPA: Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling – Compression Ignition, EPA Document EPA 420-P-04-009, April 2004

USEPA: Port Emission Inventories and Modeling of Port Emissions for Use in SIPs – White Paper #3. ICF Consultants May 4, 2004

USEPA: Final Regulatory Support Document for New Marine Comparison – Ignition Engines At or Above 30 Litres per Cylinder, EPA office of Air and Radiation, Document Number EPA40-R-03-004, January, 2003.

6.4 ACOUSTIC ENVIRONMENT

6.4.1 BOUNDARIES

6.4.1.1 Temporal Boundaries

The temporal boundaries for onshore noise include all three phases of the Project; construction, operation, and decommissioning. However, no specific work was conducted related to the decommissioning phase as these works are expected to remain within the noise levels associated with the construction phase.

6.4.1.2 Spatial Boundaries

The spatial boundaries include the Project site (marine terminal, intermodal rail yard, logistics park) and the proposed rail line as discussed in Section 2. Adjacent lands were taken into consideration with respect to potential receptor locations.

6.4.1.3 Administrative, Legislative, Technical Boundaries

Both the Federal and Provincial governments provide guidelines on noise assessment in the following documents:

- Nova Scotia Department of Environment Guideline for Environmental Noise Measurement and Assessment
- Health Canada Draft Guideline on Noise Assessment for CEAA Projects.

The Federal draft guideline for noise assessment on CEAA projects requires noise to be characterized in the following ways:

- Baseline noise levels;
- Construction noise levels; and
- Operational noise levels.

The document requires that monitoring be performed at specific sensitive receptor sites including hospitals, schools, day cares, senior’s residences and selected residences in the area.

The Provincial Guideline was developed to facilitate the evaluation of noise pollution in the environment and establish acceptable sound levels. The guidelines for acceptable equivalent continuous sound levels (Leq) are:

- Leq of 65 dBA between 0700 to 1900 hours;
- Leq of 60 dBA between 1900 to 2300 hours; and
- Leq of 55 dBA between 2300 to 0700 hours.

Given the few number of sensitive receptors and their distance (300-500m) to the Project site and its location within the designated and approved Melford Industrial Reserve, the effect assessment is limited to the identification of noise sources and associated noise levels. Actual noise levels at the fence line will be identified through effects monitoring. Results will be compared against the above guidelines. If required, mitigation measures will be implemented (see Section 6.4.4). The decision making factor in this regard will be the established threshold for determination of significance (section 6.4.2 below)

With respect to noise along the proposed rail line, the discussion of effects focuses on the process for approval and resolution of railway noise issues under the Canadian Transportation Act. Of key concern in this context is the proposed re-activation of the existing rail-bed. This segment of the rail connection passes in close proximity to a number of residences in the community of Frankville. If required, site-specific mitigation measures may have to be developed in close dialogue with the local community, residents, and the Canadian Transport Agency. This will be undertaken in compliance with the Draft “Guidelines for the Resolution of Complaints Related to Railway Noise and Vibration under the Canadian Transportation Act.” These guidelines apply to the activities of railway companies that operate under federal jurisdiction including the Canadian National Railway company. The guidance document is a result of the enacted amendments (2007) to the CTA which now authorize the Agency to resolve complaints for noise and vibration related to the construction or operation of railways under its jurisdiction.

6.4.2 Threshold for Determination of Significance

A significant adverse noise effects has been determined to represent a condition, where the above guidelines are regularly exceeded.

6.4.3 Noise Effects

6.4.3.1 Construction Noise

Construction equipment includes a large number of types of machines and devices, varying widely in physical size, horsepower rating and principle of operation. Despite the variety in type and size of construction equipment, the similarities in dominant noise source and in patterns of operation are sufficient to define three categories:

- equipment powered by internal combustion engines;
- impact equipment; and
- other equipment.

6.4.3.1.1 Equipment Powered by Internal Combustion Engines

The internal combustion engine is used to provide movement to the wheels or tracks and/or operating power for working mechanisms such as buckets, dozers, etc. Exhaust noise is usually the most important component of engine noise in internal combustion engines; however, noise from the intake, cooling fans and mechanical/hydraulic transmission and control systems also can be significant contributors. The tracks of earthmoving equipment, and the interaction of materials handling equipment and earthmoving equipment with the material on which it acts, often produce significant noise output (Harris, 1979). Typical noise sources and associated noise levels are listed in Table 6.4-1.

6.4.3.1.2 Impact Equipment

Impact equipment includes pile drivers, pavement breakers, tampers, rock drills and small hand-held pneumatically, hydraulically or electrically powered tools. With the use of pile drivers, the primary noise source is the impact of a hammer striking the pile; engine related sources are secondary. The dominant sources of noise in pneumatic tools are the high-pressure exhaust and the impact of the tool bit against the material on which it acts (Harris, 1979).

6.4.3.1.3 Other Equipment

Generally, the above-mentioned categories contain the bulk of equipment used in remedial activities. There are, however, many pieces of equipment that do not fit either of these categories. Examples are the high-pitched whine from a power saw or the noise a concrete vibrator produces when it shakes concrete forms (Harris, 1979).

For comparison, a chainsaw at 1m is approximately 110 dB, a busy highway at roadside is 80 dB, and conversational speech at 1m is 60 dB. Noise levels in a library can be expected to be at about 40 dB. Table 6.4-1 indicates some typical noise levels for construction equipment.

Table 6.4-1: Typical Construction Equipment Noise Levels at 300 Meters and 500 Metres

Equipment	Type of Noise	Typical Noise Range (dBA) at 15 m	Calculated Noise Level (dBA) at 500 m	Calculated Noise Level (dBA) at 300 m
Loader	Continuous and Impulsive	74-84	44-54	48-58
Bulldozer	Continuous and Impulsive	82-95	52-64.8	56-69
Trucks	Continuous and Impulsive	82-92	52-61.8	56-66
Pumps	Continuous	68-72	38-42	42-46
Generators	Continuous	72-80	42-50	46-23
Compressors	Continuous	74-83	44-53	48-57
Pile Driver	Impulsive	89-105	54-75	63-79

Note: (1) Source: Cyril Harris, Ph. D., Handbook of Noise Control. McGraw – Hill Book Company, 1979.

It is noted that the nearest occupied property is 300 m from the site boundary lines, and, accordingly, sound pressure levels (noise) will decrease from the point of origin and diminish further from the site boundary. The next closest properties are approximately 500 m from the site boundary line. The inverse square law states that the sound pressure level will decrease by 6 decibels for every doubling in distance from the source of noise. The following formula is used to determine the change in sound pressure levels over a distance:

$$\Delta D = 10 \log (d_1/d_2)^2$$

Where d_1 and d_2 are the two distances and ΔD is the change in sound pressure level in decibels (dB)

Given the above formula, the approximate sound pressure levels for a bulldozer at 500 m from the property boundary would be 52-64.8 dBA. A level of 64.8 dBA is below the lowest recommended noise level of 65 dBA for the hours from 0700 to 1900 as per the NSE Guidelines presented in Section 6.4.1.3. The approximate sound pressure levels for loaders, pumps, generators and compressors at 300 m would also be lower than the 65 dBA guideline. However, the upper range for trucks and bulldozers are calculated as 66 and 69 dBA, respectively, both higher than the guideline. The attenuation formula does not take into account the effect of vegetation, topography, or climatic conditions, which would also affect the noise levels. It is likely that the level would be even lower at both the 300 m and 500 m receptors due to the large amount of tree cover between the site and the receptors.

Construction work on the site will also include pile driving. The upper calculated noise level for pile drivers range from 75 to 79 dBA which exceeds the 65 dBA guideline. It is expected that most of the pile driving work will take place at a distance of at least 500 m from the closest residence.

It is noted that when several pieces of equipment are operating in proximity to each other, sound levels (in dBA) are not additive. For example, two bulldozers, each with an operating sound level of 82 dBA would be the equivalent of a level of 85 dBA, since 3 dBA represents a doubling of the noise level, a difference that is considered to be barely perceivable to the human ear.

In the case of two or more pieces of construction equipment working at the perimeter of the site, it is possible that the additive effects of this equipment may produce a sound level greater than the 65 dBA guideline. It should be noted that construction work will be concentrated more towards the center of the property (>500 m), and any construction work performed at the perimeter of the site closest to the residences is expected to be of short duration.

A noise monitoring program performed by AMEC at a quarry in which typical construction equipment was operating produced 2-hour average results ranging from 46.2 to 56.8 dBA (AMEC, October 2007). Monitoring during blasting produced an instantaneous reading of 74.7 dBA at a monitoring location 250 m from the blast location (AMEC, July 1996).

6.4.3.2 Operational Noise

In general, normal operational noise sources for all activities will be required to be attenuated so that resultant noise levels at the site boundary (otherwise referred to as the site perimeter or fence-line) are in the range of 55-65 dBA, in accordance with the Nova Scotia Department of Environment and Labour (NSE) Guidelines for Environmental Noise Measurement and Assessment (Section 6.4.1.3).

The federal guidelines require that monitoring be performed during the operation of the facility during daytime, nighttime and an overall 24 hour period. In addition significant impacts to sensitive receptors must be assessed and if prescribed levels set out in the document are exceeded then mitigation is required.

6.4.3.2.1 Container Terminal Noise

A literature review of noise generated from other container terminals has identified an operation using similar equipment that has had to manage noise problems. The operation of the Ferguson Container Terminal in Auckland, New Zealand, in a primarily industrial area with pockets of residences, has resulted in noise issue concerns from residents located at distances from 300 m to 700 m from the terminal and railway yards. The closest residence to the Melford Terminal is approximately 500 m, falling within the distance range of receptors identified at the Ferguson Container Terminal. A planned expansion of the Ferguson Container Terminal resulted in a task force being developed to address noise issues raised by residents. Discussions with residents identified two different aspects of the noise arising from the terminal operations:

1. Specific penetrating noise sources including warning sirens on cranes and straddle carriers, ships horns sounded on departure and train crossing warning bells.
2. General plant noise sources such as refrigerated container units, ships generators and straddle carriers.

The penetrating noise sources often have little effect on measured noise levels due to their infrequent nature and short duration, but generally result in the greatest concern to residents (www.poal.co.nz). This is a result of the audibility of these sources due to their tonal characteristics and intermittent operation. It was recognized by the terminal operators that both these types of noise sources need to be addressed in the long term management of noise from the container terminal. It is possible that such long term management of noise will also be required at the closest residential receptors for the proposed Melford Terminal Project.

As in the construction phase, noise levels generated from a particular point source would degenerate over distance.

6.4.3.2.2 Railway Noise and Vibration

During operation, 1 to 3 trains are expected to be leaving MIT per day. The typical noise level associated with a passing freight train is reported to reach approximately 95dBA at 15 m distance (CHMC 1977). Given the absence of residential development along most of the rail corridor, this is generally not expected to cause a significant adverse effect. Noise levels, however, could become a concern where the rail line passes in close proximity to residences in Frankville. This section of rail corridor, however, represents a re-activation of rail service along an existing rail bed and focus will have to be on the resolution of potential noise issues.

In Canada, as populated areas have expanded over the past few decades, residential developments have been built closer to existing railway facilities. At the same time, railway activities have intensified as the demand for rail transportation has increased. Based on these considerations, the Canadian Transportation Agency (CTA) has seen an increase in railway noise complaints. In response to this increase, in June 2007, Parliament enacted amendments to the CTA which now authorized the Agency to resolve complaints for noise and vibration related to the construction or operation of railways under its jurisdiction. The CTA currently has published a Draft Document “Guidelines for the Resolution of Complaints Related to Railway Noise and Vibration under the Canadian Transportation Act.” These guidelines apply to the activities of railway companies that operate under federal jurisdiction including the Canadian National Railway company.

The guidelines apply to all forms of railway noise and vibration produced during the construction and the operation of a railway. For instance, this can be noise from passing trains or idling locomotives, shunting noise, or noise from the compression or “stretching” of trains. However, it should be noted that train whistles which are blown for safety reasons to warn of a train’s passage are a legal requirement of the *Railway Safety Act* (CTA, 2007) [(1)].

Noise generated from railway activities includes steady state, such as idling of a locomotive; intermittent such as the passage of a train; or impulse, such as the very short sharp sound caused by the coupling of rail cars within railway yards. Most of the noise issues brought to the CTA result from rail switching operations conducted at night (CTA, 2007). Railway operations also increase ground borne vibrations from the operation of high speed trains, trains with stiff primary suspensions, flat or worn wheels as well as the type and condition of the rails and rail support system. Soil and subsurface conditions also strongly influence the level of vibration: stiff clay soils propagate vibrations more effectively. Shallow rock concentrates vibrations close to the surface and spreads them farther from the track. Vibrations are more perceptible inside buildings which may be affected than they are outside. Generally the more massive the building is the lower the levels of induced vibration.

The guidelines are designed to encourage collaboration among the parties to railway noise or vibration complaint. They are also designed to encourage predictability, transparency and consistency in the Agency’s decision-making on noise and vibration complaints. Although these guidelines are not a regulation, Agency decisions are legally binding on the parties involved subject to the appeal rights presented in these guidelines.

The guidelines are meant to address principally noise and vibration disputes with regard to existing railway infrastructure or facilities. It is noted that approximately 10 km of existing railway line will be used by the project, with the remaining to be constructed. This section of the existing railway line is currently abandoned, and track has been removed. A review of aerial photos for this portion of rail line determined that there are a number of residences located along the existing 10 km abandoned railway line, which, once the rail line is again operational, will likely fall under the CTA guidelines.

For proposed projects that require Agency approval under subsection 98(1) of the CTA, railway companies must evaluate the potential environmental impacts – including noise and vibration issues. Section 98(1) of the Act indicates that “A railway company shall not construct a railway line without the approval of the Agency,” As per section 98(2), “The Agency may on application by the railway company, grant the approval if it considers the location of the railway line is reasonable, taking into consideration requirements for railway operations and services and interests of the localities that will be affected by the line.” Before authorizing the construction of a railway facility, the agency must be satisfied that the proposed infrastructure and facilities will not create significant adverse environmental impacts. Exceptions to the Act as per Section 98(3) states that approval is not needed for the construction of a railway line if the line is within the right of way of an existing railway line or within 100 m of the centre line of an existing railway line for a distance of no more than 3 km. Based on a review of aerial photos and topographic mapping, there does not appear to be any permanent residences in the immediate area of the proposed rail line. However, a number of cottages which appeared to be abandoned were noted by field staff along the proposed rail line.

NOTES:
(1) http://www.cta-otc.gc.ca/rail-ferro/bruit-noise/consultation/b-e.html

6.4.4 Mitigation

The potential adverse effects of noise and/or vibration from the construction and operation phases can be mitigated through the implementation of the following measures:

<u>Construction Phase:</u>
In conducting site construction operations, MITI will:

- Ensure that all equipment has appropriate noise-muffling equipment installed and in good working order.
- Conduct routine noise monitoring at both the site boundaries and nearby occupied properties as appropriate.
- Restrict intensive construction activities to the hours of 0700-1900 where practical.
- Ensure that the public has contact numbers for appropriate construction and government personnel in the case of noise issues.
- Ensure that the public is given adequate prior notice of any blasting activities scheduled to take place.
- Maintain, where practical, treed buffers between the working site and the public.

The above measures address the issues of noise and/or vibration as they may affect nearby residents. There are also concerns as to the impacts from construction activities that generate noise emissions transmitted through the underwater environment.

Although there is not an extensive use of the nearshore waters by cetaceans and seals (Section 5.8.2), these species may be susceptible to damage from the underwater noises generated using conventional pile-driving techniques.

Possible mitigation, if required, includes working during low tide, working outside of sensitive periods, the use of ramped warning signals and masking the noise with bubble curtains (David, 2006). The need for the implementation of these measures will be established in consultation with the regulators.

MITI also proposes to use alternative construction techniques such as vibratory pile-driving. Additionally, MITI will confer with representatives of both the recreational fishery and the commercial fishery in order to identify and consider seasonal and daily activity schedules which will be the least likely to disrupt these activities, at least to the extent that proposed measures are consistent with the orderly and timely construction of the facility.

Operation Phase:

Noise factors will be considered in the design and selection of equipment in order to meet the levels of the NS noise guidelines at near-by receptors. Further, during operation of the facility, MITI will implement the following measures to minimize noise effects:

- Appropriate and properly operating noise-mufflers on all noise emitting equipment;
- Noise monitoring (site boundaries and nearby occupied properties) as appropriate;
- Establish mechanism to address complaints response procedures;
- Maintenance, where practical, of treed buffers;
- If required, obtain approval by CTA as per Section 98(1) of the *Canadian Transportation Act*; and
- Implementation and adherence to “Guidelines for the Resolution of Complaints Related to Railway Noise and Vibration” under the *Canadian Transportation Act*.

With respect to the noise related effects of the rail line, specific mitigation measures will be developed in consultation with the municipality, residents, the provincial regulators and the Canadian Transport Agency as per Section 98(2) of the *Canadian Transportation Act.*

Decommissioning

Noise levels during decommissioning would be expected to be comparable to construction-related noise levels. Mitigation measures proposed for the construction phase therefore generally also apply to the decommissioning phase.

6.4.5 Monitoring

Construction Phase

A pre-construction noise monitoring program will be undertaken at sensitive receptor locations in the vicinity of the proposed rail line. The measurements will complement the data base on ambient noise levels established as part of the baseline data collection (see Section 5.4).

As the construction activities unfold, noise monitoring will be undertaken in response to noise complaints raised by the public.

Operation Phase
For the operation phase of the Project, a noise monitoring program will be developed in consultation with the regulator. It is envisaged that this program will be implemented during the first few years of operation in order to establish and verify noise levels at receptors locations. The program will be modified depending on results and issues identified during the initial operating years.

Decommissioning
The approach to noise monitoring during the decommissioning phase will be similar to that proposed for the construction phase.

6.4.6 Residual Effects

Overall effects of noise during the Project's construction and operation phase are not expected to be significant (Table 6.4-2). The nearest occupied residence is approximately 300 m away from the Project site. Any project-related noise that reaches these properties will be significantly decreased relative to the point of origin. If required, noise abatement measures (buffer plantings, berms) will be employed to reduce operation-related noise effects at the nearest residential receptors to levels within regulatory guidelines.

Sensitive receptors along the new rail line will be limited to a few cottages and residences in Frankville near the existing railbed. The future noise levels from rail transport at receptor locations in the vicinity of the rail line are unknown. However, any train transport related noise effects along the train tracks would be infrequent (1 to 3 trains within 24hrs), of short duration, and relevant for only a few residences or cottages. Further, if required, mitigation measures can be implemented should noise levels exceed acceptable levels. This could entail measures at the source (equipment, track design, hours of operation, berms and plantings) or at the receiving end (e.g., buffer plantings). Should complaints on noise be raised, MIT is committed to resolve issues in accordance with the "Guidelines for the Resolution of Complaints Related to Railway Noise and Vibration" under the Canadian Transportation Act. Overall, the residual adverse noise effects are evaluated as likely not significant.

Table 6.4-2: Residual Environmental Effects Summary for Noise

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Nor reversible	Ecological/Social-cultural and Economic Context			
Construction										
Disruption of residences around property by site preparation (blasting, pile driving earth moving) and construction of marine and on-shore components.	A	• Ensure that all equipment has appropriate noise-muffling component installed and in good working order. • Conduct routine noise monitoring at both the site boundaries and nearby occupied properties as appropriate. • Restrict intensive activity to hours between 700 and 1900 where practical. • Supply public with contact numbers for appropriate construction; and government personnel in the case of noise issues Give public prior notice of blasting. • Maintain, where practical, treed buffers between the working site and the public. • Adherence to NSEL Guidelines for Environmental Noise Measurement and Assessment.	Low to medium	Construction envelope at Project site and along rail line	Construction Phase	R	Rural setting; sparsely populated; nearest residential receptors at 300 m off-site; residences near rail line concentrated in Frankville	Not significant	-	-

Table 6.4-2: Residual Environmental Effects Summary for Noise

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Nor reversible	Ecological/Social-cultural and Economic Context			
Operation										
Increased noise levels from container terminal operations (general equipment noise and intermittent penetrating noise such as ship horns and warning sirens)	A	• Adherence to NSE Guidelines for Environmental Noise Measurement and Assessment • Ensure that all equipment has noise suppression component equivalent to original equipment and in good operating condition • Noise monitoring (site boundaries and nearby occupied properties) as appropriate; • Establish mechanism to address complaints response procedures; • Maintenance, where practical, of treed buffers; • If required, obtain approval by CTA as per Section 98(1) of the Canadian Transportation Act.	Low	MIT site and rail line	Operation Phase; 24/7 terminal operation; 1-3 trains per day on rail track	R	Rural setting; sparsely populated; nearest residential receptors at 500 m off-site; Only permanent residences near rail line are in Frankville	Not significant for site and most of rail track; significance of noise for residences at Frankville is uncertain		

Table 6.4-2: Residual Environmental Effects Summary for Noise

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Nor reversible	Ecological/Social-cultural and Economic Context			
Railway noise and vibration	A	• Adherence to Canadian Transportation Agency guidelines for noise and vibration • Implementation of and adherence to "Guidelines for the Resolution of Complaints Related to Railway Noise and Vibration" under the Canadian Transportation Act	Low	MIT site and rail line	Operation Phase; 24/7 terminal operation; 1-3 trains per day on rail track	R	Rural setting; sparsely populated; nearest residential receptors at 300 m off-site; Only permanent residences near rail line are in Frankville	Not significant for site and most of rail track; significance of noise for residences at Frankville is uncertain		

* (for Magnitude): For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 4.
** (for Likelihood of Occurrence; Level of Confidence): Only addressed for significant effect

6.4.7 References

AMEC Earth and Environmental. Conrad Quarry Air Quality and Noise Monitoring Program, October 2007

Cyril Harris, Ph. D., Handbook of Noise Control. McGraw – Hill Book Company, 1979.

David, J.A., 2006. *Likely sensitivity of bottlenose dolphins to pile driving noise*. Water and Environment Journal. Volume 20, March 2006. ISSN 1747-6585

6.5 OCEANOGRAPHIC CONDITIONS

6.5.1 Analysis, Mitigation and Environmental Effects Evaluation

6.5.1.1 Effects

The existing oceanographic conditions have been described in Section 5.5 and include a characterization of bathymetry, hydrography, waves, tides, currents, and sediment transport.

The proposed container terminal at Melford will occupy 165 ha, including 22.7 ha of infill which will serve as the wharf. The wharf will protrude into the Strait various distances, ranging from 122.6 m to 259.3 m, depending upon the existing shoreline, for a total area of some 60 ha.

The wharf face is located along a line that approximately follows a 16.75-metre contour to accommodate 16.5 m of vessel draft with a minimum of dredging. Variations in this contour will result in a greater depth in some places and the possible requirement for minor dredging in others. Dredging of a limited amount of area at the wharf face will be required to ensure a constant draft of 17 metres (Section 2.5.5). All dredged materials will be either used as fill for Project construction or disposed of on-shore at an approved facility. Any changes in bathymetry immediately at the wharf site would be small scale and very localized.

Dredged material will be disposed of on-land, however the proposed infilling and dredging activities could, for the duration of the marine works, cause suspension of sediments in the water column. This could temporarily increase the sediment volume and type of sediments transported. Only the small fraction lost during dredging operations will enter the water column. This fraction varies for various dredging techniques, but is typically about 1percent of the total amount dredged and it is released continuously throughout dredging operations. The coarse material settles quickly within distances ranging from a few meters for gravel to a few tens of meters for sand. Only the fine particles (silt and clay) stay in suspension long enough to be dispersed over longer distances.

With ambient currents in the range of those reported in Section 5.5.5, the loss of about 1percent of the amount of the fine particles that represent between 8 percent and 57percent of the dredged material typically results in a plume with initial maximum concentration within 5m of the point of release between 10mg/l and 100mg/l. Concentrations drop below 1mg/l (which usually less than background TDS concentration in the coastal environment) typically between 100m to 500m downstream from the point of release. Therefore, it is expected that sediment transport away from the construction site will be minimal (refer also to Section 6.8).

Other than these very localized and, in the case of the sediment transport, also temporary effects, the proposed wharf is considered to be too small to cause a measurable change in the characteristics of waves, tides, and/or currents in the Strait of Canso or the general vicinity of MIT.

6.5.1.2 Mitigation

No specific mitigation related to potential effects of the Project on oceanographic conditions has been identified. For mitigation measures related to Project-related effects on marine habitat refer to Section 6.8.

6.5.2 Follow-up and Monitoring

Bathymetry and currents are expected to be monitored during the initial years of the terminal operation to ensure a safe vessel operation.

6.5.3 Summary of Significant Environmental Effects

The potential for the Project to affect the oceanographic conditions in the Strait is very limited. Given the small size of the proposed wharf in relation to the Strait of Canso, no measurable changes in the existing oceanographic characteristics of the Strait are anticipated.

Only notable short-term effect may be the temporary increase in sediment loadings in the marine water column and thus temporarily increased sedimentation within the vicinity of the wharf. This has been assessed as part of the effects on marine habitat in Section 6.8. The Section also includes a discussion of mitigation measures.

Oceanographic characteristics of the marine environment at the proposed wharf site are of particular concern in the context of potential effects of these factors on Project design and operation. This is discussed in Section 9.0.

6.5.4 References

Bury K.V. 1975.Statistical Models in Applied Science. John Wiley & Sons.

Canada Ice Service. 2001. Sea Ice Climatic Atlas: East Coast of Canada 1971-2000.

Church, J.A., Gregory, J.M., Huybrechts, P., Kuhn, M., Lambeck, K., Nhuan, M.T., Qin, D. and Woodworth, P.L. (2001): Changes in sea level; in Climate Change 2001: The Scientific Basis, (ed.) J.T. Houghton, Y. Ding, D.J. Griggs, M. Noguer, P.J. van der Linden, X. Dai, K. Maskell and C.A. Johnson, contribution of Working Group I to the Third Assessment Report of the Intergovernmental Panel on Climate Change, Cambridge University Press.

Gumbel E.J., 1958. Statistics of extremes. Columbia University Press.

Ocean Circulation. 1989. Edited by Gerry Bearman. Oxford, Pergamon Press.

O'Neill, A.D.J., 1977. Climate and Ice in the Strait of Canso Region.

Intergovernmental Panel on Climate Change. Last update: 31 October 2007. Available at: www.ipcc.ch

TranSystems. 2006. Strait of Canso, Nova Scotia: Conceptual Design. FINAL Phase II Feasibility Analysis Report.

6.6 GROUNDWATER

The issues regarding the quality and quantity of groundwater are the effects that the proposed MIT construction and operation may have on water supply wells, and the effects that changes to the groundwater regime may have on surface water bodies, streams, and wetlands adjacent to the Project.

Groundwater quality or quantity effects may often be of long duration. Unlike surface water, where sun, exposure to air, wind, and wave action may help to break down or disperse deleterious substances introduced to a stream or lake, the dark and cold conditions present in the subsurface are generally conducive to the long-term preservation of many substances. Thus, deleterious materials introduced into the subsurface aquatic environment may remain there for long periods of time, and once adsorbed to soil and rock, may serve as a long-term source of material to be dissolved into groundwater. These dissolved materials may in turn be introduced to surface waters via base flow and discharge to wetlands, thus possibly affecting those environments as well.

The groundwater search indicates that there are approximately 69 domestic and industrial water wells extending from Sand Point (southeast of the footprint), through to Auld's Cove (Section 5.6). Additionally, there are also a number of watercourses located within the footprint of the Logistics Park and the rail and transmission corridors (Section 5.9).

6.6.1 Boundaries

6.6.1.1 Project Boundaries

For the assessment of effects on the Groundwater VEC, the same temporal boundaries have been assumed as those established for the construction and operation phases of the Project. In addition, the potential for effects on groundwater beyond the decommissioning of the Project site is also considered.

The spatial Groundwater VEC boundary is defined by the surface watershed divide, assuming similarities with the groundwater watershed.

6.6.1.2 Technical Boundaries

The technical boundaries are determined by the collected data on groundwater. At this point in the planning process, information on the groundwater resources, including such characteristics as quantity, quality, flows, recharge and discharge areas have been collected from existing sources (NSE water well records) and through sampling of selected residential wells in the vicinity of the Project site (Section 5.6). Site specific data will be collected during pre-construction activities through on-site drilling program for hydrogeological and geotechnical investigations.

6.6.2 Threshold for Determination of Significance

The significance of the effects on groundwater resources is based on the evaluation of the anticipated effects of Project-related activities on:

- The change of well water yields; and
- Change of well water quality.

A change in water well yields that result in a long-term reduction in water supply at a receiver location is considered a significant effect. Further, a Project-related change in well water quality beyond the drinking water quality guidelines for Nova Scotia/Canada is considered a significant effect (as noted previously in Section 5.6, Nova Scotia has adopted the GCDWQ from Health Canada).

It is of note that changes to the groundwater regime can also cause significant effects on ecological receptors. For example, the change in groundwater levels and flow can lead to the alteration of wetlands and/or baseflow conditions and thus fish habitat in water courses. The significance of these effects is established in the respective sections of this report (Section 6.9 and 6.10).

6.6.3 Effects on Groundwater

6.6.3.1 Effects of Construction

The main considerations with respect to impacts on water supply wells from the Project during construction include:

- blasting and vibration damages, with consequent temporary siltation (for dug and drilled wells) and possible permanent reduction in well yield (for drilled wells) during construction;
- trenching, site drainage and large cuts or changes in surface topography, could result in water level reductions during and after construction (dug well effects); and
- accidental release of fuel chemicals due to equipment failure during site preparation and construction.

The severity of the water supply well impacts are expected to be a function of well type (spring, dug well, drilled well), age of the well, well construction method, distance from the site boundaries, overburden thickness and the hydraulic properties of the soil and bedrock.

With respect to groundwater quantity, the main concerns related to Project site construction are:

- potential loss of well yield or lowered water level in dug wells (this is not expected to be severe due to the relative distance and small number of wells involved);
- possible damage to, or loss of, drilled wells during blasting operations; and
- possible reduction in base flow at on-site streams and reduced (or increased) discharge at wetlands.

With respect to groundwater quality, the main concerns related to plant site construction are:

- chemistry changes in down-gradient wells due to uncontrolled runoff;
- temporary siltation of dug wells during heavy equipment operations; and
- accidental release of hazardous materials up-gradient of wells or streams.

There are currently residences with private water wells near the terminal footprint on Route 344, as well as nearby Middletown road. Blasting associated with the contouring of the rail corridor and the Project site could have an adverse effect on near-by water wells. Effects from accidental spills and proposed mitigation and management measures are addressed in Sections 2.9 and 8.

Since there are no known locations within the proposed Project site which may contain sulphide mineralization, contamination of wells and/or on-site streams from acidic drainage is of little concern. Nevertheless, precautionary monitoring for acid rock drainage will take place prior to construction, in association with geotechnical investigations.

6.6.3.2 Effects of Operation

The main considerations with respect to impacts on water supply wells from the Project during operation will be limited to wells down gradient from the rail and transmission ROW and will include:

- accidental (acute) spills and release of chemicals, and possible releases due to fires, during MIT operation.

As with the construction phase, the severity of the water supply well impacts will be a function of well type, age of the well, well construction method, distance from the rail and transmission ROW boundaries, overburden thickness and the hydraulic properties of the soil and bedrock. With regard to groundwater quantity, the main concern is potential loss of well yield or lowered water level in dug wells. With respect to groundwater quality, the main concerns related to the operation of MIT include:

- chemistry changes in down-gradient wells due to uncontrolled ROW runoff; and
- acute accidental release of hazardous materials along the rail and transmission ROW up-gradient of wells or streams.

Potable water sources and water requirements for the marine terminal, intermodal yard, and the future businesses in the logistics park have not been determined yet. It is anticipated that businesses will be expected to develop their own groundwater wells. The water withdrawal requirements will be determined as part of the detailed design phase, and if required, site-specific hydro-geological investigations will be undertaken to determine sustainable well yields and compatibility with near-by ground water users. No significant adverse effects are anticipated.

6.6.4 Mitigation

6.6.4.1 Construction Phase

To reduce/eliminate any negative effects associated with potential spills, erosion and sedimentation during Project construction, an EMP will be implemented. Also, a contingency plan will be implemented for spill response and clean-up in the event of an accidental spill involving hazardous substances. Refuelling and maintenance activities for mobile equipment will be restricted to designated locations. These refuelling locations will be established away from open water (30 m vegetated corridor as well as 100 m distance between fuelling stations and any open water course) and will be designed with some level of containment such as a concrete pad, or other types of low permeability cover to restrict infiltration. For equipment that must be refuelled away from the designated refuelling stations, the locations below the fuel tank and nozzle will require temporary protection by the placement of absorbent spill pads or other temporary low permeable liner and collection system. The emergency response plan/spill response plan will specify that accidental spills or leaks of petroleum products or other deleterious substances from the vehicles, equipment and storage containers need to be immediately contained and cleaned up in accordance with regulatory requirements. Hazardous waste including containers for petroleum hydrocarbon will be collected and disposed off-site at a licensed facility and in accordance with regulatory guidelines.

Where possible, non potable water will be used for industrial purposes requiring large volumes of water such as fire response (e.g. England's Lake Reservoir). Groundwater flow direction is assumed to generally follow the surface topography. The few private water wells in the site area are all located transgradient to the groundwater flow and surface water runoff will be controlled through an on-site waste water and surface water management system and a temporary stormwater management system. Residential wells down gradient from the rail and transmission ROW are considerable distances removed from it. Therefore, considering these factors, the Project is not predicted to have significant adverse effects on domestic potable water quality.

Mitigation measures have been developed for the construction and operation phase and are summarized in Table 6.6-1. It is expected that similar mitigation measures would apply during the decommissioning of MIT. This would be specified and detailed in a decommissioning plan as discussed in Section 2.6.1.

Table 6.6-1: Mitigation Measures for Groundwater Quality and Quantity Effects

Potential Effect	Mitigation Measures	Project Application
• loss of well yield • temporary siltation of wells	• implement EMP during construction phase • avoid blasting to the extent possible within 500 m of residential wells • use ripping techniques as an alternative to blasting where possible • conduct pre-blast well survey (if not already sufficiently covered by baseline water well survey) • remedial action as necessary to restore damaged wells and/or provide temporary potable water as needed • conduct groundwater monitoring program at the Project site prior to construction to obtain baseline information (level, flow, quality)	• Construction Phase: blasting during site preparation
• water-level lowering in shallow dug or drilled wells	• monitoring and remedial action as necessary to restore damaged wells and/or provide temporary potable water as needed	• Construction Phase: excavation during site preparation
• groundwater quality degradation from spills	• application of EMP • proper fuel management • (See Section 2.9 and 8) • remedial action as necessary to restore damaged groundwater, wells and/or provide other sources of potable water as needed	• Construction and Operation Phases
• stream flow decreases, dry streams	• design to minimize depth of cuts near streams;	• Construction Phase: excavation during site preparation
• degradation of groundwater, surface base flow and well-water quality due to accidental spills	• application of EMP contingency planning (spill containment, recovery, etc.; see Section 2.9 and 8) • remedial action as necessary to restore damaged groundwater, wells and/or provide other sources of potable water as needed	• Operation Phase

Table 6.6-1: Mitigation Measures for Groundwater Quality and Quantity Effects

Potential Effect	Mitigation Measures	Project Application
• contamination of wells and/or onsite streams from acidic drainage in areas of known sulphide mineralization on-site	• precautionary monitor for acid generating rock • if required implement acid rock management plan	• Construction Phase
• groundwater quality degradation and siltation	• drainage and vibration controls • Implement EMP during construction phase • remedial action as necessary to restore damaged wells and/or provide temporary potable water as needed	• Construction Phase rail construction and repairs

An important component of the mitigation is the development and implementation of an EMP for the construction and the operation phases of the Project. This Plan will address a variety of topics including those relevant to groundwater protection, such as emergency response planning, and monitoring (for more details refer to Section 2.9 and Section 11).

6.6.4.2 Operation Phase

Mitigation measures during the operation phase are limited to the implementation of a site-specific EMP and associated spill response/ERP.

6.6.5 Monitoring

6.6.5.1 Construction

Based on the detailed design of the plant site grading plans, a detailed survey of those homes and wells located within 800 m of the blast areas will be undertaken following the NSE guidelines for blasting at quarries. The pre-blast survey includes: an inspection of all buildings located with the boundaries of the pre-blast survey; inventory of wells including water sampling for general chemistry, metals and bacteria; and short-term pumping tests (where wells are accessible), to determine the capacity of individual wells and nearby aquifers.

6.6.5.2 Operation

At this point in time, the need for a groundwater monitoring program during Project operation has not been identified.

6.6.5.3 Decommissioning/Abandonment

Prior to the decommissioning and abandoning of the MIT facilities, MITI will develop a decommissioning plan. The plan will specify decommissioning objectives, approach, activities, schedules, and site rehabilitation and will be developed in consultation with the municipality and regulatory agencies. If indicated at that time, a groundwater monitoring program will be designed to verify the effectiveness of mitigative measures employed in the Project decommissioning phase.

6.6.6 Residual Effects and Significance

The Project's environmental residual adverse effects on groundwater resources at and near the Project site during the construction and operation phase are considered to be not significant.

With the implementation of mitigation measures (Tables 6.6-1 and 6.6-2) the effects on water quality, and yield in water supply wells are expected to be limited to the construction phase and of minimal geographic extent.

Unplanned or accidental events can occur, potentially causing damage to groundwater resources. These events are discussed in more detail in Section 8. MITI's approach has been to apply best environmental management practices to prevention and preparedness training so as to reduce the likelihood of such events, and to be well prepared to implement an effective emergency response should an event occur.

Table 6.6-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Nor reversible	Ecological/Social-cultural and Economic Context			
Construction										
Siltation of dug and drilled wells and possible permanent decrease in well yield of drilled wells from blasting and vibrations	A	• Conduct pre-blast well survey (if not already sufficiently covered by baseline water well survey) • Establish and implement EMP • Avoid blasting to the extent possible within 500m of residential wells • Consider alternatives to blasting (e.g., ripping techniques) where possible • Remedial action as necessary to restore damaged wells and/or provide temporary potable water as needed	Potentially all water wells within about 500m of blasting activity	Blast sites within Project site plus the rail and transmission corridors with max 500 m zone	Temporary (dug and drilled wells) possibly permanent (drilled)	R/NR	Vacant Project site; sparsely populated area	Not significant		
Water level reductions in dug wells or damage to / loss of drilled wells during blasting operations	A	• Monitoring and remedial action as necessary to restore damaged wells and/or provide temporary potable water as needed.	Low	Project site and adjacent lands	Construction and operation phase	NR	Vacant Project site; sparsely populated area; designated for industrial use	Not significant		

Table 6.6-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects: Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Nor reversible	Ecological/Social-cultural and Economic Context	Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
Groundwater quality degradation from accidental release of fuel or other hazardous materials (equipment failure; handling accident)	A	• Establish and implement EMP including Spill Management Plan and Contingency Plan • Proper fuel management • Remedial action as necessary to restore damaged groundwater, wells and/or provide other sources of potable water as needed	Magnitude limited to individual spill event and affected water course	All water courses and lakes downstream of the rail and transmission corridors and Project site	Construction Phase – accidental event only	R	Vacant Project site; sparsely populated area; designated for industrial use	Potentially significant	Low	High
Contamination of wells and/or groundwater from acidic drainage in areas of known sulphide mineralization on site	A	• Precautionary monitoring for acid generating rock • If required, implement acid rock management plan	Low; no areas of known sulphide mineralization on site	If at all an issue – limited to small pockets within Project site and / or along the rail and transmission corridors	Construction Phase	R	No areas of known sulphide mineralization on site / along either the rail or transmission corridors	Not significant		
Stream flow decreases, dry streams	A	• Design to minimize depth of cuts near streams • Fish and habitat compensation, if required – see "Freshwater Environment"	Low	Local watercourses	Construction phase	R	Vacant Project site; sparsely populated area; designated for industrial use	Not significant		
Operation										

Table 6.6-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Nor reversible	Ecological/Social-cultural and Economic Context			
Degradation of groundwater and well water quality due to accidental spills	A	• Application of EMP including Spill Control Plan and Contingency Plan • Proper fuel management • Remedial action as necessary to restore damaged groundwater, wells and/or provide other sources of potable water as needed	Magnitude limited to individual spill event and affected water course	All water courses and lakes downstream of the rail and transmission corridors and Project site	Operation	R	Vacant Project site; sparsely populated area; designated for industrial use	Potentially significant	Low	High
Salt contamination and/or chemistry changes in down-gradient groundwater from on-Site roadways	A	• Implementation of a Site-specific EMP including Spill Control Plan and Contingency Plan • Re-fuelling and maintenance for mobile equipment will be located away from open water (30 m vegetated corridor and100 m distance between fuelling stations and water course) and will be designed with low-permeability collection systems	Magnitude limited to individual spill event and affected water course	All water courses and lakes downstream of the rail and transmission corridors and Project site	Operation	R	Vacant Project site; sparsely populated area; designated for industrial use	Potentially significant	Low	High

Table 6.6-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Nor reversible	Ecological/Social-cultural and Economic Context			
Alteration of groundwater flow and control of surface water runoff from terminal operation	A	• A storm water management system to allow collection and treatment of runoff	Magnitude limited to individual spill event and affected water course	All water courses and lakes downstream the rail and transmission corridors and Project site	Operation	R	Vacant Project site; sparsely populated area; designated for industrial use	Potentially significant	Low	High
Degradation of groundwater, surface base flow and well-water quality due to accidental spills	A	• Application of EMP contingency planning (spill containment, recovery, etc. • Remedial action as necessary to restore damaged groundwater, wells and/or provide other sources of potable water as needed	Magnitude limited to individual spill event and affected water course	All water courses and lakes downstream of the rail and transmission corridors and Project site	Operation	R	Vacant Project site; sparsely populated area; designated for industrial use	Potentially significant	Low	High

* (for Magnitude): For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 4.
** (for Likelihood of Occurrence; Level of Confidence): Only addressed for significant effect

6.7 SURFACE WATER

The principal interactions between the Project activities and surface waters are associated with: land disturbance during and after construction and commissioning of the Project site; wastewater and storm-water discharges during the construction and operation phases of the Projects; and alterations to flow regimes and related changes to downstream areas from loss of surface waters in the Logistics Park and Marine Terminal footprint.

The greatest potential for impact to surface waters is expected to be during the construction phase and will affect quantity and possibly quality. The largest discharge component by volumes is expected to be stormwater during both the construction and operation phases.

6.7.1 Boundaries

6.7.1.1 Project Boundaries

The spatial boundaries include all surface waters (watercourses and waterbodies) within the Logistics Park for both initial and future expansion areas. Additionally, all surface waters within the rail and transmission corridors, and associated downstream surface water resources are included.

The temporal boundaries will include all three phases of the Project; construction, operation, and decommissioning.

6.7.2 Threshold for Determination of Significance

The significance of the effects on surface water resources is based on the evaluation of the anticipated effects of Project-related activities on:

- Alterations to surface water quantity; and
- Alteration of surface water quality.

A change in surface water quantities that results in a long-term and/or permanent reduction of the resource to downstream locations is considered a significant effect. Further, a Project-related change in surface water quality that could result in long-term and /or permanent impacts to aquatic life is considered a significant effect.

It is of note, that changes to surface water resources can also cause significant effects on ecological receptors (habitat and biota). For example, changes to quantities of surface water can lead to the alteration of wetlands and/or base flow conditions and thus fish habitat in water courses. The significance of these effects is established further in the respective sections of this report (Section 6.9 and 6.10).

Guidelines published by the CCME (2007) for the protection of aquatic life, recommend the following for total suspended sediments (TSS) concentration for surface waters:

> *Clear flow: Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d) and;*
>
> *High flow: Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. Should not increase more than*

10% of background levels when background is >250 mg/L.

6.7.3 Effects on Surface Water

6.7.3.1 Effects of Construction

Construction activities and associated potential effects are listed below. Surface water quality will be monitored throughout the construction phase (refer to Section 6.7.5).

The three principal types of water discharge expected at the Site during construction include:

- Clean, and possible sediment-laden, stormwater;
- Construction waste water (hyrdrostatic test waters, concrete wash water, stormwater that has been in contact with uncured concrete etc.); and
- Sanitary waste water (worker sites and field offices).

The guiding document regarding the mitigation

Construction Envelope

Within the development borders of the Logistics Park and rail and transmission corridors, designated temporary material storage and lay-down areas will be established.

There is a potential for runoff and erosion from both these areas to affect the quality of downstream surface water resources. Increased siltation and turbidity can decrease quality, and run-off and erosion could lead to acid rock drainage (ARD) from storage of fill material on the lay-down areas.

Site Preparation, Clearing, Grubbing

Site clearing and grading will take place within the demarcated development envelope and along the rail and transmission ROWs. The main watercourse exiting Reeves Lake will be rerouted along the rail ROW within the Logistics Park.

There is a potential for runoff and erosion to affect surface water quality within and downstream of the work areas. Impacts may include increased siltation and turbidity from run-off and erosion and from movement of construction vehicles. There is also a potential impact possible from ARD while rocks are exposed.

The changes in topography on the Logistics Park site from grading will result in permanent losses of watercourses and subsequent alterations in surface water quantities to downstream areas. In addition, non-permanent impacts related to changes to drainage patterns from watercourse rerouting and diversion of runoff will also occur. Relative amounts of infiltration and runoff on the Logistics Park footprint will change, and could result in deleterious effects to downstream areas.

On-shore Cut and Fill, Blasting

Cut and fill work, including blasting, will be required for levelling the Logistics Park site and for establishing the rail ROW.

There is a potential for erosion resulting from this activity and from the movement of construction vehicles, which could affect the quality of surface water within and downstream of the work areas. Increased siltation and turbidity will decrease surface water quality.

Furthermore, run-off and erosion can also impact surface water resources. There is also a potential impact possible from ARD while rocks are exposed,

The detonation of explosives in the vicinity of surface waters could impact quality via introduction of ammonia and other detonation by-products.

Watercourses within the Logistics Park footprint will be permanently lost, thus impacting downstream areas by decrease in quantity of surface water resources.

Foundations

Following grading, excavations and levelling, the foundations of buildings and major equipment will be constructed including all underground services and the storm-water management system. Roads will be established in and around the complex.

There is a potential for runoff and erosion to affect surface water quality within and downstream of the work areas. Impacts may include increased siltation and turbidity from run-off and erosion and from movement of construction vehicles. There is also a potential impact possible from ARD while rocks are exposed.

Construction waste water (hyrdrostatic test waters, concrete wash water, stormwater that has been in contact with uncured concrete etc.) if managed incorrectly will decrease the quality of surface waters that may receive run-off.

Buildings, Utilities, Equipment

All buildings associated with the Logistics Park and intermodal rail yard will be built as per the detailed engineering designs. Utilities such as water supply and wastewater treatment units will be constructed for these buildings.

Construction waste water (hyrdrostatic test waters, concrete wash water, stormwater that has been in contact with uncured concrete etc.) if managed incorrectly will decrease the quality of surface waters that may receive run-off.

Transportation of Construction Material

During the construction period, equipment and materials will be delivered by road, rail and ship. Initially, materials and equipment will be transported to the Project Site by truck via Highway 344 until completion of the rail access, which can then be utilized.

Day-to-day transportation operations during construction activities are not anticipated to have an adverse effect on surface waters. However, there is a possibility of accidental discharge into watercourses as a result of accidents or malfunctions. Such an incident could have a significant effect on surface water resources at, and downstream of, the accident site (Section 8).

Management of Surface Water (stream diversions, stream crossings)

The changes in topography on the Logistics Park site will result in permanent losses of on-site watercourses and therefore permanent changes to quantity of surface water resources, drainage, and diversion of runoff on and from the site. As well, the relative amounts of infiltration and runoff on the Logistics Park footprint will change.

The rail and transmission ROWs will cross a number of watercourses at various locations. There is a potential for runoff and erosion to affect surface water quality within and downstream of the work areas. Impacts may include increased siltation and turbidity from run-off and erosion and from movement of construction vehicles. There is also a potential impact possible from ARD while rocks are exposed.

Wastewater
A variety of liquid wastes will be generated during construction, including oils and lubricants from equipment, and wastewater (i.e., runoff, sewage).

Discharge of these waste liquids into watercourses, either purposefully or due to accidents or malfunctions, will decrease the quality of surface water resources.

Stormwater
There is potential for deleterious effects on surface water resources resulting from both clean and possible sediment-laden stormwater to affect surface water quality within and downstream of the work areas. Impacts may include run-off and erosion leading to increased siltation and turbidity and from movement of construction vehicles. There is also a potential impact possible from ARD while rocks are exposed.

Contaminated Soils
In general, the Project Site overall is considered to have a low risk of contaminated soils as it is and has been largely undeveloped. However, there is potential for the discharge of pollutants to surface waters from contaminated soil and/or highly acidic or alkaline soils.

Site Rehabilitation at Temporarily Used Sites
Upon termination of the use of temporary sites such as lay-down areas, all surface structures will be dismantled and removed from the Site.

There is potential for deleterious effects on surface water resources resulting from improper disposal of waste material. Additionally, there is a potential for runoff and erosion to affect surface water quality within and downstream of the work areas. Impacts may include increased siltation and turbidity from run-off and erosion and from movement of construction vehicles. There is also a potential impact possible from ARD while rocks are exposed.

6.7.3.2 Effects of Operation

Operations activities and associated potential effects are listed below. Surface water quality will be monitored throughout the operation phase (refer to Section 6.7.5).

The three principal types of water discharge expected at the Site during operation include:

- Potentially oily stormwater from some process complexes (i.e., paved or hard surfaces);
- Clean stormwater from some process complexes and general areas, either paved (hard

surface) and unpaved (soft surface); and
- Domestic-type or sanitary waste water.

The aforementioned effects of construction will result in loss of watercourses within the footprint of the Logistics Park. Therefore any impacts from Operations to surface water resources will be to downstream areas outside the borders of the Park. The largest discharge component by volume will be storm-water as much of the site will have gravel or impervious surfaces.

Potable water sources and water requirements for the marine terminal, intermodal yard, and the future businesses in the logistics park have not been determined yet. It is anticipated that businesses will be expected to develop their own groundwater wells. The water withdrawal requirements will be determined as part of the detailed design phase, and if required, site-specific hydro-geological investigations will be undertaken to determine sustainable well yields and compatibility with near-by ground water users. No significant adverse effects are anticipated.

Logistics Park Footprint

Discharge of treated water and surface run-off over land could have a potentially deleterious effect on surface waters through contamination, erosion, increased turbidity, and siltation of downstream areas that will decrease quality. Furthermore, run-off and erosion can also impact through possible ARD.

Day-to-day transportation operations within the Park are not anticipated to have an adverse effect on surface waters. However, there is a possibility of accidental discharge into watercourses as a result of accidents or malfunctions. Such an incident could have a significant effect on surface water quality at, and downstream of, the accident site (Section 8).

Rail ROW

During this phase, many materials will be delivered by rail. Day-to-day transportation operations are not anticipated to have an adverse effect on surface water resources. However, there is a possibility of accidental discharge into watercourses as a result of accidents or malfunctions. Such an incident could have a significant effect on surface water quality at, and downstream of, the accident site (Section 8). Any impacts, from Operations, to surface water resources in the Rail ROW will therefore be limited to downstream areas.

6.7.3.3 Effects of Decommissioning

Details for project decommissioning have not been developed at the present time, so effects of this phase on the freshwater environment cannot be determined.

6.7.4 Mitigation

6.7.4.1 Construction

To reduce/eliminate any negative effects associated with potential spills, erosion and sedimentation during project construction, an EMP will be implemented. Also, a contingency plan will be implemented for spill response and clean-up in the event of an accidental spill involving hazardous substances. Refuelling and maintenance activities for mobile equipment will be restricted to designated locations. These refuelling locations will be established away from open water (30 m vegetated corridor as well as 100 m distance between fuelling stations and any open water course) and will be designed with some level of containment such as a concrete pad, or other types of low permeability cover to restrict infiltration. For equipment that must be refuelled away from the designated refuelling stations, the locations below the fuel tank and nozzle will require temporary protection by the placement of absorbent spill pads or other temporary low permeable liner and collection system. The emergency response plan/spill response plan will specify that accidental spills or leaks of petroleum products or other deleterious substances from the vehicles, equipment and storage containers need to be immediately contained and cleaned up in accordance with regulatory requirements. Hazardous waste including containers for petroleum hydrocarbon will be collected and disposed off-site at a licensed facility and in accordance with current guidelines.

Acid Rock Drainage (ARD)

The Site bedrock belongs to the Mabou group, which based on available information has low potential for ARD. Nonetheless, as a precautionary measure, prior to construction, samples from rock excavation areas will be tested for acid generating potential. If acid generating rock is determined to exceed the 500 m^3 regulatory volume, a management plan for the rock will be developed for approval by NSE. The plan will consider the suitability of isolating the area through in-fill or berms, stabilization, and excavation and disposal at a facility approved to accept material.

6.7.4.2 Operation

Key mitigation measures related to surface water is the proper operation of a stormwater management system and a waste water management and treatment system. Both systems need to be continuously monitored with respect to their effectiveness and compliance with regulatory standards. With respect to the potential effects caused by malfunctions and accidents, spill prevention and emergency response planning (including training) are required to ensure any such events are unlikely to occur. In the event of a malfunction or accident with potential for surface water contamination, appropriate containment and remediation measures are to be taken in accordance with the emergency response plans (see also Section 8).

Mitigation measures developed for the construction and operation phases are summarized in Table 6.7-1, and in some cases, discussed further in Section 6.7.4.3. It is expected that similar mitigation measures would apply during the decommissioning of MIT. This would be specified and detailed in a decommissioning plan as discussed in Section 2.6.1.

Table 6.7-1: Mitigation Measures for Surface Water Quality and Quantity Effects

Potential Effect	Mitigation Measures
Construction Phase	
• Impacts from run-off and erosion; and • Siltation and turbidity of surface waters	Use of suitable backfill materials
	Restrictions on the removal of riparian vegetation
	Establish a buffer zone of 20m around surface waters
	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan
	Erosion and sediment control measures will be implemented as described in an EMP. Measures will be specified in site-specific erosion and sediment control plans (temporary storm water detention, sedimentation ponds, open swale systems for drainage)
	Perform pre-construction surveys and inspect excavations regularly

Table 6.7-1: Mitigation Measures for Surface Water Quality and Quantity Effects

Potential Effect	Mitigation Measures
• Acid rock drainage erosion to surface waters	Perform pre-construction surveys and inspect excavations regularly
	Obtain samples and develop a management plan (refer to Section 6.7.4.1)
	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan
	Erosion and sediment control measures will be implemented as described in an EMP. Measures will be specified in site-specific erosion and sediment control plans (temporary storm water detention, sedimentation ponds, open swale systems for drainage)
	Precautionary testing for ARD
• Permanent alteration of drainage patterns	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan
	Establishment of stable, naturally functioning stream channels should be will be strived for
• Non-permanent impacts from modification of surface waters	Establish a buffer zone of 20m around surface waters
	Restrictions on the removal of riparian vegetation
	Erosion and sediment control measures will be implemented as described in an EMP. Measures will be specified in site-specific erosion and sediment control plans (temporary storm water detention, sedimentation ponds, open swale systems for drainage)
• Permanent loss of surface waters (within the Logistics Park footprint)	Mitigative measures (i.e. compensation plans are discussed in conjunction with the loss of fish habitat, in Section 6.9)
• Impacts from blasting activities	Avoidance of ammonium nitrate and fuel-oil mixtures
	Establish an EMP for blasting activities
	Adherence to federal guidelines on blasting[1]
• Impacts related to water crossings	Adherence to federal and provincial guidelines on watercourse crossings (refer to Section 6.9.4.1)
	Establish a buffer zone of 20m around surface waters
	Restrictions on the removal of riparian vegetation
	Erosion and sediment control measures will be implemented as described in an EMP. Measures will be specified in site-specific erosion and sediment control plans (temporary storm water detention, sedimentation ponds, open swale systems for drainage)
• Impacts related to stormwater	Management of storm water quantity and quality to relevant provincial standards
	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan
	Removed vegetation will be replaced, or process areas will be gravelled, paved, or curbed as soon as practical to minimize erosion and direct run-off to a stormwater collection system
	Erosion and sediment control measures will be implemented as described in an EMP/EPP. Measures will be specified in site-specific erosion and sediment control plans (temporary storm water detention, sedimentation ponds, open swale systems for drainage)
• Impacts related to wastewater	Stormwater will be collected and treated to relevant provincial standards in a storm water management system prior to discharge into the Strait, as per a Stormwater Management Plan

Table 6.7-1: Mitigation Measures for Surface Water Quality and Quantity Effects

Potential Effect	Mitigation Measures
	Utilization of mobile sanitary wastewater treatment units approved under relevant regulations and guidelines to treat sanitary wastewater on-site, or holding tanks for sanitary waste management (determined following the Front End Engineering and Design (FEED) assessment)
	Guidelines for the storage and disposal of chemicals, fuel and lubricants storage and concrete wash containment will be addressed in the EPP.
• Impacts related to contaminated soils	Remediate contaminated soil promptly (if contaminated soils cannot be treated on site, dispose soils off-site at a licensed hazardous waste hauler)
• Impacts related to the improper disposal of waste materials	Excess construction materials will not be deposited in any watercourse/waterbody or anywhere where they could be reintroduced into the aquatic environment
	Collect hazardous waste for disposal in accordance with an established waste management plan
	Oil-water separation and sediment retention, and settling structures will be designed
• Accidental discharges and/or malfunctions	Provisions for spill control
	All fuelling and maintenance of construction equipment will be separated by 30 m vegetated corridor from water, and a 100 m distance between fuelling stations and any open water course will be maintained from watercourses/waterbodies/wetlands
	All on-site fuels, oils, and chemicals stored >50m from surface waters
	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan
	Spill prevention and clean-up equipment and plans
	Train all staff in the handling, storage, and disposal of hazardous materials
	Store chemicals and other hazardous substances in designated locations and in accordance with the manufacturers' recommendations and federal and/or provincial regulations, as applicable
	Utilization of an EPP/EMP prepared specifically for this phase that will prescribe environmental management measures, mitigation, spill prevention protocols, contingency measures, responsibilities, supervision, and reporting requirements/measures
Operations Phase	
• Contamination, erosion, turbidity, and siltation from discharge of water and/or surface water run-off	A 30m buffer zone should be employed wherever possible.
	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan; system to employ oil-water separation and sediment retention, and settling structures
	Storage of containers containing dangerous goods in designated area with separate drainage system connected to waste water treatment facility
	Operation of wastewater collection and management system; discharge quality to meet regulatory requirements; compliance monitoring
	Monitoring of proper functioning of stormwater and waste water management system (effects monitoring and compliance monitoring)
• Accidental discharges and/or malfunctions	See above mitigative measures listed for construction phase

[1] Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright, D.G. and G.E. Hopky, 1998).

Although potential impacts related to the decommissioning phase of the project have not been included a general mitigative measure would involve the development of a decommissioning plan, in consultation with the municipality and regulatory agencies, which will specify decommissioning objectives, approach, activities, schedules, and site rehabilitation.

6.7.5 Monitoring

6.7.5.1 Construction and Operation

Environmental management considerations for the Project include monitoring and maintenance programs such as Environmental Effects Monitoring (EEM), and Environmental Compliance Monitoring (ECM). These environmental management features will be refined and expanded on throughout the Project design. The EMP includes EEM for surface water quality. ECM for effluent quality and quantity will be undertaken; the Site surface water management systems and water treatment facilities have been designed to include controlled outlet structures with monitoring points.

Monitoring programs outlined above will be designed to verify the effectiveness of the mitigative measures. The details of the monitoring programs will be determined in consultation with regulatory agencies and documented in the Project EMP.

During construction, increased monitoring of surface waters during storm events will take place to confirm that mitigative measures are functional properly and identify areas that need to be addressed.

6.7.5.2 Decommissioning

Prior to the decommissioning and abandoning of the MIT facilities, MITI will develop a decommissioning plan. The plan will specify decommissioning objectives, approach, activities, schedules, and site rehabilitation and will be developed in consultation with the municipality and regulatory agencies. Monitoring programs outlined above will be designed to verify the effectiveness of mitigative measures employed in the Project decommissioning phase. The details of the monitoring programs will be determined in consultation with regulatory agencies and documented in the Project EMP.

6.7.6 Residual Effects

Residual impacts refer to those environmental effects predicted to remain after the application of suggested/required mitigation measures outlined in Section 6.7.4. The predicted residual effects are considered for each phase for the Logistics Parks and rail ROW as per the criteria established in Section 4.0. Significance is determined based on the following criteria as specified by the CEAA:

- Magnitude (*Low, Medium,* or *High*);
- Geographic extent;
- Frequency;
- Duration; and
- Reversibility

For adverse residual effects the evaluation for the individual criteria was combined into an overall rating of significance. An adverse impact is considered “significant” where the residual effect was classified as major; while those impacts considered “not significant” had residual effects classified as medium, minor, or minimal. It is important to note that although a significant residual effect may be determined for one individual criterion within a VEC, that the overall significance of effects on the VEC as a whole may still be not significant when the relative values of the different criteria are balanced against one another.

Table 6.7-2 provides the results of the effects assessment for the surface water resource VEC for construction and operation phases of the Project. Details for project decommissioning have not been developed at the present time, so effects of this phase on the surface water quality and quantity cannot be determined.

Table 6.7-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects: Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context	Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
Construction										
Potential run-off and erosion, siltation and turbidity	A	• Establish and implement EMP including erosion and sediment control plan near surface streams, activities will be conducted in compliance with Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters • Restrictions on the removal of riparian vegetation • Establish a buffer zone of 20m around surface waters to be maintained • Stormwater will be collected and treated in a temporary storm water facility prior to discharge into the Strait	Low	Logistics Park and Rail and Transmission Corridors	Construction Phase - entire	R	Decreased quality	Minimal		
Impacts from ARD erosion	A	• Use of local fill, which has low ARD potential • Perform pre-cautionary pre-construction survey to confirm absence of ARD • If necessary, develop a management plan in consultation with NSE • Collection and management of storm water quantity and quality to relevant provincial standards prior to discharge into the Strait • Establish and implement EMP including erosion and sediment control plan	Low	Logistics Park and Rail and Transmission Corridors	Construction phase - entire	R	Decreased quality	Minimal		

Table 6.7-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Alteration of drainage patterns and infiltration/runoff	A	• Maintain 30 m vegetated buffer zone around streams and wetlands and 100 m distance between fuelling stations and any open water course/wetland • Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge, as per a Stormwater Management Plan • Implement a Habitat Compensation Plan acceptable to DFO, and monitor for success (see Freshwater Environment) • EMP provisions for working in/near watercourses	Low	Logistics Park	Permanent	NR	Decreased quantity	Minor		
Blasting activities	A	• Avoidance of ammonium nitrate and fuel-oil mixtures • Include provisions for blasting in EMP • Adherence to federal guidelines (Use of Explosives in or Near Canadian Fisheries Waters)	Low	Logistics Park	Short term - infrequent	R	Decreased quality	Minimal		
Watercourse crossings	A	• Adherence to federal and provincial guidelines on watercourse crossings • Establish a buffer zone of 20m around surface waters and restrict the removal of riparian vegetation, where practicable • Establish and implement EMP including erosion and sediment control plan	Low	Rail and Transmission Corridors including downstream areas	Construction phase	R	Decreased quality	Minimal		

Table 6.7-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Impacts from stormwater	A	• Stormwater will be collected and treated to relevant provincial standards in a temporary storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan • Removed vegetation will be replaced, or such areas will be gravelled, paved, or curbed as soon as practical • Establish and implement EMP including erosion and sediment control plan	Low	Logistics Park and Rail Corridor including downstream areas	Construction phase	R	Decreased quality	Minimal		
Impacts from wastewater	A	• EMP provisions for temporary stormwater management	Low	Logistics Park and Rail Corridor including downstream areas	Construction phase	R	Decreased quality	Minimal		
Operation										
Contamination, erosion, turbidity, and siltation of surface waters from discharge of water and/or surface water run-off	A	• EMP provisions for stormwater management • Use of a stormwater management system that meets all regulatory requirements • Monitoring of storm water effluent quality • On-site sanitary wastewater treatment	Low	Logistics Park and Rail Corridor including downstream areas	Infrequent	R	Decreased quality	Minimal		

* (for Magnitude): For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 4.
** (for Likelihood of Occurrence; Level of Confidence): Only addressed for significant effect

6.7.7 Summary of Significant Environmental Effects

None of the predicted residual effects on the surface water VEC criteria are Significant. The potential for adverse environmental effects relate primarily to short-term, reversible, decreases in surface water quality. However, effective mitigation measures have been identified. Monitoring will be required to verify the effectiveness of all mitigation measures and to identify the need for design adjustments. Consequently, no adverse residual effects are anticipated.

Unplanned or accidental events can occur, potentially causing damage to surface water quality. The severity of effects from accidental events is dependent upon the magnitude of the event, location of the event, and the time of year. For the prediction of residual adverse environmental effects, it is acknowledged that, while the likelihood is low, the result can be Significant. Unplanned events are, by their very nature, difficult to predict. Our approach has been to apply environmental management practices to prevention and preparedness training so as to reduce the likelihood of such events, and to be well prepared to implement an effective emergency response should an event occur. Emergency Preparedness Planning will include the development and maintenance of a high degree of readiness through equipment purchase and maintenance, training exercises and simulations. Emergency Preparedness Planning has been integrated into all phases of the Logistics Park and Rail Corridor design, planning, and execution. Accidents and/or Malfunctions are discussed further in Section 8.0.

Through careful design and planning, combined with prudent application of proven mitigation measures, this Effects Assessment for surface water quality and quantity has identified and addressed all potential adverse environmental effects, and through the application of appropriate mitigation measures has reduced the predicted adverse impacts to a low level of significance.

6.7.8 References

CCME (Canadian Council of Ministers of the Environment), 2007. Canadian Water Quality Guidelines for the Protection of Aquatic Life. Update #7, September 2007. http://www.ccme.ca/assets/pdf/aql_summary_7.1_en.pdf.

6.8 MARINE ENVIRONMENT

The marine habitat of the Strait of Canso/Chedabucto Bay supports a typical range of marine species (i.e. fish, shellfish, marine mammals, and benthic invertebrates), and provides a migratory path for some fish, such as Atlantic salmon and sea-run trout (Section 5.8). Nearshore, shallower areas also support various marine plant species. Lobster is by far the most important species in terms of economic value within the Strait/Chedabucto Bay, and thus the emphasis in assessing impacts has been placed on this species.

The wharf associated with the Marine Terminal will result in loss of fish habitat. A permitting process (HADD Authorization) through DFO is required to authorize this loss. Information on this habitat was collected as described in Section 5.8 and will be supplemented by additional survey data to be submitted to DFO as part of the permitting process, along with an assessment of the role of this habitat to fish production, primarily lobster. Under the HADD process, compensation for loss of productive habitat is required. As such a draft compensation plan has been developed to be submitted to DFO as part of this EIS (Appendix 6.8-A).

The marine environment VEC includes marine habitat, marine fauna including species at risk, marine flora including species at risk due to the role vegetation plays as a component of marine habitat and as a food source for both fish and invertebrate species. Fisheries and aquaculture are also considered due to the level of importance to the regional economy and importance as a socio-cultural activity among maritime communities.

6.8.1 Boundaries

6.8.1.1 Project Boundaries

The spatial boundaries include the marine habitat immediately offshore that will be used for the marine wharf component of the Project and the area immediately adjacent.

The temporal boundaries will include all three phases of the Project; construction, operation, and decommissioning.

6.8.1.2 Ecological Boundaries

The ecological spatial boundaries vary between species due to differences in distribution, migration patterns, and life histories of marine biota that utilize the habitat at various levels depending upon the organism and the specific lifecycle stage.

The ecological temporal boundaries applied in this assessment are identical with those established for the overall Project. Marine habitat is available year round to diverse population assemblages and some lifecycle stages of various species. It is important to note that benthic habitat and communities are present in the study area year round and that particularly sensitive times for anadromous fish populations include periods of migration and spawning (*e.g.*, mid May to mid July, and October to December).

Table 6.8-1 provides a description of the ecological boundaries.

Table 6.8-1: Ecological Boundaries for Marine Environment VEC

VECs	Boundaries
Marine habitat	Temporal: Includes all three phases of the Project; construction, operation, and decommissioning
	Spatial: Includes the area that will be used for the marine wharf and areas immediately adjacent
Marine fauna including species at risk	Temporal: Migration patterns dictate that not all species of marine fauna will be in the study area on a year round basis; however the area is host to fauna throughout the year
	Spatial: Encompasses the extent of the Strait of Canso and Chedabucto Bay and throughout the water column
Marine flora including species at risk	Temporal: Many species of marine flora thrive year round while others are seasonal
	Spatial: Proposed footprint and the immediately adjacent area
Fisheries and aquaculture	Temporal: Includes all seasons in which fisheries, both commercial and recreational take place within the stated spatial boundaries.
	Spatial: Encompasses the area in which the fishery takes place, which extends from the Strait of Canso and Chedabucto Bay and throughout the water column

6.8.1.3 Administrative and Legislative Boundaries

Marine benthos is a component of fish habitat and therefore is subject to regulations under the federal *Fisheries Act*. Section 35 (1) of the *Fisheries Act*, states that no one shall carry on any work or undertaking that results in the harmful alteration, disruption or destruction of fish habitat (HADD). Environment Canada administers sections of the *Fisheries Act* prohibiting the introduction of deleterious substances into waters frequented by fish (Section 36).

The protection of marine fauna falls under the jurisdiction of the federal *Fisheries Act* and the administration of DFO; however, Environment Canada administers those aspects of the *Fisheries Act* dealing with pollutants affecting fish (Sections 36-42). Species at risk fall under the federal *Species at Risk Act* and/or the provincial *NS Endangered Species Act*.

For commercial fisheries, the administrative boundaries are considered to be DFO statistical districts 9 and 14. These areas encompass the Strait of Canso (east of the Causeway) and Chedabucto Bay, including the inshore shipping route and Project terminal area. DFO assumes responsibility for the management of fish stocks in this area. The fisheries considered for this assessment include all finfish and shellfish harvested commercially or recreationally.

6.8.1.4 Technical Boundaries

The technical boundaries include information from desktop studies and existing literature and discussions with government officials. In addition to this, the analysis of the benthic habitat and communities was based on a review of available information as well as an underwater benthic habitat and invertebrate community survey (UBHS) and a marine sediment sampling program (MSSP) completed within the proposed footprint.

Information regarding commercial and recreational fisheries was acquired through conversations with DFO personnel who supplied both anecdotal and statistical information.

Aquaculture information was obtained from the website of the provincial Department of Fisheries and Aquaculture.

6.8.2 Threshold for Determination of Significance

A significant adverse effect on the marine environment and biota is defined as one that is likely to cause any one of the following:

- adverse changes to critical habitats;
- further impairment of the ecological functioning of the biotic community;
- mortality or serious injury to species at risk (SAR);
- a reduction in the abundance of one or more non-listed species from the existing level from which recovery of the population is uncertain, or more than one season would be required for a locally depleted population or altered community to be restored to pre-event conditions; and
- increased ecological risk to a level that long term effects to the health of aquatic biota is predicted.

6.8.3 Effects on the Marine Environment

6.8.3.1 Effects of Construction

The effects of construction are briefly discussed in the following sections.

Marine Habitat

The construction of the terminal will have an adverse effect on marine habitat in the immediate area due to the removal of habitat within the footprint. Dredging and/or construction activities will disturb the substrate in the area and may re-suspend sediments with PCB concentrations that exceed some established guidelines. Further, construction activities closer to and on shore have the potential to release sediment into the marine environment via run-off.

Marine Fauna including Species at Risk

For the purposes of this assessment marine fauna includes fish and shellfish, marine mammals, sea turtles, and benthic invertebrates. Potential interactions from the construction phase include siltation from marine construction, direct mortality of individuals through the process of infilling or dredging, loss of habitat from the footprint, and avoidance of the area due to noise and other disturbances.

The habitat within the proposed footprint provides protection and forage areas for many aquatic species (Section 5.8). Fish, marine mammals, and sea turtles will be minimally affected as the habitat being lost is not considered limited or critical for species survival and they will be able to easily move to nearby areas. Benthic invertebrates and some shellfish (e.g. mussels) without the ability to move to a new location will be lost during the construction phase, including larval species. This area has been recognized as an important area for snow crab larval production. Potential siltation from construction activities will destroy habitat outside the footprint of the project area. A build up of silt via sediment plumes will smother sessile benthic invertebrates and demersal fish eggs. Some species are known to avoid areas of high sediment concentration (Wildish et. al., 1977). Species at risk listed by COSEWIC and SARA (Section 5.8) are all free-swimming and thus should be minimally impacted by the construction because of their ability to remove themselves from the area. It should be noted that any effect on the population for species at risk is a serious effect due to their sensitive nature.

Sources of construction noise for the Marine Terminal will include dredging, the placement of armour stone or fill and the placement of caissons, steel sheet piling or piles. Blasting may also be required to remove rock from the project footprint. These activities will produce noise that can adversely affect marine fauna and may cause marine fauna to move out of the affected areas close to the source.

There is considerable variation in the hearing ability within marine species therefore it is difficult to make general statements about behaviour related to this activity. Potential impacts to marine mammals include interfering with communications, foraging, echolocation, and breeding (David, 2006). Caltran (2001) studied the effects of pile driving on harbour seals and sea lions and found that most individuals vacated the area within 500 m of the activity. Tyack (1982) suggests that avoidance behaviour due to intermittent sounds, such as those produced during pile driving, occurs only when noise levels exceed 160 to 170 dB 1mPa.

The physical effects on fish have been examined by Turnpenny and Nedwell (1994) and include the following reactions to noise levels:

- transient stunning at 192 dB re 1 μPa;
- internal injuries at 200 dB re 1 μPa;
- egg/larval damage at 220 dB re 1 μPa; and
- fish mortality at 230-240 dB re 1 μPa.

In addition, Pearson et al. (1992) notes that the lower noise threshold that can cause subtle changes in fish behaviour is approximately 160 dB.

Dredging of marine sediment will be required in some locations within the project area. The dredge spoils are anticipated to be land disposed so there will be no effects from smothering due to disposal activities. Dredging can, however, cause re-suspension and mobilization of marine sediments, including those areas that have been found to have PCB concentrations above CCME PELs and CEPA ocean disposal guidelines. Particle size analysis shows that the sediment is comprised mainly of gravel and sand which will settle out quickly, minimizing the effects over a large area.

Marine Flora including Species at Risk

There is a substantial amount of marine plant growth in the nearshore areas of the proposed footprint (approximately 30 ha with > 60% cover). Much of this vegetation is marine macroalgae, with eelgrass present in small quantities. Marine plants provide food and cover for many larval, juvenile, and adult fish, shellfish, and invertebrate species and in parts of Nova Scotia seaweed harvesting is an important commercial fishery.

A build up of silt via potential sediment plumes will choke out marine plants.

The construction of the terminal will result in the loss of all marine plants within the footprint of the proposed terminal.

Fishing and Aquaculture

A significant fishing industry of nearly 700 registered fishing vessels operates out of the Strait of Canso; however, this activity is limited around Melford (Section 5.11). There are active seafood brokering and processing businesses in the Strait area as well but none in the Study Area.

The construction of the terminal will remove approximately 23 (22.7) ha in area that was available for both commercial and recreational fishing activities. In addition, effects described for the marine habitat would also have an adverse effect on the local fishery.

The fishery may also be affected because of the attraction of fish to lighting from construction activities.

Potential sediment run-off or plumes could lead to mortalities and/or displacement of fish species.

Aquaculture operations are not located in the vicinity of construction activities.

6.8.3.2 Effects of Operation

The effects of construction are briefly discussed in the following sections:

Marine Habitat

Re-suspension of sediment resulting from propeller wash can negatively affect marine habitat through the introduction of potentially contaminated soils into the water column.

Potential adverse effects on marine habitat can occur from the discharge of wastewater and bilge water from the cargo vessels utilizing the terminal. The release of ballast water may also introduce non-native and invasive species into the marine environment.

Stormwater runoff from the marine terminal site will be directed to the marine environment which may introduce contaminants into the Strait of Canso/Chedabucto Bay.

Marine Fauna and Flora including Species at Risk

The noise generated by propeller cavitations can be up to 83% of the underwater acoustic field surrounding large vessels (Southall, 2005) that will be loading and unloading at the terminal. Effects may occur on marine mammals including changes in behaviour such as avoidance, changes in migration routes, and changes in reproductive or feeding behaviour.

Increased vessel traffic in the area has the potential to interfere with marine mammal sound production and communication and may result in an elevated probability of collisions. In animals like cetaceans that are highly dependent on sound, the ability to recognize sound signals in the presence of background noise is important in communicating, detecting predators, locating prey, and, in toothed whales, echo-locating (Lawson et al. 2000).

Propeller wash can negatively affect flora and fauna through the re-suspension of sediment resulting in siltation that can smother invertebrates, cover hard bottoms and negatively affect the ability of species such as mussels and scallops to settle and develop. This effect can also smother marine plants and negatively affect the colonization of plants in the area.

Potential adverse effects on marine flora and fauna can also occur from the discharge of wastewater and bilge water from cargo vessels.

Stormwater runoff from the marine terminal site will be directed to the marine environment which may introduce contaminants into the Strait of Canso/Chedabucto Bay and adversely effect fauna and flora species.

Following construction, marine plants will quickly re-establish on hard surfaces in the area, including armour stone and concrete and steel infrastructure within the subtidal and intertidal zones. A portion of this growth may be used as habitat for other marine species; however, plants that establish on a vertical surface (i.e. on the terminal itself) offer little in terms of useful habitat (G. Sharp, pers. comm., 2007).

Fisheries and Aquaculture

Potential operational impacts to fisheries and aquaculture are associated with Project-related vessels entering and leaving the area. The increase in shipping within the area has the potential to interfere with fishing vessels and increase the ambient underwater noise that may affect the distribution and/or migration of fish movement in the area and decrease catches. Additionally, fishing gear could be lost if vessels do not utilize the marked shipping lanes.

Aquaculture sites, remote from the site and outside of the potential to be affected by accidents and malfunctions, will not be affected by the terminal operation. Current vessel traffic does not have any adverse effect on these sites and it is not anticipated that an increase in traffic will alter that situation.

6.8.3.3 Effects of Decommissioning

Effects associated with the decommissioning phase are expected to involve generally similar issues as those identified for the construction phase. The principal approach to decommissioning is outlined in Section 2.8. The specific effects on the marine environment will very much depend on the extent of the decommissioning. Of key importance would be the question whether or not the marginal wharf would be removed and the filled in area rehabilitated to pre-development conditions. It is more likely that the marginal wharf will remain in place. However, should the wharf be removed, it would provide an opportunity for beneficial effects through re-construction of natural marine habitat. Any such in-water work would need to be conducted with the necessary mitigation measures to avoid and reduce temporary effects related to sediment loadings and potential accidental contamination (e.g., fuel spills). As stated in Section 2.8, the decommissioning objectives and approach would be discussed with all relevant stakeholders and would need to be implemented in compliance with the regulatory standards applicable at that time.

6.8.4 Mitigation

Mitigation measures developed for the construction and operation phases are summarized in Table 6.8-2.

Although potential impacts related to the decommissioning phase of the project have not been included, a general mitigative measure would involve the development of a decommissioning plan, in consultation with the municipality and regulatory agencies, which will specify decommissioning objectives, approach, activities, schedules, and site rehabilitation.

6.8.4.1 Construction and Operation

The construction of the marginal wharf and related works will result in the permanent loss of approximately 23 (22.7) ha of marine habitat. The *Fisheries Act* and relevant policies of the

DFO require that MITI compensate for these losses/alterations to the satisfaction of DFO and with the objective of achieving “no net loss” of fish habitat. A detailed analysis of the habitat types to be lost and options for replacing this habitat have been evaluated and the results of this investigation are included in the attached proposed Habitat Compensation Plan, in Appendix 6.8-A. The loss of marine habitat, while not considered critical or limiting habitat for any of the species identified as being in the area, is considered significant. The implementation of measures outlined in the Habitat Compensation Plan will offset any losses.

To reduce/eliminate any negative effects associated with potential spills, erosion, and sedimentation during project construction, an Environmental Management Plan (EMP) will be implemented. Also, a contingency plan will be implemented for spill response and clean-up in the event of an accidental spill involving hazardous substances. Refuelling and maintenance activities for mobile equipment will be restricted to designated locations. These refuelling locations will be established away from open water (30m vegetated corridors as well as a 100 m distance between fuelling stations and any open watercourse/wetland) and will be designed with some level of containment such as a concrete pad, or other types of low permeability cover, to prevent infiltration. For equipment that must be refuelled away from the designated refuelling stations, the locations below the fuel tank and nozzle will require temporary protection by the placement of absorbent spill pads or other temporary low permeable liner and collection system. The emergency response plan/spill response plan discussed in Section 8 will specify that accidental spills or leaks of petroleum products or other deleterious substances from the vehicles, equipment and storage containers need to be immediately contained and cleaned up in accordance with regulatory requirements. Hazardous waste, including containers for petroleum hydrocarbons, will be collected and disposed off-site at a licensed facility and in accordance with regulatory guidelines.

To minimize the re-suspension of sediments in the water column the following measures should be followed:

- Ensure that the dredge bucket descends to the bottom in manner which reduces the potential re-suspension of sediments as the bucket contacts the bottom
- Minimize the potential for washing of material from the bucket during ascent by having the operator try to achieve full bucket capacity
- Control the rate at which the bucket ascends to reduce the potential of winnowing of sediment
- Empty the bucket after material is unloaded before continuing to dredge
- Use a rinse tank to remove build-up on the bucket
- Do not drag the bucket on the bottom for the purposes of levelling; and
- If necessary, limit dredging activities to periods during which tidal currents are weakest.

In addition, the use of suction dredging will be investigated as a means of minimizing the re-suspension of marine sediments.

There will be no blasting in the marine environment, and thus there is no concern over possible effects of this activity. However, there may be some required near the shore and some precautions as noted in the table below will be observed.

Table 6.8-2: Mitigation Measures for the Marine Environment

Potential Effect	Mitigation Measures
Construction	
Marine Habitat	
Dredging of sediments	• Slow ascent and descent bucket speeds to reduce chance of re-suspension • Attempt to achieve full bucket capacity • Completely empty the bucket after material is emptied and before continuing • Use of a rinse tank to remove build-up • Do not use bucket to level high spots • Do not drag the bucket on the bottom for the purposes of levelling • If necessary, limit dredging activities to periods during which tidal currents are weakest • Use of silt booms or curtains to contain sediment wherever feasible
Sediment runoff	• Use of silt booms or curtains to contain sediment • Erosion and Sediment Control Plan (ESCP)
Permanent loss of habitat	• Habitat Compensation Plan (Appendix 6.8-A)
Accidental discharge and/or malfunctions	• Implementation of an EMP and EPP • Also refer to Section 8.0.
Marine Fauna including Species at Risk	
Increase in noise due to construction	• Make use of ramped warning signals • Mask noise through the use of bubble curtains, where practical • Make use of alternative techniques to pile driving such as vibratory pile driving, where practicable
Impacts from blasting activities (close to marine environment)	• Avoid the use of explosives consisting of ammonium nitrate or fuel-oil mixtures • Manage timing, location, and technical specifications of blasting operations appropriately • Establish an EMP for blasting activities • Subdivide large charges, use of blasting caps to produce a series of small discrete time-delayed detonations • Adherence to federal guidelines on blasting close to fish habitat.
Siltation	• Use of silt booms or curtains to contain sediment • ESCP
Mortalities	• Works to be completed during periods of least biological activity/sensitivity, where practicable
Permanent loss of habitat	• Habitat Compensation Plan (Appendix 6.8-A)
Accidental discharge and/or malfunctions	• Implementation of an EMP and EPP • Contingency Plan • Also refer to Section 8.0.
Marine Flora including Species at Risk	
Mortalities	• Works to be completed during periods of least biological activity/sensitivity, where practicable
Permanent loss of habitat	• Habitat Compensation Plan (Appendix 6.8-A)
Accidental discharge and/or malfunctions	• Implementation of an EMP and EPP • Contingency Plan • Also refer to Section 8.0.
Fisheries and Aquaculture	
Adverse effects of lighting on fish during construction	• No unnecessary lighting will be used • Area lighting will be angled directly at work areas and shielded where possible • Implementation of a lighting plan

Table 6.8-2: Mitigation Measures for the Marine Environment

Potential Effect	Mitigation Measures
Sediment runoff from construction and siltation	• Use of silt booms or curtains to contain sediment • ESCP
Decrease in catch due to loss of habitat in construction of terminal	• Development of an appropriate financial compensation plan for fishermen who document a demonstrated loss
Accidental discharge and/or malfunctions	• Implementation of an EMP and EPP • Contingency Plan • Also refer to Section 8.0.
Operation	
Marine Habitat	
Propeller wash from cargo vessels	• Depth is such that wash is not expected to be an issue; vessels may be docked with the assistance of tugs
Release of ballast water and/or wastewater in marine environment	• Vessels will comply with all federal guidelines for the release of ballast water
Stormwater runoff	• Implementation of a stormwater management plan • ESCP
Accidental discharge and/or malfunctions	• Implementation of an EMP and EPP • Contingency Plan • Also refer to Section 8.0.
Marine Fauna and Flora including Species at Risk	
Propeller wash from cargo vessels	• Depth is such that wash is not expected to be an issue; vessels may be docked with the assistance of tugs
Release of ballast water and wastewater in marine environment	• Vessels will comply with all federal guidelines for the release of ballast water
Increased traffic of vessels	• Follow standard vessel operating procedures
Increased noise from cargo vessels	• Follow standard vessel operating procedures • It is anticipated that fauna will habituate to the modest increase in vessel noise
Stormwater runoff	• Implementation of a stormwater management plan • ESCP
Accidental discharge and/or malfunctions	• Implementation of an EMP and EPP • Contingency Plan • Also refer to Section 8.0.
Fisheries and Aquaculture	
Loss of gear/reduced catch	• Development of a financial Compensation Plan
Interference with fishing vessels	• Follow standard vessel operating procedures • Development of a financial Compensation Plan
Increased underwater ambient noise	• Follow standard vessel operating procedures • It is anticipated that fauna will habituate to the modest increase in vessel noise
Accidental discharge and/or malfunctions	• Implementation of an EMP and EPP • Also refer to Section 8.0.

[1] Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright, D.G. and G.E. Hopky, 1998).

6.8.4.2 Decommissioning

Mitigation measures related to the decommissioning activities will need to be established in context of the Decommissioning Plan (refer to Section 2.8).

6.8.5 Monitoring

6.8.5.1 Construction and Operation

Marine Habitat

Prior to implementation of a habitat compensation project, additional physical assessment of the area will be completed to ensure that bottom conditions are appropriate. Assessment will focus on determining if the bottom will support rock clusters or other habitat improvements, and to ensure that sediment transport does not result in fines infilling the crevices in the habitat structures.

Monitoring of the habitat compensation plan will be carried out to document the success of the Project. The monitoring program will be developed in consultation with DFO.

Stormwater runoff will be monitored to ensure that the TSS concentrations meet regulatory standards.

Marine Fauna and Flora including Species at Risk

An environmental effects monitoring plan for marine fauna and flora in the waters surrounding the terminal will be implemented for the first few years of terminal operation to confirm the predictions made in this assessment.

Fisheries and Aquaculture

MITI will engage all regulatory planning processes to enhance navigation safety for all vessels, including commercial fishers. MITI will maintain an open dialogue with the local fishing industry throughout Project planning and construction and will develop a financial Compensation Plan to address demonstrated damage/loss of gear or access.

6.8.5.2 Decommissioning

Prior to the decommissioning and abandoning of the MIT facilities, MITI will develop a decommissioning plan. The plan will specify decommissioning objectives, approach, activities, schedules, and site rehabilitation and will be developed in consultation with regulatory agencies. Monitoring programs will be designed to verify the effectiveness of mitigative measures employed in the Project decommissioning phase. The details of the monitoring programs will be determined in consultation with regulatory agencies and documented in the Project EMP.

6.8.6 Residual Effects

Residual impacts refer to those environmental effects predicted to remain after the application of suggested/required mitigation measures outlined in Section 6.8.4. The predicted residual effects are considered for each phase of the wharf as per the criteria established in Section 4.0. Significance is determined based on the following criteria as specified by the CEAA:

- Magnitude (*Low, Medium,* or *High*);
- Geographic extent;
- Frequency;
- Duration; and
- Reversibility

For adverse residual effects the evaluation for the individual criteria was combined into an overall rating of significance. An adverse impact is considered “significant” where the residual effect was classified as major; while those impacts considered “not significant” had residual effects classified as medium, minor, or minimal. It is important to note that although a significant residual effect may be determined for one individual criterion within a VEC, that the overall significance of effects on the VEC as a whole may still be not significant when the relative values of the different criteria are balanced against one another.

For marine habitat, a significant adverse effect is one where the marine benthic habitat would be altered, either physically, chemically, biologically, in quality or extent, to such a degree that there is a decline in the species diversity of the habitat following the implementation of habitat compensation. This effect would be reflected by a decline in abundance and/or change in distribution of the benthic community within the Strait of Canso, beyond which natural recruitment (reproduction and migration from unaffected areas) would not return that population to its former level within several generations.

A significant adverse effect to marine fauna is defined as one that affects a population of a species or a portion thereof in such a way as to cause a decline in abundance and/or distribution beyond which natural recruitment (reproduction and in-migration from unaffected areas) would not return that population, or any populations or species dependent upon it, to its former level within several generations (i.e., the integrity of the population would be threatened).

A significant adverse effect is one where the marine flora would be lost or disturbed to such a degree that there is a decline in the species diversity of the habitat following the implementation of habitat compensation. This effect would be reflected by a decline in abundance and/or change in distribution of the flora within the Strait of Canso, beyond which natural recruitment (reproduction and migration from unaffected areas) would not return that population to its former level within several generations.

A positive effect on flora and fauna would occur if the overall abundance of a species or population is increased, or natural mortality is reduced, or the area available to a species to occupy and exploit is increased.

A significant adverse effect on fisheries is defined as a Project related, uncompensated reduction in the incomes of commercial fishers or fishing profitability as a result of effects on target marine fish populations, damage to fishing gear or vessels, or loss of access to fishing grounds. A positive effect is one that enhances incomes or profitability of commercial fisheries or aquaculture operations, or that enhances the catch levels of recreational fishers.

An adverse effect that does not meet the above criteria is evaluated as not significant.

Table 6.8-3 provides the results of the effects assessment for the marine environment VECs for construction and operation phases of the Project. Details for project decommissioning have not been developed at the present time, so effects of this phase on the marine environment cannot be determined.

Table 6.8-3: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects: Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context	Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
Construction										
Marine Habitat										
Dredging of sediments	A	• Slow ascent and descent bucket speeds to reduce chance of re-suspension • Attempt to achieve full bucket capacity • Completely empty the bucket after material is emptied and before continuing • Use of a rinse tank to remove build-up • Do not use bucket to level high spots • Do not drag the bucket on the bottom for the purposes of levelling • If necessary, limit dredging activities to periods during which tidal currents are weakest • Use of silt booms or curtains to contain sediment wherever feasible	Low	Project footprint and immediate surrounding area	Intermittent and short-term over 3 years.	R	Potential fish habitat	Not significant		
Habitat alteration from blasting activities	A	• Adhere to DFO Guidelines for the Use of Explosives in or Near Canadian Fishery Waters	Low	Project footprint and immediate surrounding area	Intermittent and short-term over 3 years.	R	Potential fish habitat	Not significant		

Table 6.8-3: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects: Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context	Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
Permanent loss of habitat	A	• Habitat Compensation Plan as required by DFO	Low	Project footprint	Permanent throughout life of the Project	R	Affected habitat type widely represented within Strait of Canso and Chedabucto Bay	Not significant		
Marine Flora and Fauna including Species at Risk										
Increase in noise due to construction	A	• Conduct work at low tide whenever feasible • Make use of ramped warning signals • Mask noise through the use of bubble curtains, where practical • Make use of alternative techniques to pile driving such as vibratory pile driving	Low	Project footprint and immediate surrounding area	Intermittent and short-term over 3 years.	R	Potential fish habitat	Not significant		
Blasting	A	• Adhere to DFO Guidelines for the Use of Explosives in or Near Canadian Fishery Waters	Low	Project footprint and immediate surrounding area	Intermittent and short-term over 3 years.	R	Potential fish habitat	Not significant		
Mortalities	A	• Works to be completed during periods of least biological activity / sensitivity, where practicable	Low	Project footprint	Short term	NR	Aquatic biota	Not significant		

FINAL REPORT

Table 6.8-3: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects: Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context	Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
Fisheries and Aquaculture										
Adverse effects of lighting on fish during construction	A	• No unnecessary lighting will be used • Area lighting will be angled directly at work areas and shielded where possible • Implementation of a lighting plan	Low	Project footprint and immediate surrounding area	Intermittent and short-term over 3 years.	R	Potential fish habitat	Not significant		
Decrease in catches	A	• Development of a financial compensation plan	Low	Strait of Canso and Chedabucto Bay	Intermittent over 3 years.	R	Affected habitat type widely represented within Strait of Canso and Chedabucto Bay	Not significant		
Operation										
Marine Habitat, Flora and Fauna, including Species at Risk										
Increased noise and propeller wash from cargo vessels	A	• Follow standard vessel operating procedures • It is anticipated that fauna will habituate to the modest increase in vessel noise • Depth is such that wash is not expected to be an issue; if it is, vessels will be docked with the assistance of tugs	Low	Shallow water areas surrounding terminal	Permanent / Average one ship per day	R	Potential fish habitat	Not significant		

FINAL REPORT

Table 6.8-3: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Release of ballast water and wastewater in marine environment	A	• Vessels will comply with all federal guidelines for the release of ballast water	Low	Strait of Canso and Chedabucto Bay	Permanent / Average one ship per day	R	Potential fish habitat	Not significant		
Stormwater runoff entering marine habitat	A	• Implementation of a stormwater management plan	Low	Water column within plume of runoff	Intermittent over operational life	R	Potential fish habitat	Not significant		
Fisheries and Aquaculture										
Loss of gear/decrease in catch	A	• Development of a financial Compensation Plan	Low	Strait of Canso and Chedabucto Bay	Permanent / Average one ship per day	R	Potential fish habitat	Not significant		

* (for Magnitude): For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 4.
** (for Likelihood of Occurrence; Level of Confidence): Only addressed for significant effect

6.8.7 References

AMEC Earth and Environmental Limited. 2003. Fish Habitat and Resource Assessment for the Proposed Marine Coal Terminal Unloading Terminal at Point Tupper, Nova Scotia.

Atlantic Leatherback Turtle Recovery Team. 2006. Recovery Strategy for Leatherback Turtle (Dermochelys coriacea) in Atlantic Canada [Proposed]. Species at Risk Act Recovery Series, DFO, Ottawa, ON.

Atlantic Whitefish Recovery Team. 2006. Recovery Strategy for Atlantic whitefish (Coregonus huntsmani) in Atlantic Canada [Proposed]. Species at Risk Act Recovery Series, DFO, Ottawa, ON.

Au, W.W.L., R.W. Floyd, R.H. Penner and A.E. Murchison. 1974. Measurement of echolocation signals of the Atlantic bottlenose dolphin, Tursiops truncatus Montagu, in open waters. J. Accout. Soc. Am. 56(4): 1280-1290.

Breeze, H., D.G. Fenton. R.J. Rutherford and M.A. Silva. 2002. The Scotian Shelf: An ecological overview for ocean planning. Can. Tech. Rep. Fish. Aquat. Sci. 2393.

Caltran Consulting. 2001. Pile Driving Demonstration Project: Marine Mammal Impact Assessment. Prepared for the California Department of Transportation, Contract No. 04-A0148.

Canadian Wildlife Services (CWS). 2004. Environmental Assessment Best Practices Guide for Wildlife at Risk in Canada. First Edition: 27 February 2004.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2002. COSEWIC assessment and update status report on the leatherback turtle (*Dermochelys coriacea*). COSEWIC, Ottawa, ON.

Committee on the Status of Endangered Wildlife in Canada (COSEWIC). 2003. COSEWIC assessment and update status report on the harbour porpoise, *Phocoena phocoena*, (Northwest Atlantic population) in Canada. Committee on the Status of Endangered Wildlife in Canada. Ottawa: 30p. http://www.sararegistry.gc.ca/status/status_e.cfm. Last accessed January, 2006.

David, J.A. 2006. Likely Sensitivity of bottlenose dolphins to pile driving noise. Water and Environment Journal. Volume 20, March 2006. ISSN 1747-6585

Environment Canada (EC). 2005. Species at Risk Act (SARA) website: http://www.speciesatrisk.gc.ca/map/default_e.cfm

Evans, W.E. 1982. Preliminary Evaluation of Perception and Detection of Man-made Noise (LNG Source) by Selected Marine Animals. Hubbs-Sea World Research Institute Technical Report No. 82-142.

Jacques Whitford, 2004. Environmental Assessment for the Proposed Bear Head LNG Terminal. Bear Head, Nova Scotia.

James, M., S.A. Sherrill-Mix, K. Martin, R.A. Myers. 2006. Canadian waters provide critical foraging habitat for leatherback sea turtles. Biol. Conserv. 133 (2006) 347-357.

Lawson, J.W., R.A. Davis, W.J. Richardson and C.I. Malme. 2000. Assessment of Noise Issues

Relevant to Key Cetacean species (Northern Bottlenose and Sperm Whales) in the Sable Gully Area of Interest. Prepared for Oceans Act Coordination Office. LGL Report TA2446-2. July 20, 2000.

Mitchell, S., 2000. St. Georges Bay Ecosystem Project (GBEP): Research Report III: A Review of Benthic Fauna/Community Studies in Atlantic Canada and Northeastern American Shallow Waters. Document prepared by the Interdiscplinary Studies in Aquatic Resources, St. Francis Xavier University, Antigonish Nova Scotia for Fisheries and Oceans Canada, Can. Manuscr. Rep. Fish Aquat. Sci. 2513, iv + 71p + Appendix.

National Marine Fisheries Service and U.S. Fish and Wildlife Service. 1991. Recovery plan for U.S. population of loggerhead turtles. National Marine Fisheries Service, Washington, DC.

Nova Scotia Department of Aquaculture and Fisheries, 2007. Aquaculture Site Mapping. Accessed October 16, 2007, http://www.gov.ns.ca/fish/aquaculture/aquamap.shtml

Nova Scotia Department of Natural Resources, 2007. Species at Risk in Nova Scotia. http://www.gov.ns.ca/natr/wildlife/endngrd/

Nova Scotia Museum of Natural History (NSMNH). 1996a. The Natural History of Nova Scotia, Vol. 2, Theme Regions. Davis, D.S. and S. Brown (editors). Nimbus/Government of Nova Scotia, Halifax, N.S.

Nova Scotia Museum of Natural History (NSMNH). 1996b. The Natural History of Nova Scotia, Vol. 1, Topics And Habitats. Davis, D.S and S. Brown (editors). Nimbus/Government of Nova Scotia, Halifax, N.S.

National Oceanographic and Atmospheric Association. 1994. Review of American lobster (Homarus americanus) habitat requirements and responses to contaminant exposures: 1-52

Pearson, W. H., Skalski, J. R., and Malme, C. I. 1992. "Effects of sounds from a geophysical survey device on behavior of captive rockfish Sebastes spp., Can. J. Fish. Aquat. Sci. 49, 1343–1356.

Sears, R. and J. Calambokidis. 2002. Update COSEWIC status report on the blue whale (Balaenoptera musculus) Atlantic population, Pacific population in Canada. Mingan Island Cetacean Study.

Shoop, R.R. and R.D. Kenney. 1992. Seasonal distributions and abundance of loggerhead and leatherback sea turtles in waters of the northeastern United States. Herpetological Monograph. 6: 43-67.

Southall, B. 2005. Shipping Noise and Marine Mammals: A Forum for Science, Management and Technology. US National Oceanographic and Atmospheric Administration.

Stewart, P.L. and L. White, 2001. A Review of Contaminants on the Scotian Shelf and in Adjacent Coastal Waters: 1970 to 1995. Canadian Technical Report of Fisheries and Aquatic Sciences 2351

Turnpenny, A.W. and J.R. Nedwell. 1994. The Effects on Marine Fish, Diving Mammals and Birds of Underwater Sounds Generated by Seismic Surveys. Reported by FAWLEY Aquatic Research Laboratory Ltd.

Tyack, P. 1982. Investigations of the potential effects of underwater noise from petroleum industry activities on migrating gray whale behavior. Rep. Alaska Miner. Manage. Serv. 1983. 399 pp.

United States (US) Fish and Wildlife Service and National Marine Fisheries Service. 1992. Recovery plan for the Kemp's ridley sea turtle, Lepidochelys kempii. National Marine Fisheries Service, St. Petersberg, FA.

Watkins, W.A. 1986. Whale reactions to human activities in Cape Cod waters. Mar. Mamm. Sci. 2(4): 251-262.

Wildish, D.J., N.J. Poole, and D.D. Kristmanson. 1977. Temporal changes of sublittoral macrofauna in L'Etang Inlet caused by sulfite pulp mill pollution. Fish. Mar. Serv. Tech. Rep. 718.

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

Personal Communications

Elaine Walker, 2007. Policy and Economics Branch, Fisheries and Oceans Canada. (902) 426-6384. Received Fisheries Landing Statistics and License Renewal Summary

Jeff Schyuler, 2007. Area Manager, Fisheries and Oceans Canada. Sherbrooke NS. (902) 522-2832. Information regarding Aboriginal and recreational fisheries.

Glyn Sharp, 2007. Marine Plants Biologist, Fisheries and Oceans Canada. (902) 426-6042. Information regarding marine plant biology and commercial harvest.

6.9 FRESHWATER ENVIRONMENT

The freshwater environment VEC includes all freshwater habitat, biota, and species at risk.

6.9.1 Boundaries

6.9.1.1 Project Boundaries

The spatial boundaries include all freshwater environments (watercourses and waterbodies) within the Logistics Park for both initial and future expansion areas. Additionally, all watercourses that will be crossed by the rail corridor, and associated downstream freshwater resources are also included. Wetland habitats are not considered in this section but are addressed separately in Section 6.11.

The temporal boundaries will include all three phases of the Project; construction, operation, and decommissioning.

6.9.1.2 Ecological Boundaries

The ecological spatial boundaries vary between species due to differences in distribution, migration patterns, and life histories of freshwater biota that utilize the habitat at various levels depending upon the organism and the specific lifecycle stage. Freshwater species inhabit freshwater environments throughout the Logistics Park and Rail Corridor area.

The ecological temporal boundaries applied in this assessment are identical with those established for the overall Project. Freshwater habitat is available year round due to diverse population assemblages and various lifecycle stages of some species. It is important to note that particularly sensitive times for fish populations include periods of migration and spawning (*e.g.*, mid May to mid July, and October to December).

6.9.1.3 Administrative and Legislative Boundaries

The most applicable administrative and legislative boundaries are discussed below. Additional information regarding provincial and federal regulatory processes is provided in Section 1.3.

Fisheries Act

Fish habitat is protected and regulated by the *Fisheries Act*, administered by DFO. The primary section of the *Fisheries Act* applicable to this proposed development is Section 35(2), which states that fish habitat cannot be harmfully altered, disrupted or destroyed (HADD). The meaning of fish habitat in this instance is any spawning, nursery, rearing, food supply and migration areas on which fish are directly or indirectly dependent for their life processes. A draft Habitat Compensation Plan has been developed (Appendix 6.8-A) and an application for a HADD authorization will be submitted to DFO.

Further, in order to alter fish habitat or divert watercourses in Nova Scotia, an application is to be submitted to NSE for approval. In coordination with DFO, the application is reviewed and a decision is made as to whether the project can or cannot proceed. Should permission to proceed be granted, conditions of approval will be set which will include habitat compensation requirements. The protection of salmonid habitat is currently a priority for regulators in the province of Nova Scotia and the proponent must be able to demonstrate that all reasonable efforts have been made to avoid habitat destruction through avoidance and/or redesign.

Species at Risk Act and *Endangered Species Act*

With respect to Species at Risk (SAR), the federal *Species at Risk Act* (SARA*)* protects rare or endangered species. This Act applies to all federal lands in Canada, to all wildlife species listed as being at risk, and to their critical habitat. The objective of the Act is to prevent wildlife species from becoming extinct, to provide for their recovery, and to support an ongoing process of monitoring, assessment, response, recovery, and evaluation to be undertaken to improve the species status and ecosystem. DFO is responsible for aquatic species at risk.

On provincial land, SARA is intended to complement existing laws and agreements to provide for the legal protection of wildlife species and conservation of biological diversity. The Province of Nova Scotia provides species protection through its *Endangered Species Act* (ESA). Species listed provincially may or may not correspond to species listed under SARA; however, there is a reciprocity agreement built into SARA such that those species at risk identified by each province will be protected on federal land in the province in which it is listed.

Navigable Waters Protection Act (NWPA) and *Nova Scotia Environment Act*

The Federal government has authority to protect the public right of navigation in navigable waters. This is accomplished pursuant to the NWPA, R.S.C. 1985, c. N-22 and is administered by Transport Canada. Watercourses to be re-routed or crossed by transportation infrastructure will be submitted to Transport Canada for a determination of navigability under Section 5(1) of the NWPA.

Approvals under the Provincial *Environment Act* and Regulations may also apply for any work conducted in or around watercourses.

Canadian Environmental Protection Act

The *Canadian Environmental Protection Act* (CEPA) is the primary component of a group of inter-related laws, policies and institutions which, taken together, give all Canadians a shared responsibility in protecting the Canadian environment. The key purpose of the Act is the prevention and management of risks posed by toxic and other harmful substances. In addition, the Act manages the impacts on health and the environment of the products of biotechnology, marine pollution, disposal at sea, fuels, emissions from vehicles, engines and equipment, hazardous wastes, environmental emergencies and other sources of pollution.

6.9.1.4 Technical Boundaries

The technical boundaries include information from desktop studies and existing literature and discussions with government officials, federal and provincial.

In addition to this, field survey data collected during the 2007-2008 field season was also used.

6.9.2 Threshold for Determination of Significance

A significant adverse effect from the Logistics Park and Rail Corridor on the freshwater environment and biota is defined as one that is likely to cause any one of the following:

- adverse changes to critical habitats;
- further impairment of the ecological functioning of the biotic community;
- mortality or serious injury to species at risk (SAR);

- a reduction in the abundance of one or more non-listed species from the existing level from which recovery of the population is uncertain, or more than one season would be required for a locally depleted population or altered community to be restored to pre-event conditions; and
- increased ecological risk to a level that long term effects to the health of aquatic biota is predicted.

6.9.3 Effects on the Freshwater Environment

6.9.3.1 Effects of Construction

A detailed description of the construction activities is provided in Section 2.0.

Construction Envelope

Within the development borders of the Logistics Park, designated temporary material storage and lay-down areas will be established, as well as for the rail ROW as required.

There is a potential for runoff and erosion from both these areas to affect the quality of freshwater aquatic habitat within and downstream of the sites. Increased siltation and turbidity will decrease freshwater quality and could lead to losses of biota from suffocation. Furthermore, run-off and erosion can also impact the freshwater environment through possible acid rock drainage (ARD) from the exposure of acidic rocks or their temporary storage as fill material on the lay-down areas.

Site Preparation, Clearing, Grubbing

Site clearing and grading will take place within the demarcated development envelope and along the Rail Corridor in a similar fashion. The main watercourse exiting Reeves Lake will be rerouted along the rail corridor within the Logistics Park.

There is a potential for runoff and erosion to affect the quality of freshwater aquatic habitat within and downstream of the work areas. Increased siltation and turbidity will decrease freshwater quality and could lead to losses of biota from suffocation. Run-off and erosion can also impact the freshwater environment through possible ARD from exposed rock.

On-shore Cut and Fill, Blasting

Cut and fill work, including blasting, will be required for levelling the Logistics Park site and for establishing the Rail Corridor. The changes in topography on the Logistics Park site from grading will result in permanent losses of aquatic habitat and subsequent displacement and/or loss of aquatic biota. In addition, non-permanent impacts related to modification of aquatic habitat, and changes to drainage patterns from watercourse rerouting, will also occur. Relative amounts of infiltration and runoff on the Logistics Park footprint will change, and could result in deleterious effects to downstream aquatic habitat.

There is a potential for erosion as a result of this activity that could affect the quality of freshwater aquatic habitat within and downstream of the work areas. Increased siltation and turbidity will decrease freshwater quality and could lead to losses of biota from suffocation. Run-off and erosion can also impact the freshwater environment through possible acid rock drainage (ARD) from exposed rock.

The detonation of explosives in the vicinity of fish habitat may cause fish mortality, and may potentially affect the physical characteristics of fish habitat. The use of explosives may also result in the introduction of ammonia and other detonation by-products into the aquatic environment. These contaminants can be lethal to fish and other aquatic biota (Wright and Hopky 1998).

Three (3) watercourses within the Logistics Park footprint will be permanently lost, but will be rerouted to maintain connectivity between headwaters and discharge to the Strait (Figure 2.5-8). This could result in displacement and/or loss of aquatic biota, although it is anticipated that recolonization of the rerouted watercourses will take place over time.

Foundations

Following grading, excavations and levelling, the foundations of buildings and major equipment will be constructed including all underground services and the stormwater management system. Roads will be established in and around the complex.

There is a potential for erosion as a result of these activities that could affect the quality of freshwater aquatic habitat within and downstream of the work areas. Increased siltation and turbidity will decrease freshwater quality and could lead to losses of biota from suffocation. Run-off and erosion can also impact the freshwater environment through possible ARD from exposed rock.

Buildings, Utilities, Equipment

All buildings associated with the Logistics Park and intermodal rail yard will be built as per the detailed engineering designs. Utilities such as water supply and wastewater treatment units will be constructed for these buildings.

No adverse effects on freshwater environments are expected during this phase of construction.

Transportation of Construction Material

During the construction period, equipment and materials will be delivered by road, rail, and ship. Initially, materials and equipment will be transported to the Project Site by truck via Highway 344 until completion of the rail access, which can then be utilized.

Day-to-day transportation operations during construction activities are not anticipated to have an adverse effect on freshwater aquatic habitat. However, there is a possibility of accidental discharge into watercourses as a result of accidents or malfunctions. Such an incident could have a significant effect on freshwater biota at, and downstream of, the accident site (Section 8).

Management of Surface Water (stream diversions, stream crossings)

The changes in topography on the Logistics Park site will result in permanent losses of freshwater aquatic habitat and therefore permanent changes to drainage, and diversion of run off on and from the site (Figure 2.5-1). As well, the relative amounts of infiltration and runoff on the Logistics Park footprint will change.

The Rail Corridor will cross a number of watercourses at various locations. There is a potential for erosion as a result of this activity that could affect the quality of freshwater aquatic habitat within and downstream of the work areas. Increased siltation and turbidity will decrease freshwater quality and could lead to losses of biota from suffocation. Run-off and erosion can also impact the freshwater environment through possible ARD from exposed rock. These activities could thus result in displacement of and/or loss of aquatic biota.

Management of Wastewater

A variety of liquid wastes will be generated during construction, including oils and lubricants from equipment, and wastewater (i.e., runoff, sewage). Discharge of these waste liquids into watercourses, either purposefully or due to accidents or malfunctions, will have a deleterious effect on freshwater aquatic habitat and biota.

Management of Contaminated Soils

In general, the Project Site overall is considered to have a low risk of contaminated soils as it is and has been largely undeveloped. However, there is potential for the discharge of pollutants to freshwater aquatic habitat from contaminated soil and/or highly acidic or alkaline soils.

Site Rehabilitation at Temporarily Used Sites

Upon termination of the use of temporary sites such as lay-down areas and construction camps, all surface structures will be dismantled and removed from the Site.

There is potential for deleterious effects on freshwater aquatic habitat resulting from improper disposal of waste material. Additionally, there is a potential for erosion as a result of this activity that could affect the quality of freshwater aquatic habitat within and downstream of the work areas. Increased siltation and turbidity will decrease freshwater quality and could lead to losses of biota from suffocation. Run-off and erosion can also impact the freshwater environment through possible ARD from exposed rock.

6.9.3.2 Effects of Operation

Logistics Park Footprint

The aforementioned effects of construction will result in loss of watercourses within the footprint of the Logistics Park, due to diversion of those watercourses around the Park and the Terminal facility. Therefore any impacts from Operations to the aquatic freshwater environment will be to downstream areas outside the borders of the Park.

Discharge of treated water and surface run-off over land could have a potentially deleterious effect on freshwater aquatic habitat through contamination, erosion, increased turbidity, and siltation of downstream freshwater aquatic habitat that will decrease freshwater quality and could lead to losses of biota from suffocation. Run-off and erosion can also impact the freshwater environment through possible ARD.

Day-to-day transportation operations within the Park are not anticipated to have an adverse effect on freshwater aquatic habitat. However, there is a possibility of accidental discharge into watercourses as a result of accidents or malfunctions. Such an incident could have a significant effect on freshwater biota at, and downstream of, the accident site (Section 8).

Rail Corridor

During this phase, many materials will be delivered by rail. Day-to-day transportation operations are not anticipated to have an adverse effect on the freshwater environment. However, there is a possibility of accidental discharge into watercourses as a result of accidents or malfunctions. Such an incident could have a significant effect on freshwater biota at, and downstream of, the accident site (Section 8).

6.9.3.3 Effects of Decommissioning

Effects associated with the decommissioning phase are expected to involve generally similar issues as those identified for the construction phase. The principal approach to decommissioning is outlined in Section 2.8. The specific effects on the freshwater aquatic environment will very much depend on the extent of the decommissioning. Of key importance would be the question whether or not site including the logistics park would be rehabilitated to pre-development conditions. It is more likely that the key elements of the infrastructure (roads, water supply, stormwater management) will remain in place for subsequent land uses. However, should the site be completely rehabilitated, it would provide an opportunity for beneficial effects through re-construction of natural water courses. Any in-water works and works near existing water courses would need to be conducted with the necessary mitigation measures to avoid and reduce temporary effects related to sediment loadings and potential accidental contamination (e.g., fuel spills). As stated in Section 2.8, the decommissioning objectives and approach would be discussed with all relevant stakeholders and would need to be implemented in compliance with the regulatory standards applicable at that time.

6.9.4 Mitigation

Mitigation measures developed for the construction and operation phases are summarized in Table 6.9-1 and, where noted, are discussed further in Section 6.9.4.1.

Although potential impacts related to the decommissioning phase of the project have not been included a general mitigative measure would involve the development of a decommissioning plan, in consultation with the municipality and regulatory agencies, which will specify decommissioning objectives, approach, activities, schedules, and site rehabilitation.

Construction/Operation

The construction of the Logistics Park and related works will result in the permanent loss of freshwater habitat. The *Fisheries Act* and relevant policies of the DFO require that MITI compensate for these losses/alterations to the satisfaction of DFO and with the objective of achieving “no net loss” of fish habitat. A draft Habitat Compensation Plan (Appendix 6.8-A) has been developed as a mitigative measure and as part of an Application to DFO for Authorization. The loss of freshwater habitat, while not considered critical or limiting habitat for any of the species identified as being in the area, is considered to be potentially significant. The implementation of measures outlined in the Habitat Compensation Plan will offset any such losses.

To reduce/eliminate any negative effects associated with potential spills, erosion and sedimentation during project construction, an Environmental Management Plan (EMP) will be implemented. Erosion and sedimentation control measures will be developed on the basis of the Erosion and Sedimentation Control Handbook (NSDEL 1988). These measures will have to be designed on a site specific basis and will have to address surface stabilization (e.g., buffer strips, temporary matting, riprap lining) drainage control (e.g., diversion ditches, check dams, straw barriers, siltation ponds. Also, a contingency plan will be implemented for spill response and clean-up in the event of an accidental spill involving hazardous substances. Refuelling and maintenance activities for mobile equipment will be restricted to designated locations. These refuelling locations will be established away from open water (30 m vegetated corridor as well as a 100 m distance between fuelling stations and any open water course/wetland) and will be designed with some level of containment such as a concrete pad, or other types of low permeability cover to restrict infiltration. For equipment that must be refuelled away from the designated refuelling stations, the locations below the fuel tank and nozzle will require temporary protection by the placement of absorbent spill pads or other temporary low permeable liner and collection system. The emergency response plan/spill response plan will specify that accidental spills or leaks of petroleum products or other deleterious substances from the vehicles, equipment and storage containers need to be immediately contained and cleaned up in accordance with regulatory requirements. Hazardous waste including containers for petroleum hydrocarbon will be collected and disposed off-site at a licensed facility and in accordance with current guidelines.

Table 6.9-1: Mitigation Measures for the Freshwater Environment

Potential Effect	Mitigation Measures
Construction Phase	
• Impacts from run-off and erosion; and • Siltation and turbidity of surface waters and potential loss of biota	Use of suitable backfill materials
	Restrictions on the removal of riparian vegetation
	Establish a buffer zone of 20m around freshwater habitat
	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan
	Erosion and sediment control measures will be implemented as described in an EMP. Measures will be specified in site-specific erosion and sediment control plans (temporary storm water detention, sedimentation ponds, open swale systems for drainage)
• Acid rock drainage erosion to surface waters	Perform pre-construction surveys and inspect excavations regularly
	Obtain samples and develop a management plan if required (refer to Section 6.9.4.1)
	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan
	Remediate contaminated soil promptly (if contaminated soils cannot be treated on site, dispose soils off-site at a licensed hazardous waste hauler)
	Erosion and sediment control measures will be implemented as described in an EMP. Measures will be specified in site-specific erosion and sediment control plans (temporary storm water detention, sedimentation ponds, open swale systems for drainage)
• Permanent alteration of drainage patterns	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan
• Non-permanent impacts from modification of freshwater habitat	Conduct in-water works during non-critical periods
	Establish a buffer zone of 20m around freshwater habitat
	Restrictions on the removal of riparian vegetation

Table 6.9-1: Mitigation Measures for the Freshwater Environment

Potential Effect	Mitigation Measures
	Erosion and sediment control measures will be implemented as described in an EMP. Measures will be specified in site-specific erosion and sediment control plans (temporary storm water detention, sedimentation ponds, open swale systems for drainage)
• Impacts from blasting activities (within or close to freshwater environments)	Manage timing, location, and technical specifications of blasting operations appropriately
	Avoidance of ammonium nitrate and fuel-oil mixtures
	Establish an EMP for blasting activities
	Subdivide large charges , use blasting caps to produce a series of small discrete time-delayed detonations, where practical
	Implementation and compliance with appropriate setback distances from fish and spawning habitat according to substrate types
	Deployment of bubble/air curtains as appropriate to disrupt shock waves
	Complete works during periods of least biological activity/sensitivity, where practicable
	Removal or exclusion of fish from work area prior to blasting
	Adherence to federal guidelines on blasting[1]
• Permanent alteration/damage/destruction to aquatic habitat (HADD)	Habitat Compensation Plan (refer to Section 6.9.4.1)
• Displacement or loss of aquatic biota	Restore substrates
	Complete works during periods of least biological activity/sensitivity
	Prior removal or exclusion of fish from work area
• Impacts related to water crossings	Conduct in-water works during non-critical periods
	Adherence to federal and provincial guidelines on watercourse crossings (refer to Section 6.9.4.1)
	Establish a buffer zone of 20m around freshwater habitat
	Restrictions on the removal of riparian vegetation
	Erosion and sediment control measures will be implemented as described in an EMP. Measures will be specified in site-specific erosion and sediment control plans (temporary storm water detention, sedimentation ponds, open swale systems for drainage)
• Impacts related to wastewater	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan
	Utilization of mobile sanitary wastewater treatment units approved under relevant regulations and guidelines to treat sanitary wastewater on-site, or holding tanks for sanitary waste management (determined following the Front End Engineering and Design (FEED) assessment)
• Impacts related to contaminated soils	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan
	Remediate contaminated soil promptly (if contaminated soils cannot be treated on site, dispose soils off-site at a licensed hazardous waste hauler)
• Impacts related to the improper disposal of waste materials	Excess construction materials will not be deposited in any watercourse/waterbody or anywhere where they could be reintroduced into the aquatic environment

Table 6.9-1: Mitigation Measures for the Freshwater Environment

Potential Effect	Mitigation Measures
	Collect hazardous waste for disposal in accordance with an established waste management plan
	Oil-water separation and sediment retention, and settling structures will be designed according to Canadian environmental regulation standards
• Accidental discharges and/or malfunctions	Provisions for spill control outlined in a Contingency Plan
	All fuelling and maintenance of construction equipment to be completed away from watercourses/waterbodies
	All on-site fuels, oils, and chemicals stored >50m from freshwater environments
	Storm water management system
	Spill prevention and clean-up equipment and plans
	Train all staff in the handling, storage, and disposal of hazardous materials
	Store chemicals and other hazardous substances in designated locations and in accordance with the manufacturers' recommendations and federal and provincial regulations, where applicable
	Utilization of an EPP/EMP prepared specifically for this phase that will prescribe of environmental management measures, mitigation, spill prevention protocols, contingency measures, responsibilities, supervision, and reporting requirements/measures
Operations Phase	
• Contamination, erosion, turbidity, and siltation of the freshwater environment from discharge of water and/or surface water run-off	Use of suitable backfill materials
	Line ditches with vegetation for erosion protection and sediment removal
	Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan
	Restrict removal of riparian vegetation alongside banks and ditches of watercourses
	Oil-water separation and sediment retention, and settling structures will be designed according to Canadian environmental regulation standards
	Erosion and sediment control measures will be implemented as described in an EMP. Measures will be specified in site-specific erosion and sediment control plans (temporary storm water detention, sedimentation ponds, open swale systems for drainage)
• Accidental discharges and/or malfunctions	See above under construction

[1] Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright, D.G. and G.E. Hopky, 1998).

6.9.4.1 Discussion of Mitigative Measures

Acid Rock Drainage (ARD)

The Site bedrock belongs to the Mabou group which, based on available information, has low potential for ARD. Nonetheless, as a precaution, prior to construction, samples from rock excavation areas will be tested for acid generating potential. If acid generating rock is determined to exceed the 500 m^3 regulatory volume, a management plan for the rock will be developed for approval by NSE. The plan will consider the suitability of isolating the area through in-fill or berms; stabilization; and excavation and disposal at a facility approved to accept material.

Habitat Compensation Plan

Construction of the Logistics Park and the rail access will result in the alteration due to rerouting, and some possible loss of at least four (4) watercourses, along with the associated habitats and fish communities. Reeves Lake will be affected in that the construction of the rail track will disconnect it from it's natural downstream receivers. These losses are addressed in the draft Habitat Compensation Plan (Appendix 6.8-A) submitted to DFO as part of the Application for Authorization. Discussions related to the development of the plan and compensation options will follow additional habitat studies, planned for summer 2008, to determine the amount/extent of freshwater habitat that will be lost.

Water Crossings

Large diameter box culverts will be utilized for all watercourse crossings along the Right of Way for the Rail Corridor. These culverts will be bank to bank with open bottoms, so as not to affect fish habitat in any way.

6.9.5 Monitoring

6.9.5.1 Construction and Operation

Guidelines published by the CCME (2007) for the protection of aquatic life, recommend the following for total suspended sediments (TSS) concentration for surface waters:

> *Clear flow: Maximum increase of 25 mg/L from background levels for any short-term exposure (e.g., 24-h period). Maximum average increase of 5 mg/L from background levels for longer term exposures (e.g., inputs lasting between 24 h and 30 d)* and;
>
> *High flow: Maximum increase of 25 mg/L from background levels at any time when background levels are between 25 and 250 mg/L. Should not increase more than 10% of background levels when background is >250 mg/L.*

Surface water quality will be monitored throughout the construction phase and also during initial years of operation.

Environmental management features for the Project include monitoring and maintenance programs such as Environmental Effects Monitoring (EEM) and Environmental Compliance Monitoring (ECM). These environmental management features will be refined and expanded on throughout the Project design. The EMP includes EEM for surface water quality, fish and fish habitat including the habitat compensation plan, and monitoring of the new diversion channels for stability and functioning. ECM for effluent quality and quantity will be undertaken; the Project surface water management systems and water treatment facilities will be designed to include controlled outlet structures with monitoring points.

Monitoring programs outlined above will be designed to verify the effectiveness of the mitigative measures. The details of the monitoring programs will be determined in consultation with regulatory agencies and documented in the EMP.

6.9.5.2 Decommissioning

Prior to the decommissioning and abandoning of the MIT facilities, MITI will develop a decommissioning plan. The plan will specify decommissioning objectives, approach, activities, schedules, and site rehabilitation and will be developed in consultation with regulatory agencies. Monitoring programs outlined above will be designed to verify the effectiveness of mitigative measures employed in the Project decommissioning phase. The details of the monitoring programs will be determined in consultation with regulatory agencies and documented in the Project EMP.

6.9.6 Residual Effects

Residual impacts refer to those environmental effects predicted to remain after the application of suggested/required mitigation measures outlined in Section 6.9.4. The predicted residual effects are considered for each phase for the Logistics Parks and Rail Corridor as per the criteria established in Section 4.0. Significance is determined based on the following criteria as specified by the CEAA:

- Magnitude (*Low, Medium,* or *High*);
- Geographic extent;
- Frequency;
- Duration; and
- Reversibility

For adverse residual effects the evaluation for the individual criteria was combined into an overall rating of significance. An adverse impact is considered “significant” where the residual effect was classified as major; while those impacts considered “not significant” had residual effects classified as medium, minor, or minimal. It is important to note that although a significant residual effect may be determined for one individual criterion within a VEC, that the overall significance of effects on the VEC as a whole may still be not significant when the relative values of the different criteria are balanced against one another.

Table 6.9-2 provides the results of the effects assessment for the freshwater environmental habitat VEC for construction and operation phases of the Project. Effects associated with the decommissioning phase are expected to involve similar issues as those discussed for the construction phase.

Table 6.9-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Construction										
Potential run-off and erosion, siltation and turbidity	A	• Use of suitable backfill materials • Restrictions on the removal of riparian vegetation • Establish a buffer zone of 20m around freshwater habitat • Management of storm water quantity and quality to relevant provincial standards • Storm water will be collected and treated in a storm water facility prior to discharge into the Strait • Establish and implement EMP including erosion and sediment control plan	Low	Logistics Park and Rail Corridor	Construction Phase - entire	R	Decreased water quality and potential mortality of aquatic biota without protective status; Site designated and approved industrial reserve	Not significant		
Impacts from Acid Rock Drainage	A	• Precautionary pre-construction surveys, • If required, develop a management plan with NSE • Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan • Establish and implement EMP including erosion and sediment control plan	Low	Logistics Park and Rail Corridor	Construction phase - entire	R	Potential contamination of freshwater habitat without protective status; Site designated and approved industrial reserve	Not significant		

FINAL REPORT

Table 6.9-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Alteration of drainage patterns and infiltration/runoff	A	• Management of storm water quantity and quality to relevant provincial standards • Storm water will be collected and treated in a storm water facility prior to discharge into the Strait , as per a stormwater management plan	Low	Logistics Park	Permanent	NR	Permanent loss of freshwater habitat without protective status; Site designated and approved industrial reserve	Not significant		
Non-permanent impacts related to habitat modifications	A	• Conduct in-water works during non-critical periods • Establish a buffer zone of 20m around freshwater habitat • Restrictions on the removal of riparian vegetation • Establish and implement EMP including erosion and sediment control plan	Low	Logistics Park	Construction phase	R	Impacts to freshwater habitat without protective status; Site designated and approved industrial reserve	Not significant		

Table 6.9-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Damage to fish and fish habitat from blasting activities	A	• Include provisions for blasting in EMP • Adhere to Guidelines for the Use of Explosives in or Near Canadian Fishery Waters[1] • Manage timing, location, and technical specifications of blasting operations appropriately, and conduct pre-blast surveys • Avoid ammonium nitrate and fuel-oil mixtures • Use of blasting caps to produce a series of small discrete time-delayed detonations; subdivide large charges • Implementation and compliance with appropriate setback distances from fish and spawning habitat according to substrate types • Deploy noise generating devices to deter fish from blasting site • Complete works during periods of least biological activity/sensitivity • Removal or exclusion of fish from work area prior to blasting	Low	Logistics Park	Short term - infrequent	R	Potential impacts and/or loss of habitat and biota without protective status; Site designated and approved industrial reserve	Not significant		
Displacement or loss of aquatic biota; permanent alteration/ damage/ destruction to aquatic habitat	A	• Habitat Compensation Plan • Restore substrates • Complete works during periods of least biological activity/sensitivity • Prior removal or exclusion of fish	Medium ($\geq$ 4 watercourses and 1 water-body)	Logistics Park and Rail Corridor	Permanent	NR	Permanent loss of habitat and aquatic biota without protective status;	Not significant		

Table 6.9-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects: Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context	Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
		from work area • Conduct in-water works during non-critical periods • Fish salvage/removal program					Site designated and approved industrial reserve			
Watercourse crossings	A	• Conduct in-water works during non-critical periods • Adherence to federal and provincial guidelines on watercourse crossings (refer to Section 6.9.4.1) • Establish a buffer zone of 20m around freshwater habitat • Restrictions on the removal of riparian vegetation • Establish and implement EMP including erosion and sediment control plan	Low	Rail Corridor including downstream areas	Construction phase	R	Impacts to freshwater habitat/biota without protective status; Site designated and approved industrial reserve	Not significant		
Impacts from wastewater	A	• Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan • Utilization of mobile sanitary wastewater treatment units approved under relevant regulations and guidelines	Low	Logistics Park and Rail Corridor including downstream areas	Construction phase	R	Impacts to freshwater habitat/biota without protective status; Site designated and approved industrial reserve; Site designated and approved industrial reserve	Not significant		

Table 6.9-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Impacts related to contaminated soils	A	• Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan • Remediate contaminated soil promptly (if contaminated soils cannot be treated on site, dispose soils off-site at a licensed hazardous waste hauler) • Spill Control Plan and Contingency Plan	Low	Logistics Park and Rail Corridor including downstream areas	Construction phase	R	Impacts to freshwater habitat/biota without protective status; Site designated and approved industrial reserve	Not significant		
Impacts related to improper disposal of waste materials	A	• Excess construction materials will not be deposited in any watercourse/water body, or anywhere they could be introduced into the aquatic environment • Collect hazardous waste for disposal in accordance with an established waste management plan • Oil-water separation and stormwater management system will be designed according to Canadian environmental regulation standards	Low	Logistics Park and Rail Corridor	Construction phase	R	Impacts to freshwater habitat/biota without protective status; Site designated and approved industrial reserve	Not significant		

Table 6.9-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Accidents and malfunctions		• Provisions for spill control • Develop and implement Contingency Plan • All on-site fuels, oils, and chemicals stored >50m from freshwater environments • Storm water management system • Spill prevention and clean-up equipment and plans • Train all staff in the handling, storage, and disposal of hazardous materials • Store chemicals and other hazardous substances in designated locations and in accordance with the manufacturers' recommendations and federal and provincial regulations, where applicable • Utilization of an EMP prepared specifically for this phase that will prescribe of environmental management measures, mitigation, spill prevention protocols, contingency measures, responsibilities, supervision, and reporting requirements/measures	Depends on nature of spill	Logistics Park and Rail Corridor including downstream areas	Short term, infrequent	R	Impacts to freshwater habitat/biota without protective status; Site designated and approved industrial reserve	Not significant		

FINAL REPORT

Table 6.9-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Operation										
Contamination, erosion, turbidity, and siltation of the freshwater environment from discharge of water and/or surface water run-off	A	• Erosion and Sediment Control Plan • Stormwater will be collected and treated to relevant provincial standards in a storm water facility prior to discharge into the Strait, as per a Stormwater Management Plan • Oil-water separation and a stormwater management system will be designed according to Canadian environmental regulation standards	Low	Logistics Park and Rail Corridor including downstream areas	Infrequent	R	Impacts to freshwater habitat/biota without protective status; Site designated and approved industrial reserve	Not significant		

Table 6.9-2: Summary of Mitigation and Significance of Residual Effects

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Environmental Effects					Significance of Residual Effect	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Accidental discharge and/or malfunctions	A	• Provisions for spill control • Development and implementation of EMP and Contingency Plan • All on-site fuels, oils, and chemicals stored >50m from freshwater environments • Storm water management system • Spill prevention and clean-up equipment and plans • Train all staff in the handling, storage, and disposal of hazardous materials • Store chemicals and other hazardous substances in designated locations and in accordance with the manufacturers' recommendations and federal and provincial regulations, where applicable	Depends on nature of spill	Logistics Park and Rail Corridor including downstream areas	Short term, infrequent	R	Impacts to freshwater habitat/biota without protective status	Not significant		

* (for Magnitude): For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 4.
** (for Likelihood of Occurrence; Level of Confidence): Only addressed for significant effects

6.9.7 References

CCME (Canadian Council of Ministers of the Environment), 2007. Canadian Water Quality Guidelines for the Protection of Aquatic Life. Update #7, September 2007. http://www.ccme.ca/assets/pdf/aql_summary_7.1_en.pdf.

NSEL (Nova Scotia Department of Environment and Labour). 1988. Erosion and Sedimentation Control Handbook for Construction Sites. NS Department of the Environment. Environmental Assessment Division.

6.10 TERRESTRIAL ENVIRONMENT EFFECTS ASSESSMENT

This section discusses the potential impacts of the proposed Project on the terrestrial environment, including all terrestrial habitat, biota (including birds), and SAR.

6.10.1 Boundaries

6.10.1.1 Project Boundaries

The spatial Project Boundaries include the footprint of the proposed Terminal and Logistics Park, as well as the footprint of the associated rail and transmission corridor. Temporal project boundaries are concurrent with the Project schedule (Section 2.3).

6.10.1.2 Ecological Boundaries

The spatial ecological boundaries include all undeveloped environments within the footprint of the proposed Terminal and Logistics Park and the rail and transmission corridors. Also included are all undeveloped environments within 500 m of the Project Site. This buffer is considered to be the maximum extent to which noticeable effects on habitat, vegetation, birds, wildlife and species at risk can be reasonably expected as a result of Project components and activities.

Temporal ecological boundaries encompass the entire year since interactions between vegetation/habitat and project components or activities can occur year round. This applies to every year of all phases of the Project. Habitat is at the basis of the population health of most terrestrial wildlife. However, habitat is particularly important during breeding season. For birds, migration seasons are also of particular concern. Most bird species, including passerines and raptors, breed in late spring and early summer (May-Aug). Owls breed earlier in the season from late winter to early spring (Feb-May). Most other wildlife breed in spring and summer.

6.10.1.3 Administrative Boundaries

The Federal *Wildlife Act* and the *Migratory Birds Convention Act* (MBCA) are important regulatory mechanisms to protect birds. The NSDNR administers the *Nova Scotia Wildlife Act* which provides mechanisms for the preservation of wildlife species diversity and abundance, including migratory birds. Further protection of migratory birds is also provided by the federal *Canadian Wildlife Act* which is administered by Environment Canada. The Nova Scotia *Endangered Species Act* (NSESA) and the federal *Species at Risk Act* (SARA) offer legal protection to some rare species that have been proclaimed as endangered, rare or vulnerable under the Acts.

6.10.1.4 Technical Boundaries

No technical boundaries concerning terrestrial vegetation and wildlife habitat have been identified. Plant, bird and habitat surveys (including wetlands) have been carried out during summer and early fall of 2007 within the Study area, which encompasses the Project footprint as well as 200-500 m of either side of the transmission and new rail corridor and the areas immediately adjacent to the existing rail bed. Surveys of terrestrial habitat in these areas were carried out in select, representative parcels, covering all forest types. The information collected provides adequate information for the effects assessment, as all habitat types were surveyed and provincial habitat mapping exists (see Section 5.10). To further strengthen and supplement the baseline data, additional field surveys (breeding birds, rare species, wetlands) are undertaken by the proponent for the transmission and rail corridor during the early and late summer season of 2008. MITI will issue this information in a technical report upon completion of the surveys. The effects assessment on owls and Odonates relies on an evaluation of Project-related effects on suitable habitat.

6.10.2 Threshold for Determination of Significance

A significant adverse effect of Project components or activities on vegetation, habitat and wildlife is defined as an effect that causes a decline in abundance and/ or a change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return the population to its pre project level within several generations. A significant adverse effect on sensitive/ critical wildlife habitat is defined as an adverse effect that causes a net loss of habitat function.

An adverse effect that does not cause such declines or changes is not considered to be significant.

A positive effect occurs when Project Activities help increase abundance or diversity of species or enhances habitat.

6.10.3 Effects on the Environment

The effects of project activities during the construction and the decommissioning phase are similar, as are proposed mitigation measures. Therefore, both phases will be evaluated together.

6.10.3.1 Construction Phase

Construction activities, such as clearing, grubbing and blasting, associated with the project could interact with wildlife and bird species. During construction, potential effects include habitat loss, habitat fragmentation, creation of edge habitat, noise and related disturbance, and accidental spills.

Habitat loss within the footprint of MIT will amount to a total of about 217 ha (about 77 ha for the terminal and intermodal yard plus about 140 ha for the logistics park). For the purpose of this EIS, it is assumed that all habitat within the footprint will be permanently lost. Nevertheless, the final development will likely integrate some habitat (e.g., part of the existing wetlands and water courses) as elements of the stormwater management system. Other habitat may be converted to amenity green space (ornamental plantings and turf).

Within the footprint of the marine terminal and the logistics park, the affected habitats consist of areas used for human habitation, as well as land covered with early stages of regenerating vegetation after agricultural or other uses. It will be replaced mostly with paved surfaces and buildings. As mentioned above, a small percentage of the cleared area will be converted to green open space such as amenity green and for stormwater management system.

In the rail corridor, it is estimated that the permanent vegetation loss may amount to about 25 ha. This relates to the 25 km of new rail development. The re-activation of the existing railbed (about 10km) is not expected to cause any notable habitat loss. Approximately 45 ha is likely to be lost temporarily as it relates to the clearing of the Right-of-Way (ROW) beyond the actual rail bed. While the ROW will generally be re-vegetated, for safety purposes, the vegetation will not consist of trees and tall shrubs. The clearing therefore, will effectively result in habitat alteration.

The new transmission corridor will result in the alteration of habitat over a distance of about 20km and a ROW width of 51m (see Section 2.4.7), i.e., a total of 102 ha. It is of note that about 70 % (14 km) of the new transmission line ROW will run adjacent to the proposed new rail ROW (Section 1.0, Figure 1.1-1).

Effects of Habitat Loss and Alteration

Clearing and grubbing will result in permanent loss of habitat for wildlife species, including shorebirds, waterfowl, raptors, passerines, breeding birds, mammals, reptiles, herpetiles and possibly species at risk. Efforts will be made during detailed project design to minimize the overall area to be cleared.

<u>Effects of Habitat Loss and Alteration on Bird Species</u>
Habitat removal may force some species currently inhabiting the project area to move to similar habitats elsewhere. Successful survival may depend on the number of individuals of the same or closely related species already in those habitats. Most individuals that move into others species' territories often do not survive; however, these individual mortalities are generally not a conservation concern at the population level (NSDNR 2008).

Habitat loss is of particular concern to owls however, which require trees with a diameter of 15 cm or more (C. Stevens, personal communication). However, this tree size is common in the forest habitat surrounding the Project. Loss of owl populations in the area therefore, is not a likely effect of the habitat removal.

Should vegetation removal take place during the bird breeding season, reproduction activities could be disrupted and the reproductive success of an entire season jeopardized.

Within the footprint of the Project site (marine terminal and logistics park), habitat removal and site development is expected to lead to an increase in birds that are especially compatible with human activity; i.e. starlings, robins, grackles, cowbirds, rock doves, some of which are nest predators and may otherwise compete with woodland and edge birds.

Alteration of coastal habitat within the terminal footprint will result in loss of shorebird foraging, roosting and potential breeding habitat. This effect is not considered significant as the area to be developed is considered small and of poor quality for shorebird habitat.

Since the area to be cleared contains no significant habitats, and similar habitat exists in adjacent areas, birds can be expected to move to unaltered habitats in the surrounding area. Therefore, the likelihood for significant adverse effects on birds is considered low.

<u>Effects of Habitat Loss and Alteration on Vegetation</u>
The construction activities will result in loss of availability of terrestrial and wetland habitat, as well as mortality of the plants in the area affected. Also, clearing may change wind-exposure, and microclimatic conditions in adjacent forest, resulting in some die-off and reduced growth of forest species until edge vegetation matures. These effects are not considered to be significant for common plant populations, and no mitigation is required. Effects to wetlands are discussed further in Section 6.11.

Construction will result in disturbed areas without cover of natural vegetation. These include areas used as lay-down areas. They will be reclaimed at the end of the construction phase. It also includes areas stripped of infrastructure during decommissioning of the Project Site. Open soil surfaces encourage the establishment of non-native and potentially invasive species of plants. This may lead to alteration of near-by habitat and may have an adverse effect on the abundance and diversity of native flora. Due to the limited size of the affected areas, the effects are not expected to be significant for the local flora. Further, measures for the re-establishment of appropriate native vegetation in these areas may result in enhanced habitat for both plants and wildlife.

Effects of Habitat Loss and Alteration on Other Wildlife Species

Habitat removal during clearing and earthwork will result in loss of associated wildlife. Larger animals and species that move easier (faster), may move to similar habitats elsewhere. However, successful survival of these individuals will depend on the carrying capacity of those habitats, and number of individuals of the same or closely related species already residing there. There will likely also be mortality of stationary or slow moving individuals. These incidental effects on individuals are not considered to be significant for populations of common species as the populations are expected to recover. No mitigation is required.

Clearing and grubbing activities will result in loss of forest cover that provides food, shelter and breeding habitat for mammals. Since coniferous, deciduous and mixed woodlands all provide suitable places to roost or feed for bats (Bat Conservation Trust, 2008), bats roosting during the day can be impacted by these activities particularly if they are also attending to young. Bats give birth in May- June and the young are flightless for 4 weeks after birth. Therefore, the potential also exists for direct killing of young through clearing activities during this time. Bats are nocturnal, therefore foraging bats would not be impacted, as the construction would only be carried out during the day. Furthermore, foraging individuals may forage up to 20 km from roosting sites and, in general, tend to focus around bodies of water and in well-vegetated areas (Lausen et.al., 2006)

Deer wintering areas (DWAs), which are considered important habitat for white-tailed deer populations, exist along coastal areas within the proposed terminal and the logistics park (Section 5.10). Both the MIT and the Logistics Park are located within the DWA, but the easements of the transportation infrastructure are mostly located outside the DWA (Section 5.10). DWAs also exist in similar coastal habitat in the surrounding area. Due to the mild winters in the Project area, these DWAs are not used every year, however it is important to note that these areas are critical for those infrequent years of deep snow and that management of forests on Crown land is required to provide for this event. Although current information suggests that the removal of DWAs within the terminal footprint and Logistics Park is not expected to have significant adverse effects on deer populations, mitigation, other than minimization of the Project footprint (applied in the Project design) for the lost DWA may be required depending upon stand conditions in adjacent and nearby forest areas.

Effects of Habitat Loss and Alteration on Species at Risk

None of the rare plant species identified in the field and with either NSDNR status ‘yellow’ or ‘red’ is located within the footprint of the site or the rail alignment. One plant species (*Goodyera tesselata*) is located in the rail alignment where this enters the area of the future Logistics Park. This species is of conservation concern by ACCDC but labeled ‘green’ (‘secure’) by NSDNR. Confirmatory surveys on the presence of rare plant species along the proposed rail bed (including the existing rail bed, where upgrading work is required) is recommended to be implemented prior to construction work. If required, site and species-specific mitigation measures may need to be developed. This will ensure that impacts on rare plant species remain not significant.

Habitat removal may force some species currently inhabiting the project area to move to similar habitats elsewhere. Successful survival may depend on the number of individuals of the same or closely related species already in those habitats. Most individuals that move into others species' territories often do not survive; however, these individual mortalities are generally not a conservation concern at the population level (NSDNR 2008).
Potential summer foraging and roosting habitat for the Little Brown Bat and the Northern Long-eared Bat exists in the Project area. Although the area has been heavily logged in the past and mature forest is not common, there may still be a sufficient number of snags or hollow trees within the Project area which could provide suitable roosting habitat for bats. During late fall, winter and spring, these two bat species would be hibernating in caves (hibernacula) (NatureServe, 2007; NSMNH 2007). Since no known caves exist within the project footprint (M. Pulsifer, NSDNR, personal communication, 2008), wintering habitat should not be impacted. Therefore, as long as the vegetation removal takes place outside of breeding season and after young bats are able to fly, significant impacts on bats from habitat loss or alteration are not likely. Mature forest in adjacent areas will remain untouched and could provide suitable roosting and foraging habitat for displaced bats, if necessary.

Construction disturbance of standing or running water in the Project area could potentially impact Odonate species at risk. Only the nymphal stages (naiads) of Odonates are aquatic and thus vulnerable to habitat disturbance. Odonates are particularly sensitive to water level fluctuations during the emergence period, between May 15 and July 15. Activity along the banks of watercourses also has the potential to cause inadvertent trampling of naiads. Since the adverse effects on wetlands and aquatic habitat will be mitigated by means of compensation, long-term effects on Odonates are considered not significant.

Effects of Habitat Fragmentation and Creation of Edge Habitat

<u>Effects of Habitat Fragmentation on Birds</u>
Clearing and grubbing activities result in habitat fragmentation and increase the amount of edge habitat. Habitat fragmentation can limit bird distribution and the availability of suitable habitat by creating barriers to bird movement. The creation of edge habitat can have both positive and negative implications for birds. While high abundance and density of birds are often associated with edge habitat, adult birds and their nests are more exposed to predators, which often patrol edges in search of prey.

The fragmentation effect is particularly relevant to the 25 km new rail line and the proposed 20 km of new power transmission corridor. It is of note, that about 14 km (70%) of the transmission corridor will be running adjacent to the rail ROW, thus minimizing the additional fragmentation by the utility corridor. The existing 10km of railbed already constitutes a feature fragmenting forest habitat. Extensive habitat fragmentation has already occurred in the area as a result of logging roads, clear cutting, and the existing road and housing development along the Strait of Canso coast.

<u>Effects of Habitat Fragmentation on Other Wildlife</u>
Clearing of vegetation and establishment of infrastructure will result in habitat fragmentation, as some mammals are reluctant to cross cleared areas. A large, continuous area will be cleared to create space for the MIT. While animals are not likely to cross through this area, they may be able to move around the Project Site, as there is a large forested area surrounding MIT and Logistics Park, interrupted only by the proposed new rail and transmission corridor, as well as logging roads. The transmission corridor will remain vegetated (tall grass/ herbaceous shrub communities) and the rail and transmission corridors are not thought to be sufficiently wide to

limit movement of larger mammals, but smaller animals such as shrews may not cross the rail line and remain in the cover of vegetation. Herpetiles and insects routinely cross cleared areas. However, culverts constructed in order to cross wetlands and watercourses may be used by animals to cross transportation infrastructure, particularly since animals often prefer to move along a watercourse. The new rail and transmission corridor may increase opportunities for vehicular access to areas currently not accessible (e.g., by ATV). However, this is partially compensated by the re-activation of the existing rail bed which is expected to reduce the current use of that corridor for access. In addition, the vegetation in the transmission corridor and the rail traffic in the new rail corridor are expected to limit use of these corridors by ATVs.

Fences constructed at MIT or the Logistics Park may reduce the movement of large mammals and contribute to possible habitat fragmentation, but small animals will not be affected if the fences are not dug in. In summary, the adverse effects of habitat fragmentation and habitat loss on local populations of common wildlife are not considered to be significant.

The clearing of forest will increase the amount of edge habitat and open area which potentially may attract bats. The presence of the terminal may be beneficial to the resident population of the two bat species at risk, by increasing potential foraging habitat quality. Long-eared Bats are a forest interior species that can be found foraging over forest clearings and forest trails in addition to foraging in or above the canopy of woodland (NatureServe, 2007). Little Brown Bats hunt over water and open areas including forest trails. Therefore, habitat fragmentation could have a positive impact on bat populations.

Effects of Introduction of Alien and Invasive Species

There is potential for introduction of invasive species during construction and decommissioning activities. Seeds, roots or “rootable” fragments of invasive species may be stuck to construction equipment, transportation vehicles or shoes of workers. Since alien and invasive species, which lead to habitat alteration, are encouraged by un-vegetated soil surfaces, any disturbed areas should be re-vegetated as soon as possible Mitigation measures are discussed below.

Effects of Fugitive Dust

Earthwork, movement of construction and transportation machinery, and storage of soil and construction materials may result in development of fugitive dust. This may have adverse effects on vegetation near the construction sites, resulting in slower growth rates. However, these effects are not considered to be significant for common vegetation, and plants will recover. No mitigation is required.

No significant effects on wildlife are anticipated. There may be some marginal effects on amphibians from contribution of dust to sediment input into watercourses and wetlands. However, these effects are not considered to be significant. Dust- abatement measures and sediment control measures outlined in the EMP (Section 2.9) will reduce the effects of dust on vegetation, wetlands, and watercourses.

Effects of Construction Noise, Lighting and Human Presence

The main impact during construction is the habitat removal as discussed above. However, noise, lighting, and presence of humans associated with the clearing activities and subsequent construction activities may further disturb wildlife. Disturbance may disrupt normal wildlife behaviour, such as roosting, feeding, courtship, and rearing of young. Affected wildlife may abandon suitable habitat. These effects are primarily of concern to bird and mammal species at risk.

Many species of bats are known to sample the light levels before emerging from roosting spots, only emerging for a night's hunting when the light intensity outside reaches a critical level after sunset (Lee Valley, 2000). Use of floodlights and other lighting could therefore delay emergence and shorten the amount of time available for foraging (Lee Valley, 2008). Bright light may also reduce social flight activity and cause bats to move away from the lit area to an alternative dark area (Lee Valley, 2008). Furthermore, illumination of a roost can create disturbance and may cause the bats to desert the roost (Lee Valley, 2008). Construction activities will not be utilizing these types of lighting and activities will only take place during the day. Lighting is therefore not expected to impact bat populations.

Bats depend heavily on auditory function for orientation, prey capture, communication, and obstacle avoidance. Previous studies have indicated that bats are attracted by some high frequency sounds (Ryan et al. 1985, Russ et al. 2004) and high intensity sounds at a frequency range to which bats are most sensitive, could create an uncomfortable or disorienting airspace that bats may prefer to avoid (Spanjer, 2006). If these sounds are produced during daytime, when construction is to take place, bats may abandon roosting sites. Although newer roosting sites could be found in adjacent habitat, abandoning a roosting site is a greater issue if adults are tending to young. Potential impacts to newborn bats will be avoided by scheduling construction activities after June/July, when young bats are also able to fly to adjacent habitats.

No significant impacts due to construction activities on resident or migrating bats are therefore expected.

Construction noise and human presence may startle nesting birds causing them to temporarily or permanently leave their nest. Flushing of nesting birds may result in decreased productivity from factors such as nest predation, temperature loss, and changes to less favourable nesting sites.

Many mammals, including bears, may habituate to human activities and may return to the Project area once human activities become routine. In addition, anthropogenic disturbance already exists in the project area, with residences, roads, and logging activities. Therefore, it can be assumed that the animals that are present in the area are not very sensitive to human activities. Mammals like raccoons are not sensitive to human activities. There are no indications that other wildlife, such as amphibians, is sensitive to disturbance related to human activities. Human presence also may attract omnivorous predators such as raccoons, particularly if workers leave leftover food at the Project site. The increase of predators may result in decreases in prey organisms due to mortality.

Noise from construction is temporary and similar habitat is available in surrounding areas for displaced species to move to, and therefore significant adverse effects are not expected.

Spills, Malfunctions and Accidents

The potential effects of spills, malfunctions and accidents and recommended mitigation measures are discussed in Section 8.

6.10.3.2 Operation Effects

Effects of Operational Noise within the Terminal Footprint

Operational noise at the terminal, and increased human presence could result in disturbance of normal behaviours or avoidance of the area. However, few species are expected to remain in the terminal area due to lack of habitat after construction.

It is possible that bats may be attracted to structures that make unusual sounds, attract insects with lights or offer potential roosting sites (Ryan et al. 1985; Keeley et al., 2001; Russ et al. 2004). As bats use ultrasound (20 kHz and up) for echolocation of prey, there could potentially be interference with foraging activities, if the sounds from the terminal cover the frequencies that bats use for echolocation. However, the sounds emanating from terminal activities could potentially result in bats avoiding the area. Furthermore, as mentioned above, foraging individuals tend to focus around bodies of water and in well-vegetated areas (Lausen et.al., 2006). Therefore, sound emissions from the terminal are not expected to adversely affect foraging activities or lead to displacement of bats and no mitigation is required.

Effects of Operational Noise along the Rail Corridor

Vehicle traffic and train noise along the rail corridor, could lead to avoidance of potential breeding habitats and permanent displacement. Some studies on the effects of continuous noise (e.g. from roads) on bird populations showed that a number of species reacted with lower population densities at distances from 20 m to 3,530 m from the road. About 60% of the forest species investigated showed such effects (BLM, 2004). However, similar habitat is available in surrounding areas for displaced species. Further, traffic volumes will be minimal, i.e., only 1 to 3 trains per 24 hrs are expected to leave MIT. Truck traffic along the road (if at all necessary), will also be minimal. Therefore, noise effects during the operational phase are not considered significant.

The two bat species at risk are unlikely to be negatively affected by human presence and noise during the day since bats are nocturnal. Operational noise along the rail corridor is unlikely to result in high pitched noises that could result in abandonment of roosting sites. Also, several bats species have adapted to use attics or similar structures for roosting, indicating that these species are tolerant of human beings. Therefore, impacts from the presence of humans are not expected.

Effects of Terminal Lighting

One study found no difference in bat fatality or activity at wind turbines with and without lighting suggesting that bats may be investigating the structures for potential roosting sites as opposed to being attracted to the light (Arnett 2005). Other research has found that Little Brown Bats experience little to no collisions, even if large breeding colonies are present (Erikson et al. 2002). Therefore, bat collisions with terminal structures as a result of lighting, resulting in injury or death are unlikely and significant adverse effects on bat populations are not expected.

During the operation phase, wildlife may be disturbed by lights from the traffic in conjunction with transportation of containers, goods and personnel traveling to and from work. The Melford International Terminal will of necessity be well-lit with high intensity lighting at night which may attract birds and bats and cause direct mortality. The probability of nocturnal migrants being attracted to or killed at the terminal will be affected by the number, location and types of lights used (CWS 2006). Bird collisions with glass buildings or windows are also a significant source of bird mortality.

Effects of Increased Operational Traffic

Increased traffic along the rail corridor could result in the direct mortality of wildlife. This may particularly be of concern to Wood Turtles during the summer months when the species may roam through the project area. However, presence of Wood turtles on site will be incidental and significant adverse impacts are not likely. Mitigation measures to minimize wildlife collisions with vehicles are discussed below.

Terminal operation could also lead to accidental spills of transmission oil, fuel, etc. from terminal infrastructure or vessels using the terminal. Mitigation measures for malfunctions and accidents are discussed in Section 2.9.

Effects of Vessel Maneuvering on Birds

Coastal and seabirds have potential to be impacted by vessel maneuvering in the Strait and by loading noise at the terminal. Data from 2005 and 2006 Christmas Bird Counts in the area reported 10 waterfowl species (including loons, ducks, mergansers and grebes), 6 seabird and aerialist species (including gulls and guillemots), and no occurrences of shorebirds. However, historical data from CWS wintering waterfowl surveys have shown that low numbers of waterfowl use the Melford area, indicating the Melford area is not of great significance to wintering waterfowl populations. Due to the absence of wintering shorebirds and low numbers of other water species, significant impacts are not expected.

Effects of Increases Levels of Toxic and Deleterious Substances (Herbicides and Salt)

Road salt and herbicides used for road and ROW maintenance may adversely affect vegetation, water quality in wetlands and wildlife. Since wetlands may provide habitat for rare Odonates, the changes in water quality may affect suitability as breeding habitat for Odonates. Due to lack of information on tolerance of Odonate naiads to variations of salinity, it cannot be determined whether these effects may be significant.

The vegetation within the transmission corridor will be maintained by NS Power and is beyond the control of MITI. However, the EIS assumes that, within the Grant Lake watershed, the maintenance will only employ mechanical means.

With proper mitigation measures in place, no significant adverse effects are anticipated.

6.10.4 Mitigation

6.10.4.1 Mitigation of Construction and Decommissioning Effects

Table 6.10.1 provides a summary of recommended mitigation measures and residual environmental effects after successful implementation of the mitigation measures described below.

Habitat Removal and Alteration

The most basic mitigation measure is reduction of the project footprint in order to reduce the size of the area that could potentially be impacted. Lay-down areas should be reduced to the size and number that is absolutely necessary. Clearing and grubbing should be restricted to areas absolutely necessary to carry out the Project.

Mitigation measures for clearing, grubbing and blasting procedures will be established as part of the Environmental Management Plan (EMP) provisions.

<u>Habitat Removal and Alteration Mitigation Measures for Birds</u>
Care will be taken that trees with a width of 15 cm or more are not cut down unnecessarily. With implementation of these mitigation measures, significant adverse residual effects on birds are not likely.

If an Osprey, Bald Eagle or Northern Goshawk nest is found within the forested areas to be cleared, a buffer zone must be placed around the nest and clearing can only occur outside of the buffer zone.

Further management and approach will be developed in consultation with NSDNR and EC.

<u>Habitat Removal and Alteration Mitigation Measures for Species at Risk</u>

Vegetation clearing should take place outside of the bat breeding season when habitat removal could result in the death of flightless young bats. Removal of hollow trees and snags should be limited to the areas where it is absolutely necessary for the project construction in order to protect bat roosting areas.

Construction and activity along the banks of watercourses should be kept to a minimum during the sensitive Odonate emergence period (i.e., May 15 to July 15). Also, disturbance in and adjacent to riparian zones should be kept to a minimum.

<u>Habitat Fragmentation</u>
Mitigation includes efforts during the project design to minimize the overall area of vegetation clearing (i.e., minimize Project footprint, combine rail and power transmission corridor to the extent possible).

<u>Re-vegetation of Disturbed Areas</u>
Immediate site rehabilitation will occur where surface disturbance is only temporary (work camps or lay-down areas (after being stored onsite). Rehabilitation should be established based on site-specific landscape plans. Local native vegetation should be used for re-vegetation. To that effect, it is recommended to save and store the organic soil layer, for rehabilitation of disturbed areas.

Similarly, re-vegetation of reclaimed areas after the decommissioning of the facilities should use native plant species. Preferably, it should replace forest habitat lost, unless regulators such as NSDNR prefer a different habitat type. If seed mixes are used, they should preferably contain native flora. High quality commercial seed mixes usually do not contain invasive species.

Erosion at disturbed sites should be controlled in order to encourage vegetation. Efficacy of the erosion and sediment control measures, as well the establishment of native flora should be monitored through a environmental effects monitoring program implemented immediately after the construction or rehabilitation.

With implementation of these mitigation measures, significant adverse residual effects on common vegetation and wildlife are not likely.

<u>Introduction of Alien and Invasive Species</u>
In order to avoid the introduction of invasive plant species during the construction and decommissioning phase, construction and transportation equipment should be cleaned from vegetation and soil residues and inspected before entering the project site. At a minimum, this should be done when the equipment was previously used in other wet or wetland areas. This mitigation has previously been successfully carried out during other projects.

A program of monitoring and removal of noxious weeds should be established. The vegetation should be monitored at an appropriate time of the year for the presence of any noxious weeds.

<u>Dust</u>
Dust-prevention measures and dust abatement measures, such as covering of exposed soil, are outlined in the EMP.

<u>Disruption of Nesting Activities (Noise and Movement)</u>
In order to reduce the size of the affected area, clearing should be restricted to necessary areas. Construction noise will interfere with normal bird behaviour, such as feeding, migrating, and breeding. All construction equipment should have appropriate noise-muffling equipment installed and in good working order in order to minimize noise disturbance. The duration of noise disturbance should be minimized. Lighting should be restricted to areas where it is necessary.

In order to minimize interference of nesting activities from noise and human presence during the construction phase, workers should be encouraged to refrain from entering areas where no work is done, particularly areas where the vegetation is unchanged, as those areas likely hold the largest number of birds. Workers will be instructed to not leave any food items and garbage at the Project Site in order to avoid attracting omnivorous predators which may disturb or cause direct mortality or injury to wildlife. Mitigation measures are particularly important during the breeding season when nest failure could result if incubating adults are repeatedly flushed from active nests.

Due to the size of the project and the ensuing time requirements, it will not be possible to avoid sensitive time periods such as reproductive and emergence periods of wildlife other than birds.

6.10.4.2 Mitigation of Operation-Related Effects

Table 6.10.1 provides a summary of recommended mitigation measures and residual environmental effects after successful implementation of the mitigation measures described below.

Noise and Human Presence

Refer mitigation measures discussed in construction effects.

Lighting Effects

Lighting will interfere with navigation of migrating birds and can cause collisions leading to death. Lighting should only be used where required by Transport Canada regulations. Environment Canada's Canadian Wildlife Service (2006) recommends that only
lights with short flash durations and the ability to emit no light during the "off phase" of the flash (ie, LED lights), with the minimum number of flashes per minute and the briefest flash duration allowable. The U.S. Fish and Wildlife Service (2003) recommends that only white (preferred) should be used on towers or high structures at night. Solid red or flashing red lights should be avoided as they appear to attract nocturnal migrants more than white flashing lights (U.S. Fish and Wildlife Service 2003). High intensity lights, including floodlights, should be turned off at night when the terminal is not in use if at all possible. This is especially important during the spring and fall migration period.

Tinted or frosted glass windows are effective measures to reduce bird mortality from collisions (Erickson et al. 2005).

Mortality of Wildlife due to Rail Traffic

Open box culverts will be used at stream crossing and potentially wetland crossings. If open box culverts of sufficient size are put in place, they may be used by wildlife to cross the rail corridor, as wildlife often follows watercourses. This will somewhat reduce likelihood of wildlife collisions with rail cars.

Increase in Levels of Toxic and Deleterious Substances due to infrastructure Maintenance (Herbicides and Salt)

Vegetation growth will generally be regulated by physical cutting. Approved herbicides may be used for the maintenance only if necessary. Herbicides will be applied according to legal regulations (NSE), which will reduce the likelihood of their entering wetlands though run-off. Mitigation measures will be outlined in a site and project specific EMP (Section 2.9).

Ditching systems will divert surface drainage along the proposed rail bed into watercourses. Therefore, it is unlikely that run-off from roads, carrying salt or herbicides, will enter into wetlands, if the ditches are maintained appropriately. Mitigation measures for the protection of watercourses apply (see Section 6.9). However, storm water run-off collected in the Logistics Park and MIT will be discharged into the Strait of Canso. While herbicides and salt are likely carried in storm water run-off, adverse affects on marine flats are unlikely due to dilution.

The vegetation within the transmission corridor will be maintained by NS Power and is beyond the control of MITI. However, the EIS assumes that, within the Grant Lake watershed, the maintenance will only employ mechanical means.

Introduction of Alien and Invasive Species

A program of monitoring and removal of noxious weeds, established for post construction and post re-habilitation monitoring (see 6.10.4.1), will capture introduction of alien species. Equipment should be cleaned from vegetation and soil residues and inspected before entering the project site.

6.10.5 Follow- up and Monitoring

Several monitoring and follow- up programs will be implemented during all phases of the project. The site specific EMP developed for the project includes Environmental Effects Monitoring (EEM) (Section 2.9).

An EEM program will be implemented immediately post-construction and post-rehabilitation to identify any signs of a changed hydrologic regime. This program will encompass habitat and species in or near the footprint of MIT, the Logistics Park, and the rail and transmission corridors.

Further, the EEM will be implemented during construction, post-construction and post-rehabilitation for monitoring the efficacy of the erosion and sediment control measures, until the disturbed areas are sufficiently vegetated.

In order to reduce fugitive dust emissions during construction and decommissioning, environmental protection measures have been established in the Project EMP. This includes monitoring of site conditions in order to determine when to increase dust abatement measures.

Maintenance of infrastructure during the operation of the MIT and logistics park will require vegetation control. If chemical vegetation control is applied, the type of approved herbicide as well as the application will follow government regulations.

6.10.6 Residual Effects

Table 6.10.1 provides a summary of recommended mitigation measures and residual environmental effects after successful implementation of these mitigation measures.

<u>Birds (not including species at risk)</u>
Displacement or disturbance of individuals bird species that are not considered at risk is unlikely to significantly affect local or regional populations of shorebirds, waterfowl, raptors, passerines or breeding birds.

<u>Terrestrial Vegetation, Habitat and Wildlife other than Birds</u>
Project activities related to construction, operation and decommissioning of Project components are not likely to result in significant residual adverse effects on vegetation or wildlife (not including species at risk) after the successful implementation of recommended mitigation measures.

<u>Bird Species at Risk</u>
All 13 species at risk listed by NSDNR (see Section 5.10, Table 5.10-16) have potential to breed in the project area, with the exception of the Arctic Tern, Common Tern and Purple Sandpiper. Six species, the Common Loon, Canada Warbler, Gray Jay, Boreal Chickadee, Barn Swallow, and Olive-sided Flycatcher are listed as NSDNR 'Yellow', but are listed as S4 by ACCDC, indicating they are usually widespread and fairly common throughout the Atlantic Provinces (ACCDC 2007b). Therefore, implementation of the mitigation measures will likely leave minimal effects on the local populations of these species, and no effects on the regional populations.

The Common Nighthawk is listed as NSDNR 'Yellow,' COSEWIC 'Threatened' and NSESA 'Threatened,' indicating that the local population could be negatively impacted. However, ACCDC lists the species as apparently secure (S4) in Nova Scotia and New Brunswick and secure (S5) globally, indicating that regional populations should not be impacted. The Bobolink is listed as NSDNR 'Yellow' and 'Vulnerable (S3B)' by ACCDC. The New Brunswick and global population is not considered at risk by ACCDC, indicating that Bobolink populations may be negatively impacted by habitat loss locally but not regionally. The Rusty Blackbird is listed as NSNDR 'Yellow', COSEWIC 'Special Concern' and ACCDC 'Vulnerable breeding population (S3B)' in Nova Scotia and 'Apparently secure (S4)' in New Brunswick and globally. This indicates that the breeding population of this species may be negatively impacted locally, but likely not regionally.

The Northern Goshawk is listed as NSDNR Yellow and ACCDC S3B, indicating the species is vulnerable in Nova Scotia. However, the species is listed by ACCDC as S4, apparently secure, in New Brunswick and Prince Edward Island. Therefore, mitigation measures will likely leave minimal effects on the populations of this species.

<u>Plant Species at Risk</u>

No plant species with conservation status have been identified either within the footprint of the MIT nor the associated rail alignment. Consequently, adverse effects are not expected to be significant. Confirmatory pre-construction rare plant species surveys are proposed.

<u>Mammal Species at Risk</u>

The Little Brown Bat is one of the most common species in North America and the population status is secure or apparently secure across Canada (NatureServe 2007). Therefore death or displacement of this species should not affect local or regional populations. The Northern Long-eared Bats are considered rare (S2) in Nova Scotia (ACCDC 2007b) and loss of individuals of this species could have slightly more of an impact locally. Northern Long-eared Bats are considered apparently secure (S4) in New Brunswick and globally, therefore no significant regional adverse impacts are likely.

<u>Odonate and Herpetile Species at Risk</u>

No significant residual adverse impacts are likely with proper implementation of mitigation measures noted above.

Table 6.10.1: Residual Environmental Effects Summary for Terrestrial Vegetation, Habitat and Wildlife (including Birds and Species at Risk)

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Construction										
Habitat loss or alteration due to site preparation, clearing and grubbing	A	• Minimize Project footprint • Minimize lay-down areas • EMP provisions for clearing, grubbing and blasting • Removal of habitat not during migratory bird (April – July) or owl (February – March) breeding seasons or bat (May-June) breeding seasons • If Northern Goshawk nest is found, a buffer zone must be placed around nest • Construction activity along banks of watercourses should be minimized during Odonate emergence period (May 15-July 15) • Trees with diameter of 15 cm or more not to be cut unnecessarily (potential owl habitat) • Snags and hollow tress should not be cut unnecessarily (bat roosting habitat) • Confirmatory rare plant survey during pre-construction phase along rail and transmission routes; if required, implementation of species- / site-specific mitigation measureshabitat)	Low	Limited to Project footprint, Rail and Transmission Corridor	Long-term	NR during lifetime of project	Potential loss of bird, wildlife or species at risk abundance and diversity	Not significant		

Table 6.10.1: Residual Environmental Effects Summary for Terrestrial Vegetation, Habitat and Wildlife (including Birds and Species at Risk)

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Clearing of mature forest resulting in fragmentation	A	• Minimize Project footprint. • Combine transmission and rail corridor ROW to extent possible. • Minimize lay-down areas.	Low	Limited to Project footprint and Rail and Transmission Corridors	Long term Permanent	NR	Potential loss of mature forest bird species	Not significant		
Re-vegetation of disturbed areas	A/P	• Temporarily disturbed surfaces to be re-habilitated as soon as possible. • Rehabilitation to be based on site-specific landscape plans; plans to favor forest habitat and native plant species typical for the area (same applies for site rehabilitation during decommissioning phase). • Save and store organic soil layer and apply in rehabilitation. • Where applicable, use high quality seed with low probability of containing invasive species. • Apply erosion control measures. • Monitoring of EMP implementation, success of rehabilitation and erosion control measures.	Low	Limited to Project footprint and Rail and Transmission Corridors	Permanent	R		Not significant		
Introduction of invasive Species	A	• Construction and transportation equipment to be cleaned from vegetation and soil residues before entering the Project site.	Low	Local; depends on size of affected area	Construction and Decommissioning Phase/ Infrequent	R	Pristine areas and areas affected by human activity	Not significant		

FINAL REPORT

Table 6.10.1: Residual Environmental Effects Summary for Terrestrial Vegetation, Habitat and Wildlife (including Birds and Species at Risk)

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Dust	A	• Implement dust- abatement measures and sediment control measures as per EMP.	Low	Local	Construction and decommissioning phase	R	Increase sediment in watercourses/ wetlands	Not significant		
Noise disturbance due to vehicles and construction equipment	A	• Maintain all machinery in proper condition and in good repair in order to minimize noise emissions.	Low	Effects will be greatest near areas of high noise	Temporary	R	Disruption of nesting, feeding or breeding behaviours	Not significant		
Disturbance due to human presence	A	• Restrict lighting to absolute minimum. • Restrict activities to a clearly demarcated construction envelope. • Implement good housekeeping at construction camps / Project site (no food items or garbage) wildlife other than birds.	Low	Limited to Project footprint Rail and Transmission Corridors	Short-term, temporary	R	Disruption of nesting, feeding or breeding behaviours	Not significant		
Wetlands										
Wetland removal or alteration of wetlands as a result of clearing and development activities	A	• Avoidance wetlands during Project design and layout where practical • Minimize project footprint • Lay-down areas and construction camps not to be located in or near wetlands. • Establish and maintain a minimum of 20m buffer around wetlands. • Workers will be instructed not to enter wetlands.	Low	Limited to Project footprint and Rail and Transmission Corridors	Permanent	NR	Loss of wetland	Not significant		

Table 6.10.1: Residual Environmental Effects Summary for Terrestrial Vegetation, Habitat and Wildlife (including Birds and Species at Risk)

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
		• Wetlands which will be subjected to partial or total infilling to be formally evaluated in terms of wetland function. • Development and implementation of a wetland compensation plan in conjunction with the wetland alteration approval.								
Alteration of wetland hydrology due to alteration of drainage patterns	A	• Stream crossings to be constructed with culverts of sufficient size (also see Section 6.9). • Drainage structures of sufficient size to be constructed where infrastructure cuts across diffuse natural drainage paths, drainage channels, wetland habitat. • Drainage structures to dissipate hydraulic energy and maintain flow velocities sufficiently low to prevent erosion of native soil material. • Crushed rock used for road construction to allow for regular diffuse surface run-off to seep through. • Storm water management plan to maintain pre-construction flow conditions off-site. • Run-off collected along the roads not to enter directly into wetlands.	Low	Limited to Project footprint Rail and Transmission Corridors	Permanent	NR	Disruption of wetland function	Not significant		

Table 6.10.1: Residual Environmental Effects Summary for Terrestrial Vegetation, Habitat and Wildlife (including Birds and Species at Risk)

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
		• Runoff from the terminal and logistics park to be collected and treated in a storm water management system before discharge into the Strait of Canso • Maintain vegetation buffers around wetlands. • Implement environmental effects monitoring program to identify any signs of changed hydrologic regime.								
Alteration of water quality (through sediments and dust)	A	• Maintain a vegetated buffer zone of 30 m as well as a 100 m distance between fuelling stations and any open water course or wetland • Implement Stormwater Management Plan • Implemented erosion and sediment control plans specifically for the wetland crossings • Implement dust control plan • Monitor efficacy of the erosion and sediment control measures.	Low	Limited to Project footprint Rail and Transmission Corridors	Long term, possibly permanent	R	Disruption of wetland function	Not significant		
Introduction of invasive species into wetlands	A	• Construction and transportation equipment to be cleaned from vegetation and soil residues before entering the project site.	Low	Limited to Project footprint and Rail and Transmission Corridors	Long term, possibly permanent	NR	Impacts to other species and habitat	Not significant		

Table 6.10.1: Residual Environmental Effects Summary for Terrestrial Vegetation, Habitat and Wildlife (including Birds and Species at Risk)

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Operation										
Operation Disturbance due to human presence	A	• Discourage use of habitat adjacent to facility (e.g., for lunch time recreational use); establish on-site green space or establish formal designated trails.	Low	Limited to area in and near Project footprint	Throughout operation of terminal	R	Potential loss of bird species abundance and diversity	Not significant		
Noise disturbance due to vehicles and operational equipment	A	• Ensure operational equipment is in good working order and has appropriate noise-muffling equipment installed	Low	Limited to Project footprint Rail Corridor	Throughout operation of terminal	R	Potential loss of bird species abundance and diversity	Not significant		
Lighting effects and bird and bat collisions with equipment and structures	A	• White lights with short durations, the minimum number of flashes per minute and the briefest flash duration allowable should be used. • Tinted or frosted glass windows are recommended • Monitoring of bird strikes; in case of abnormal incidences, consider lighting or operating adjustments	Low	Limited to Project footprint and Rail Corridor	Throughout operation of terminal	R	Potential of direct mortality or injury to bird or bat species	Not significant		
Wildlife collisions with vehicles	A	• Open box culverts will be used at stream crossings and potentially wetland crossings	Low	Rail corridor and road (Hwy 344)	Throughout operation of terminal	I	Potential of direct death or injury to wildlife	Not significant		
Disruption of wintering shorebirds, waterfowl, seabirds/ aerialists	A	None identified – area is not an important habitat for wintering seabirds	Low	Limited to marine transport routes	Throughout operation of terminal	R	Potential to disturb roosting or feeding birds	Not significant		
Increase in levels	A	• Vegetation growth will generally be	Low	Local; depends	Short term/	R	Pristine areas	Not		

Table 6.10.1: Residual Environmental Effects Summary for Terrestrial Vegetation, Habitat and Wildlife (including Birds and Species at Risk)

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
of Toxic and Deleterious Substances due to infrastructure maintenance (herbicides and salt)		regulated by physical cutting. • Approved herbicides may be used for the maintenance only if necessary. • Herbicides will be applied according to legal regulations (NSE). • Measures are outlined in an EMP.		on size of affected wetland	infrequent		and areas affected by human activity	significant		
Wetlands										
Increase in levels of toxic and deleterious substances due to infrastructure maintenance (herbicides and salt)	A	• Vegetation growth generally to be managed by physical cutting. • Approved herbicides may be used for the maintenance only if necessary. • Herbicides to be applied according to legal regulations (NSE). • Implementation of mitigation measures for the protection of watercourses • Implement all measures of EMP.	Low	Project site and immediate surrounding area	Infrequent	R	Impacts to wildlife and habitats	Not significant		

* (for Magnitude): For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 4.
** (for Likelihood of Occurrence; Level of Confidence): Only addressed for significant effects

6.10.7 References

ACCDC (Atlantic Canada Conservation Date Centre) 2007. Website: http://www.accdc.com/products/ranking.html Accessed Nov.1, 2007

Arnett, E. B., technical editor. 2005. Relationships between bats and wind turbines in Pennsylvania and West Virginia: an assessment of bat fatality search protocols, patterns of fatality, and behavioral interactions with wind turbines. A final report submitted to the Bats and Wind Energy Cooperative. Bat Conservation International. Austin, Texas, USA. Available at: http://www.batcon.org/wind/BWEC2004finalreport.pdf Accessed Novemeber 2007.

Bat Conservation Trust. 2008. Website: http://www.bats.org.uk/

BLM (Bureau of Land Management). 2004. Website: http://windeis.anl.gov/eis/guide/index.cfm

CWS (Canadian Wildlife Service) 2006. Wind Turbines and Birds: A Guidance Document for Environmental Assessment. Available at: http://www.fws.gov/midwest//eco_serv/wind/guidance/CanadianEAguidelines.pdf Accessed November 2007.

Erickson, W.P., G.D. Johnson, D.P. Young, Jr. 2005. A Summary and Comparison of Bird Mortality from Anthropogenic Causes with an Emphasis on Collisions. USDA Forest Service Gen. Tech. Rep. PSW-GTR-191. Available at: http://www.dialight.com/FAQs/pdf/Bird%20Strike%20Study.pdf Accessed November 2007.

Keeley, B., S. Ugorez and D Strictland, 2001. Bar Ecology and Wind Turbine Considerations. Presentation and Panel Discussion. Proceedings of the National Avian-Wind Planning Meeting IV, Carmel California, May 2000. Prepared for the Avian Subcommittee of the National Wind Coordinating Committee by RESOLVE INC. Washington, DC, May 2001.

Lausen, C., E. Baerwald, J. Gruver, and R. Barclay. 2006. *Bats and Wind Turbines. Pre-siting and pre-construction survey protocols. Bats and Wind Turbines. Pre-siting and pre-construction survey protocols.* Appendix 5 to the following: Vonhof, M. 2002. Handbook of Inventory Methods and Standard Protocols for Surveying Bats in Alberta. Alberta Sustainable Resource Development, Fish and Wildlife Division, Edmonton, Alberta. Revised 2005.

Lee Valley Bats. 2008. Website: http://www.leevalleybats.org.uk/bats.htm)

NatureServe 2007. Nature Serve Explorer. Available at: http://www.natureserve.org/explorer/URL. Accessed Nov. 20, 2007.

NSDNR (Nova Scotia Department of Natural Resources), 2008. Communicated as part of a provincial government review.

NSMNH (Nova Scotia Museum of Natural History), 2007b. The Natural History of Nova Scotia. Volume 1. Topics; http://museum.gov.ns.ca/mnh/nature/nhns2/500/500.htm#topshabs ; Accessed June 2008.

Pulsifer, M. 2008. Personal communication regarding bats.

Russ, J. M., G. Jones, I. J. Mackie, and P. A. Racey. 2004. Interspecific responses to distress calls in bats (Chiroptera: Vespertilionidae): a function for convergence in call design? Animal Behaviour 67: 1005-1014.

Ryan, J. M., D. B. Clark, and J. A. Lackey. 1985. Response of *Artibeus lituratus* (Chiroptera: Phyllostomidae) to distress calls of conspecifics. Journal of Mammalogy 66: 179-181.

Spanjer, G. R. 2006. Responses of the big brown bat, Eptesicus fuscus, to a proposed acoustic deterrent device in a lab setting. A report submitted to the Bats and Wind Energy Cooperative and the Maryland Department of Natural Resources. Bat Conservation International. Austin, Texas, USA.

U.S. Fish and Wildlife Service, 2003. Interim guidelines to avoid and minimize wildlife impacts from wind turbines. Available at: http://www.fws.gov/habitatconservation/wind.pdf Accessed November 2007.

6.11 WETLANDS EFFECTS ASSESSMENT

6.11.1 Boundaries

6.11.1.1 Project Boundaries

The spatial Project boundaries include the footprint of the proposed Terminal and Logistics Park, as well as the footprint of the associated rail access and transmission corridor. Temporal Project boundaries are concurrent with the Project schedule (Section 2.1.4).

6.11.1.2 Ecological Boundaries

The spatial ecological boundaries include all freshwater and marine wetlands located within the Project Boundaries (see above). Wetlands that are hydrologically connected to wetlands in the footprint of Project infrastructure are also included in the ecological boundaries. All other wetlands are not included in the ecological boundaries.

Temporal ecological boundaries encompass the entire year, since interactions between wetlands and Project components, or effects of short term Project activities, can occur or extend year round. However, wetlands are less sensitive during the winter, when frozen. Wetlands are more sensitive during spring, summer and fall when susceptible to substrate disturbance and used by increased numbers of wildlife (e.g., breeding birds). The temporal boundaries extend over construction, operation and decommissioning phases.

6.11.1.3 Administrative and Legislative Boundaries

Wetlands in Nova Scotia are regulated under the NSEA, administered by NSE. Loss or alteration of wetlands larger than 2 ha required an Environmental Impact Assessment, which, among others, requires a formal evaluation of the wetlands following a process approved by NSE such as the wetland evaluation technique outlined by the North American Wetlands Conservation Council (1992). Alterations to or loss of wetlands smaller than 2 ha require only a Wetland Alteration Approval, issued by NSE. As part of the approval application, a wetland evaluation has to be carried out following a multi-step process prescribed by NSE, which includes information on hydrology, vegetation and rare species. Wetlands are also subject to the federal wetlands conservation policy.

6.11.1.4 Technical Boundaries

Plant, habitat and breeding bird species of conservation concern surveys have been carried out during summer and early fall of 2007 in most wetlands in the Study Area, which extends beyond the actual project footprint to include up to 500-750 m on either side of the rail bed (Section 5.10.1). To further strengthen and supplement the baseline data, additional wetland field surveys and a functional wetland analysis are undertaken by the proponent for potentially affected wetlands during the early and late summer of 2008. Upon completion, MITI will issue this information in a technical report. Formal evaluation of all wetlands affected by the Project will be undertaken as part of the detailed design phase and the development of wetland compensation plans.

6.11.2 Threshold for Determination of Significance

A significant adverse effect from the Project on wetlands is defined as an effect that is likely to cause a permanent net loss of wetland function as established during the wetland evaluation.

An adverse effect that does not cause a permanent net loss in wetland function is considered to be not significant.

6.11.3 Analysis, Mitigation and Environmental Effects Evaluation

While there are numerous freshwater wetlands located within the Study Area, few are wholly or partially in contact with Project infrastructure (see Section 5.10). The Project layout was designed in a way to avoid wetlands wherever practical.

Wetlands can be adversely affected by direct removal, fragmentation, disturbance and erosion, changes to hydrology, introduction of invasive species and release of hazardous materials. These impacts can interfere with wetland function, including species diversity. The effects can result from short term activities during the construction phase and decommissioning phases, as well as long-term activities during the Project operation. Run-off from acid generating slates exposed due to construction activities is unlikely as no such rock is known to occur in the Project Area (Section 5.1) and local fill will be used for infilling.

While the Project was designed to avoid wetlands wherever possible, a small number of wetlands are located in or near the footprint of Project infrastructure and are likely to be affected by Project activities.

The effects of Project activities during the construction and the decommissioning phase are similar, as are proposed mitigation measures. Therefore, both phases will be evaluated together.

6.11.3.1 Construction and Decommissioning

<u>Terminal and Logistics Park</u>.
Wetland # 1 and Wetland # 3, located in the footprint of the proposed Terminal, will be filled in (for locations of wetlands refer to Section 5.10, Figure 5.10-3 and 5.10-4). Wetland # 1, a robust emergent deep marsh, is about 0.9 hectares in size. Wetland # 3, a tall shrub swamp, is about 0.35 hectares. Both wetlands are not of high value in terms of wetland function, and belong to a wetland class that is common both in the vicinity of the wetland and in Nova Scotia. Both wetlands do not support rare plant species, and are not considered to provide important wildlife habitat. A total of 1.25 hectares of low value wetlands will be lost due to infilling in the proposed footprint of Terminal and Logistics Park. A wetland Alteration Approval will be required from NSE before construction can begin. In conjunction with this approval, it may be necessary to compensate for the loss of these wetlands, as Nova Scotia aims to prevent net loss of wetland function. Mitigation measures or compensation have to be negotiated with NSE.

Wetland # 2 (0.35 hectares) is located just outside of the proposed terminal footprint, upstream of Wetland # 1 and connected to it by a stream (refer to Section 5.10, Figure 5.10-4). Wetland # 2 has been classified a Robust- Emergents Deep Marsh and is located in the footprint of the Logistics Park. This wetland too will be filled in conjunction with the site development related to the Logistics Park. Similar to Wetland #1 and #3 it is not considered to be of particularly high value for plant and wildlife. Wetland # 081 is a treed bog with a surface area of 3.14 hectares. It is located in the Logistics Park and it is likely that the entire wetland will be lost due to infilling. During the detailed design stage attempts will be made to integrate the wetland with the on-site storm water management system. For the purpose of this assessment, however, it is assumed that the entire wetland will be lost due to infilling.

Marine Wetlands in the Terminal Footprint

Almost 2.5 hectares of marine flat (beach areas) will be lost to infilling during the construction of the Marine Terminal.

Construction activities at the terminal site, such as clearing, grubbing, stripping and storing of topsoil or construction materials such as sand, grading, construction or removal of foundations and rehabilitation of lay-down areas, construction camp sites and Project site (decommissioning) could result in sediment run-off and smothering of vegetation on marine flats (beaches and saline ponds) adjacent to the Project footprint. However, marine vegetation on the beach is sparse, and wave movement would likely remove most of the sediments. Similarly, sediments or dust from land based construction activities and transportation that are deposited into the marine flats and may act as nutrients, are not likely to adversely affect the marine flat and associated biota, as wave action will dilute or remove most of the material.

Accidental spills of deleterious substances from both land-based and marine construction and transportation equipment and construction materials could potentially adversely affect vegetation and wildlife in marine flats (beaches and saline ponds) adjacent to the Terminal and Logistics Park, including a 1.2 hectare of marine flat in the possible future expansion area; though again, wave action would limit potential adverse effects of spills to spills of larger amount of deleterious substances. While the proposed Logistics Park is not located adjacent to marine flats, it is located up-gradient of the marine flats. Sediments or deleterious substances originating in the Logistics Park area may be carried to the marine flats (beaches) by surface water run-off or streams.

A saline pond and associated salt marsh is located 1.5 km northwest of the proposed Terminal, though none are located directly within the terminal footprint. Due to its distance to project components and activities, it is unlikely that this wetland will be impacted directly though infilling or sediment run-off. However, it is located at the mouth of an extensive stream system which drains the area of the future Logistics Park and the areas surrounding the adjacent rail bed. There is a small potential that deleterious substances may reach this marine wetland if an accidental spill of a large amount of such substances occurs in the construction zone of the Logistics Park. Dilution due to the large amounts of freshwater in this watershed is likely to prevent adverse effects on the saltmarsh. However, surface water management (streams) and stormwater management could adversely affect the coastal saline pond and saltmarsh due to changes in the hydrology. Both reduced flow or increased flow of freshwater into the saline pond may change sedimentation patterns, salinity and vegetation composition. If streams are filled in, or the amount of surface water entering the streams is reduced due to diversion of stormwater and general reduced surface infiltration due to sealed surfaces, freshwater flow into the marine wetland will be reduced. If stormwater is collected from a larger area than is naturally drained by this watershed, and directed into the stream system, the amount of freshwater entering the saline pond would be increased, with similar effects. Also, if the stormwaters collected from a large area are drained into a stream, water levels will sharply vary depending on precipitation, which may adversely affect sediment transport and deposition in the downstream marine wetland.

Rail and Transmission Corridors

A small number of wetlands within the rail and transmission corridor will be impacted by partial infilling for the construction of the rail bed (refer to Section 5.10, Figure 5.10-3). As wetlands were avoided in the Project design where practical, the rail easement cross wetlands at there margins. Therefore, fragmentation is avoided or minimized.

- Wetland #007/008 is a treed bog with a total size of 8.04 Hectares. It is estimated that about 10-20 percent will be lost due to infilling.
- Wetland # 033/034 is a shrub fen with a total size of 11.85 hectares. It is estimated that less than 10 percent of the surface area will be filled in.
- Wetland #041/042 is a shrub bog with a total size of 3.98 hectares. It is estimated that less than 5- 10 percent of the wetland area will be lost to infilling.
- Wetland # 082 is a tall shrub swamp with a surface area of 1.26 hectares. It is estimated that less than 5 to 10 percent will be lost due to infilling.
- Wetland #101 is a treed bog with a total area of 0.79 hectares. This wetland is likely to change (perhaps dry up completely) due to the interception of drainage water by the rail line.
- Wetland #102 is a treed bog with a total area of 13.74 hectares. It is estimated that less than 5 percent will be disconnected from the rest of the wetland habitat due to the construction of the rail line; the water regime in the severed wetland is expected to change as the rail line will intercept waters draining into the wetland.
- Wetland #103 is a treed bog with a total area of 2.99 hectares. If at all, this wetland will only be affected by changes in the local drainage due to the construction of the rail line which may intercept waters currently draining to the wetland.

No new environmental impacts are expected to affect the wetlands along the existing rail bed. Refurbishing the existing rail bed should not result in any additional destruction of wetlands. However, Wetland #205 could be impacted by construction materials and machinery.

The proposed new power transmission corridor will be running in parallel to the proposed new rail corridor for about 70 percent (14 km) of the total transmission corridor length. Wetlands potentially affected by the transmission corridor but not affected by the rail corridor include Wetland #021 (Treed Bog), 031 (Shrub Fen), 118 (Treed Bog), 122 (Treed Bog), 128 and 130 (Treed Bog), 131 and 133 (Shrub Fen), 134 (Shrub Bog), 140 (Treed Bog), and 148 (Treed Bog) (for locations see Figure 5.10-3; for a listing of all surveyed wetlands refer to Table 5.10-3). Effects on wetlands by the transmission corridor are expected to be limited to the effects resulting from the construction of the H-frame wooden towers and, where applicable, trimming back of large trees within the 51m wide ROW. It is of note that MITI will undertake the clearing of the 51 m wide ROW and NSPI will construct, operate and maintain towers and ROW. It is expected that towers will be spaced to minimize interference with wetland habitat and that vegetation clearing would only affect the largest trees within the few treed wetlands along the ROW.

All wetlands belong to a wetland class that is common in the vicinity of the wetland and in Nova Scotia, and are of low value. Only one of these wetlands supports a vascular plant species considered to be rare in Nova Scotia (NSDNR Yellow), though this plant species is not uncommon in Project Area. None of the above wetlands are considered to provide important wildlife habitat. It is estimated that a total of less than three to four hectares of low value wetlands will be lost due to infilling in the proposed rail line.

Wetlands depend on a certain level of soil humidity. If the water regime is changed, so will the vegetation, character and functionality of the wetland. In addition to the direct impacts due to localized infilling, the same wetlands listed above could potentially be adversely affected by changes to the hydrology, due to impeded drainage caused by the construction of the rail bed. All of these wetlands are located upgradient of the proposed rail line and may be flooded if drainage is impeded.

In addition, a limited number of wetlands in close proximity to the rail alignment could be adversely impacted by construction-related changes in surface hydrology. Several wetlands are located up-gradient from the infrastructure and may be affected by impeded drainage. A small number of wetlands located down-gradient of the infrastructure could be adversely affected if surface water flow, including streams, decreases. These changes in wetland hydrology, would likely result in adverse effects on species diversity and wetland function.

All of the above wetlands could potentially be altered or damaged if lay-down areas are located in or near the wetlands, resulting in infilling or changes in hydrology. They also may be physically disturbed if equipment or workers enter the wetlands.

All of the above wetlands could also be adversely affected by sediment run-off during construction and decommissioning activities. Exposed soil associated with earth movement, site clearing, grubbing, grading, stripping and storing of topsoil or construction materials and reclamation of the project site during decommissioning, may result in erosion and subsequent sedimentation. Sediments carried into wetlands could smother existing vegetation, but may also contribute nutrients to the wetlands. Changes in nutrient levels will change water quality and potentially plant communities in the wetlands. Effects would be greatest in low nutrient systems such as treed bogs and shrub bogs, and would likely result in adverse effects on wetland function.

Dust and minerals from construction road runoff may have similar effects. Most fugitive dust will be formed during the construction phase or decommissioning phase from soil movement, soil and material storage, and the movement of construction equipment and transportation vehicles. The dust may cover native vegetation and smother it, but dust also deposits minerals and nutrients into the wetlands.

Wetlands in the footprint or in close proximity of the site roads and rail bed, may be adversely affected when accidental spills of deleterious substances such as fuels, lubricants or engine oil occur during the operation of construction equipment.

There is potential for introduction of invasive species during construction and decommissioning activities. Seeds, roots or “rootable” fragments of invasive species may be stuck to construction equipment, transportation vehicles or shoes of workers. These propagules may be introduced into the wetlands directly when equipment or people access the wetlands, or indirectly via run-off or dust from the roads. Invasive species such as purple loosestrife (*Lythrum salicaria*), are known to severely degrade wetland habitat and thus one or more of wetland functions. The potential for introduction of invasive species is highest in wetlands in or near the construction zone, including lay-down areas, followed by wetlands downstream or downgradient of those areas.

Wildlife using the wetlands near the construction zone as habitats may be disturbed by noise or lights, or impacted by accidental spill of hazardous materials such as fuel or lubricants from construction equipment during the construction and decommissioning phases. These effects are discussed in Section 6.10. However, none of the potentially affected wetlands are considered to be important wildlife habitat.

Numerous wetlands in the Study Area will not be adversely affected by construction or decommissioning activities due to their distance from the Project footprint.

6.11.3.2 Operation

During the operation phase, wetlands in the Logistics Park, marine flats near the Terminal and freshwater wetlands near the site roads and rail bed can be adversely affected by release of hazardous materials during maintenance activities or accidents and malfunctions, dust/ sedimentation, introduction of invasive species, as well as disturbance.

Marine Flats adjacent to the MIT may be adversely affected by spills of hazardous materials from ships, containers, and contaminated run-off originating from equipment operated on the terminal facilities or maintenance activities such as vegetation control. Wetlands in the Logistics Park, as well as wetlands at or down-gradient from the site roads and rail line may be adversely affected by accidental spills or releases of deleterious substances from rail cars, personal vehicles, containers, and chemicals used for infrastructure maintenance, which may reach the wetlands through surface water run-off.

Road salt and herbicides used for road and ROW maintenance may adversely affect vegetation and water quality in wetlands. Road salt is likely to influence vegetation species composition in freshwater wetlands, though the changes may be very small (JWEL, 2005). These changes are likely too small to adversely affect wetland function. However, since wetlands may provide habitat for rare odonates, the changes in water quality may affect suitability as breeding habitat for odonates. Due to lack of information on tolerance of odonate naiads to variations of salinity, it cannot be determined whether these effects may be significant. Marine flats will not be adversely affected by road salt used at the Terminal or Logistics Park.

Maintenance of the rail and power transmission line ROW and the Terminal surface will involve vegetation management, possibly including removal of vegetation. If vegetation management involves use of herbicides, the vegetation and thus wetland function will be adversely affected. These effects may be significant in freshwater wetlands near the rail line, if sufficient amounts of herbicides are carried into the wetlands. Adverse effects are likely not significant for marine wetlands and freshwater wetlands at a larger distance from the rail line, due to dilution. NS Power has indicated that the maintenance of the transmission line ROW within the Grant Lake watershed will rely on mechanical means rather than the application of herbicides.

Fugitive dust and sediment runoff from roads and rail during operation are not likely to adversely affect wetlands, since the amounts of material are expected to be too small to increase nutrient levels in freshwater wetlands sufficiently to change vegetation communities or water quality (odonate naiads). Therefore, no mitigation measures are proposed.

Propagules if invasive species may be carried on vehicles operated on roads and rail, and may be blown or washed into wetlands by surface water run-off. However, during the field surveys carried out in 2007, no purple loosestrife (*Lythrum salicaria*) was noted in the Study Area. Since the amount of traffic during operation of MIT will be increased over current levels, especially long distance traffic, the likelihood of introduction of invasive species is likely to increase. However, it cannot be established if the increase is significant.

There may be adverse effects on wetland functions due to increased access of the public to wetlands. Wetlands may be affected by direct disturbance by people walking in wetlands, thus trampling or drowning vegetation. Use of ATVs or dirt bikes in wetlands destroys vegetation cover and substrate, reduces water quality and may interfere with hydrology by increasing drainage through ruts. Also, wildlife may be disturbed by presence of humans, interfering with breeding and feeding. Propagules of invasive plants may be introduces on shoes or tires. However, most of the Project area is already accessible by dirt roads installed by Stora Enso (now NewPage) or local land-users, except for a limited area between Steep Creek and Pirate Harbour. Public access to wetlands in the Project area is not considered to be significantly different from the existing situations. No adverse effects were noticed during the field survey (except for clear-cutting in some wetlands with concordant used of heavy equipment and the resulting damage). Therefore, no mitigation measures for managing or restricting public access to wetlands are proposed.

During the operation phase, wildlife in wetlands may be disturbed by noise and lights from the traffic in conjunction with transportation of containers, goods and personnel traveling to and from work. Mitigation measures are discussed in Section 6.10.

6.11.4 Mitigation

6.11.4.1 Mitigation Measures for Construction and Decommissioning Phase

Mitigation measures are outlined for each potential adverse effect. Mitigation measures developed for the protection of fresh water fish and fish habitat (Section 6.9.) will also protect wetlands.

<u>Loss or alteration of wetland habitat</u>
The most basic mitigation measure is avoidance of wetlands. During Project design and layout, wetlands have been avoided where practical. The Project footprint has been minimized in order to reduce the area that could potentially be impacted. Therefore, infilling will occur in few wetlands, and there will be minimal or no fragmentation. While the current layout may be reviewed in order to evaluate the potential for avoidance of more wetlands through minor adjustments to the transmission and rail routes, it is unlikely that further adjustments are practical. Therefore, about 4.74 hectares of freshwater wetland and less than 3 hectares of marine flat will be lost in the footprint of the Terminal and the Logistics Park. Both represent common wetland types and are likely of low value in terms of wetland function. None of these are known to support a rare species.

Less than 3-4 hectares of wetland area will be lost due to infilling for the rail bed. For six of the wetlands, less than 5-20 percent of the surface area will be lost. The types of wetlands are common and likely to be of low value in terms of wetland function. However, one of the shrub bogs supports a vascular plant species that is listed “Yellow” by Nova Scotia, and thus is of higher value. As wetland function of the remaining area of these six wetlands is expected to be maintained, if hydrology can be maintained through application of the mitigation measures proposed below significant adverse effects on hydrological functions of the six wetlands are not expected. However, most of wetland # 101, a small treed bog (0.79 hectare) will be filled in. It represents a common wetland type. It does not support rare vegetation.

Wetlands which will be subjected to partial or total infilling should be formally evaluated in order to develop a suitable compensation plan as part of the application for Wetland Alteration

Approval (NSE). A wetland compensation plan in conjunction with the wetland alteration approval may consider replacing lost wetland function by creating wetland habitat at the margins of the wetlands that were partially filled in. The amount of wetland created would depend on the decision by NSE, but would be no less than the amount of wetland area lost.

The refurbishment of the existing rail bed could directly impact Wetlands #204 and #205. Care must be taken to ensure that no construction materials or machinery enter or disturb the wetland area. Construction vehicles will not be allowed to drive on the wetlands when accessing the existing rail bed.

Lay-down areas and construction camps will not be located in or near wetlands. Workers will be instructed to recognize wetlands and will be instructed not to enter wetlands, particularly while operating construction or transportation equipment.

With implementation of these mitigation measures, significant adverse residual effects on wetland functions are not likely.

The development of the transmission corridor is not expected to result in any noteable loss or alteration of wetland habitat. Once details on tower placement and construction access have been established this assessment will be revisited and, as part of the wetland compensation plan, adjusted. If required, appropriate wetland compensation will be implemented.

<u>Alteration of Wetland Hydrology</u>
Potential impacts on wetland hydrology can be mitigated through several methods.
Stream crossings need to be constructed using culverts of sufficient size to accommodate water flows related to extreme events (also see Section 6.9). Where infrastructure cuts across diffuse natural drainage paths, drainage structures of sufficient size should also be installed, in order to maintain water flow to and from wetlands at pre-construction levels. Culverts or similar drainage structures of suitable size should also be constructed where wetlands are crossed, i.e. in most cases of wetland infilling. The drainage structures should be designed to dissipate the hydraulic energy and maintain flows at velocities sufficiently low to prevent transport (erosion) of native soil material.

Generally, the crushed rock used for road construction should allow for regular diffuse surface run-off to seep through. This should be enhanced by using permeable road fill (clean shotrock) near the soil surface for additional cross drainage in areas where increased surface flow is expected. Geotextile may have to be used to maintain the pore space in the permeable road fill. During the habitat surveys in 2007 it was noted that small wet areas have formed along the logging roads in the Project area. Wet areas can develop into wetlands over time.

Stormwater should be managed in such a way that the amount of water entering the wetlands is similar toe the pre-construction levels. Run-off collected along the roads should not be allowed to enter wetlands. Runoff from the Terminal and Logistics Park should be collected and treated in a storm water facility before discharge into the Straight of Canso. However, decreases in the amounts of water entering wetlands are expected if all of the stormwater is diverted from wetlands. Vegetation buffers around wetlands will decrease this effect. The requirement for a Stormwater Management Plan will be outlined in the EMP (Section 2.9). Development of the on-site stormwater management system should attempt to integrate existing wetland and drainage channels into the system in order to minimize wetland loss.

Alteration of wetland functions as a result of changed drainage conditions will need to be considered within the compensation plan for loss of habitat functions mentioned above. An EEM program should be implemented immediately post-construction to identify any vegetation changes or new formation of wet areas adjacent to infrastructure, as this could be a sign of a disrupted hydrologic regime.

After implementation of these mitigation measures (including compensation), no significant adverse residual effects on wetland hydrology are expected.

Alteration of Water Quality

Sediment input may increase nutrient levels in wetlands, resulting in changes to the water quality and possibly species composition. Sediment input into wetlands can be reduced or prevented by the following mitigation measures:

Within the Logistics Park, a vegetated buffer zone of 30 m as well as a 100 m distance between fuelling stations and any wetland will be maintained to reduce erosion and the potential for sediments to enter wetlands via surface water run-off. Surface runoff in the Terminal and the Logistics Park should be collected and treated in sediment settling structures prior to discharge into the Straight of Canso (EMP- Stormwater Management Plan).

A vegetated buffer of 30 m will also be maintained around wetlands near the rail beds where possible. Erosion and sediment control plans will be developed and implemented specifically for the wetland crossings in order to prevent sediment run-off into the remaining area of the affected wetlands (see EMP, Section 2.9).

Appropriate general erosion and sediment control measures will be implemented on site to prevent or minimize erosion and subsequent site runoff into nearby wetlands and surface waters while soils are exposed and de-stabilized, as well as from movement of construction vehicles and storage of soils and construction materials. Where necessary and practical along the rail and transmission corridors, drainage should be directed away from the area of construction into a wooded area and be allowed to dissipate. The requirements for erosion and sedimentation control will be established in the Project EMP and measures will be specified in site-specific erosion and sediment control plans.

General erosion and sediment control methods include keeping ground disturbance to a minimum, installation of silt fences or cofferdams, and stabilizing or re-vegetating disturbed areas concurrently with construction activities (see EMP). Efficacy of the erosion and sediment control measures should be monitored. Site rehabilitation should utilize natural vegetation. However, hydro-seeding with commercially available seed mixes may be acceptable. Hydro-seeding with commercially available seed mixes has been proven successful during wetlands reclamation. Experience has shown that, in general, native wetland species gradually replace the ‘alien’ species in the seed mixes while the wetlands recover. However, some grasses and legumes in the seed mixes were still present in dry areas after five years, though interspersed with native species that had returned.

Fugitive dust from roads, construction sites and materials storage may introduce nutrients and mineral into wetlands, which may result in changes of species composition. Environmental protection measures including monitoring of site conditions will be established in the Project

EMP, and may include covering of stored construction materials and dust abatement measures in dry weather.

An environmental effects monitoring program implemented during construction and immediately post-construction or post rehabilitation (decommissioning) should monitor the efficacy of the erosion and sediment control measures, until the disturbed areas are sufficiently vegetated.

With implementation of these mitigation measures, significant adverse residual effects on water quality in wetlands are not likely.

<u>Temporal Increase in Toxic Contaminant Levels due to Malfunctions and Accidents</u>
The potential effects of spills, malfunctions and accidents on birds and recommended mitigation measures are discussed in Section 8.

<u>Alien and Invasive Species</u>
In order to avoid the introduction of invasive plant species during the construction and decommissioning phase construction and transportation equipment should be cleaned and from vegetation and soil residues before entering the Project site. At a minimum, this should be done when the equipment was previously used in other wet or wetland areas. This mitigation has previously been successfully carried out during other projects.

A program of monitoring and removal of noxious weeds should be established. The vegetation should be monitored at an appropriate time of the year for the presence of any noxious weeds. Since the biggest threat to wetlands is from purple loose strife, the monitoring should be carried out in late summer, likely August, when it is in bloom. Any invasive plants found should be dug up and properly destroyed in order to avoid further distribution. During the field surveys carried out in 2007, no purple loosestrife (*Lythrum salicaria*) was noted in the Study Area.

With implementation of these mitigation measures, significant adverse residual effects from introduction of invasive vegetation are not likely.

6.11.4.2 Mitigation Measures for the Operational Phase

<u>Increase in levels of Toxic and Deleterious Substances due to Infrastructure Maintenance (Herbicides and Salt)</u>

Vegetation growth will generally be regulated by physical cutting. Approved herbicides may be used for the maintenance only if necessary. Herbicides will be applied according to legal regulations (NSE), which will reduce the likelihood of their entering wetlands though run-off. Mitigation measures are outlined in a site and project specific EMP Environmental Management Plan.

NSPI has indicated that its maintenance of the transmission line ROW within the Grant Lake watershed will rely on mechanical means rather than the application of herbicides.

Ditching systems will divert surface drainage along the proposed rail bed into watercourses. Therefore, it is unlikely that run-off from roads, carrying salt or herbicides, will enter into wetlands, if the ditches are maintained appropriately. Mitigation measures for the protection of watercourses apply (see Section 6.9). However, stormwater run-off collected in the Marine Terminal and Logistics Park will be discharged into the Strait of Canso. While herbicides and salt are likely carried in storm water run-off, adverse affects on marine flats are unlikely due to dilution.

Temporary Increase of Contaminant Levels (Accidents and Malfunctions)
The potential effects of spills, malfunctions and accidents on birds and recommended mitigation measures are discussed in Section 8.

Introduction of Alien and Invasive Species
A program of monitoring and removal of noxious weeds, established for post construction and post re-habilitation monitoring (see 6.10), should capture introduction of alien species. However, it is expected that this program will be carried out over a limited time, starting during construction and extending into the early years of operation.

Table 6.11-1 provides a summary of recommended mitigation measures and residual environmental effects after successful implementation of these mitigation measures.

6.11.5 Follow- up and Monitoring

Several monitoring and follow-up programs will be implemented during all phases of the project. The site specific EMP developed for the project includes Environmental Effects Monitoring (EEM).

An EEM program will be implemented immediately post-construction and post-rehabilitation to identify any signs of a changed hydrologic regime in all potentially affected wetlands as well as any wetland habitat that has been created as part of a wetland compensation plan.

An environmental effects monitoring program should be implemented during construction, post-construction and post-rehabilitation for monitoring the efficacy of the erosion and sediment control measures, until the disturbed areas are sufficiently vegetated.

Site conditions should be monitored during construction to determine necessity and trigger the implementation of dust abatement measures.

A program of monitoring and removal of noxious weeds in reconstructed wetlands and ditches should be established after construction and decommissioning activities. It should be carried out for several years at appropriate times of the year, which depends on the target species. As purple loosestrife (*Lythrum salicaria*) blooms in August, the monitoring should be carried out at that time.

Maintenance of infrastructure during the operation the MIT and logistics park will require vegetation control. If chemical vegetation control is applied, the type of approved herbicide as well as the application will follow government regulations. Compliance with regulations will be monitored.

6.11.6 Residual Impacts

Project activities related to construction and decommissioning of Project components are not likely to result in significant residual adverse on wetland habitats after the successful implementation of recommended mitigation measures, including compensation.

Project activities related to operation of the Project components in most cases are not likely to result in significant residual adverse on wetland habitats after the successful implementation of recommended mitigation measures. However, there is potential that invasive alien plants establish themselves in the wetlands. Purple loosestrife is spreading across the province in ditches and can affect wetland functions. With the proposed monitoring and management program, however, effects are not expected to become significant.

FINAL REPORT

Table 6.11-1: Residual Environmental Effects Summary for Wetlands

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Construction										
Wetland removal or alteration of wetlands as a result of clearing and development activities	A	• Avoidance wetlands during project design and layout where practical • Minimize project footprint • Combination of rail and transmission corridor to the extent possible • Lay-down areas and construction camps not to be located in or near wetlands. • Workers will be instructed not to enter wetlands. • Wetlands which will be subjected to partial or total infilling to be formally evaluated in terms of wetland function. • Development and implementation of a wetland compensation plan in conjunction with the wetland alteration approval.	Low	Local; depends on size of affected wetland	Permanent / Once	Depends on wetland type: R (for all but bogs)	Project site designated and approved Industrial Reserve; parts along the rail and transmission corridors pristine and/or affected by human activity	Not significant		

Table 6.11-1: Residual Environmental Effects Summary for Wetlands

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects					Significance	Likelihood of Occurrence**	Level of Confidence**
			Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context			
Alteration of wetland hydrology due to alteration of drainage patterns	A	• Stream crossings to be constructed with culverts of sufficient size (also see Section 6.9). • Drainage structures of sufficient size to be constructed where infrastructure cuts across diffuse natural drainage paths, drainage channels, wetland habitat. • Drainage structures to dissipate hydraulic energy and maintain flow velocities sufficiently low to prevent erosion of native soil material. • Crushed rock used for road construction to allow for regular diffuse surface run-off to seep through. • Storm water management plan to maintain pre-construction flow conditions off-site. • Run-off collected along the roads not to enter directly into wetlands. • Runoff from the terminal and logistics park to be collected and treated in a storm water facility before discharge into the Straight of Canso (see EMP- Storm Water Management Plan). • Maintain vegetation buffers around wetlands. • Implement environmental effects monitoring program to identify any signs of changed hydrologic regime.	Low	Local; depends on size of affected wetland	Construction and Decommissioning Phase; once per wetland	R	See above	Not significant		
Alteration of Water Quality (through sediments and dust)	A	• Maintain a vegetated buffer zone of 30 m as well as a 100 m distance between fuelling stations and any wetland. • Implement Stormwater Management Plan • Implemented erosion and sediment control plans specifically for the wetland crossings (see EMP). • Implement dust control plan (see EMP). • Monitor efficacy of the erosion and sediment control measures.	Low	Local; depends on size of affected wetland	Construction and Decommissioning Phase/ Infrequent	R	See above	Not significant		

Table 6.11-1: Residual Environmental Effects Summary for Wetlands

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects: Magnitude*	Geographic Extent	Duration/Frequency	Reversibility (R= reversible NR = Not reversible)	Ecological/ Social-cultural and Economic Context	Significance	Likelihood of Occurrence**	Level of Confidence**
Introduction of invasive Species	A	• Construction and transportation equipment to be cleaned from vegetation and soil residues before entering the project site. • Monitor and remove noxious weeds.	Low	Local; depends on size of affected wetland	Construction and Decommissioning Phase/ Infrequent	R	See above	Not significant		
Operation										
Increase in levels of Toxic and Deleterious Substances due to infrastructure maintenance (herbicides and salt)	A	• Vegetation growth generally to be managed by physical cutting. • Approved herbicides may be used for the maintenance only if necessary. • Herbicides to be applied according to legal regulations (NSE). • Implementation of mitigation measures for the protection of watercourses (see Section 6.9.1) • Mechanical vegetation management for transmission corridor within Grant Lake watershed • Implement all measures of EMP.	Low	Local; depends on size of affected wetland	Short term/ infrequent	R	See above activity	Not significant		
Introduction of Alien and Invasive Species	A	• Monitor and remove noxious weeds in restored/ newly created wetlands	High	Local; depends on size of affected wetland	Permanent/ Infrequent	R	See above	May be significant, but unlikely		

* (for Magnitude): For definition of levels of magnitude (high, medium, low, nil, unknown) refer to Section 4.
** (for Likelihood of Occurrence; Level of Confidence): Only addressed for significant effects