Black Point Quarry Project
Municipality of the District of Guysborough, NS

Environmental Impact Statement

PART 3 Section 7

Vulcan Materials Company

February 2015

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7.0 ENVIRONMENTAL EFFECTS ASSESSMENT

7.1 AIR QUALITY AND CLIMATE CHANGE

7.1.1 Overview

Air quality concerns associated with the generation of dust have been raised by community residents and the Mi'kmaw, and so Air Quality is identified as a VC. Air quality is also a pathway to the food chain via the transport of dust and deposition of contaminants on vegetation and surface water. Air quality within the quarry is of interest to provincial workplace health and safety regulators. Outside the Property boundary ambient air quality standards are established in the provincial *Air Quality Regulations* and enforced by NSE.

Vehicles and generators used at the Project site will produce greenhouse gases (GHGs) from the combustion of fuel. GHG emissions are associated with climate change and have been the subject of provincial regulation and policy initiatives.

7.1.2 Boundaries

The boundaries for the air quality assessment are based on the nature of the activities expected to generate air emissions at the Project. These activities mainly include site preparation, construction and operation of the processing plant, access road, marine terminal and quarry.

7.1.2.1 *Temporal Boundaries*

A summary of the activities associated with air emissions and the estimated duration of each activity is presented below. Initial quarrying south of the processing plant area will generate construction materials that will be used for surfacing the processing plant area and access road, and eventually for building the marine terminal.

- Pre-Mining Activities (Phase 1)
  - Establish access and haul roads, site preparation: 3 years (2017-2020)
  - Mobilization and set up of portable processing plant (Phase 1): 1 year (2017-2018)
- Mining Related Activities (Phases 2-5)
  - Commissioning of portable processing plant (Phase 2): 2 year (2018-2020)
  - Construction of marine terminal: 1 year (2019-2020)
  - Expansion of portable processing plant (Phase 3): 2 years (2020-2022)
  - Construction of fixed processing plant (Phase 4): 1 year (2021-2022)
  - Expansion of fixed processing plant (Phases 5): 4 years (2026-2030)
  - Operation of access and haul roads, marine terminal, quarry: end of construction to end of life (~2065)
- Closure, decommissioning, and final reclamation: estimated at 2 years but may be extended.

Quarrying will take place nine months out of the year weather permitting and ship loading will take place on a year-round basis. Operating hours will be 24 hours a day, with 16-hours of production (two 8-hour shifts) and one 8-hour maintenance shift per day. The specific hours each day that production will occur may vary. Blasting will be performed between 8 am and 6 pm. Blasting is expected to occur 2 – 3 times per week and will not occur on statutory holidays

or Sundays. Ship loading may occur 24 hours per day with a maximum anticipated duration of 2 days per week, and equipment maintenance may occur at any time during the day if needed, although most maintenance activities will be scheduled for the 8-hour maintenance shift.

The greatest emissions to the air are expected to occur several years following start-up of the full scale fixed operating plant in Phase 5 (2022). Based on forecasted sales, annual emissions will gradually increase from Operating Year 1 (2018) and reach the expected maximum annual rate no earlier than 2024.

With respect to climate change, the hydrological assessment incorporated possible climate change scenarios extending 70 years in the future; 70 years is thus adopted as the temporal boundary for the climate change aspects described here.

7.1.2.2 *Spatial Boundaries*

The spatial boundaries for the air quality assessment are threefold: the Project Area (within the Project property boundary where workplace health and safety regulations dominate), the Affected Area, where provincial ambient air quality standards must be met, and the larger Study Area, including the shipping routes between the marine terminal and established shipping lanes, where more diffuse Project impacts many be expected.

Climate change is a trans-boundary global issue, but the climate change assessment of this Project is related to provincial initiatives and emissions reduction targets.

7.1.2.3 *Administrative Boundaries*

Air quality within the Project site is regulated by the province through the *Workplace Health and Safety Regulations*, which establishes the air quality conditions needed to maintain worker health. Air quality outside of the Project site is also regulated by the province, which may set air quality emissions standards for industrial operations in the industrial operating permit. Maximum permissible ground level concentrations of various air pollutants, including Total Suspended Particulate (TSP or dust) are listed in Schedule A of Nova Scotia's *Air Quality Regulations*. Federal regulators may reference similar limits established under the *Canadian Environmental Protection Act.*

7.1.2.4 *Technical Boundaries*

Technical boundaries represent theoretical or actual limits to the Project team's ability to assess a VC, pathway or receptor. For the Air Quality and Climate Change VC, no technical boundaries were encountered. Prediction of ambient air quality changes is based on air dispersion modeling (**Appendix O**), experience with granite quarry design and operation, quantification of total potential emissions, existing climate and ambient air conditions, and proximity to nearby receptors.

7.1.3 Threshold for Determination of Significance

Particulate matter is the primary criteria air contaminant of concern for the Project.

Air contaminants that are of most concern from project operations include total suspended particulate (TSP), particulate matter less than 10 and 2.5 microns in diameter (PM10 and PM2.5, respectively), nitrogen oxides (NOx), carbon monoxide (CO) and sulphur dioxide (SO2).

The Nova Scotia Air Quality Regulations (179/2014) establishes limits on TSP, SO2, nitrogen dioxide and CO. In addition, the Canadian Council of Ministers of the Environment issues Canada-wide issued standards for particulate matter less than 2.5-micron in diameter ($PM_{2.5}$). These standards are used as thresholds for determination of significance and provided in Table 7.1-1.

A significant adverse effect is defined as an exceedance of the Nova Scotia or CCME ambient air quality standards at a residential or commercial location outside the property boundary, where the exceedance is due to emissions from the operation and the event occurs more than twice in the period of time that the standard is based.

Table 7.1-1:
Ambient Air Quality Standards

Jurisdiction	Pollutant	Averaging Time	Current Standard	Standard 2015	Standard 2020
NSE	TSP	24- Hour	120 µg/m^3	--	--
		Annual	70 µg/m^3	--	--
NSE	SO2	1-Hour	900 µg/m^3	--	--
		24- Hour	300 µg/m^3	--	--
NSE	NO2	1-Hour	60 µg/m^3	--	--
		Annual	400 µg/m^3	--	--
NSE	CO	1-Hour	34600 µg/m^3	--	--
		8Hour	12700 µg/m^3	--	--
CCME	$PM_{2.5}$	24- Hour	--	28 µg/m^3	27 µg/m^3
		Annual	--	10 µg/m^3	8.8 µg/m^3

A quarry, where the annual production exceeds 500,000 tonnes, is required to consider all National Pollutant Release Inventory (NPRI) substances for reporting to the NPRI, regardless of the hours worked by employees.

There are no national or province-wide Nova Scotia standards or limits for greenhouse gas emissions. In 2007, the Nova Scotia Government passed the *Environmental Goals and Sustainable Prosperity Act* (*EGSPA*), an innovative piece of legislation on sustainable development and economic prosperity. EGSPA contains the first hard caps of greenhouse gas (GHG) emissions in Canada. Among other actions, the *Act* requires a reduction in provincial GHGs of 10% below 1990 levels by the year 2020.

In order to lessen the province's dependency on imported fossil fuels and reduce greenhouse gas and air pollutant emissions, the Government of Nova Scotia in 2009 tabled *Toward a*

Greener Future - Nova Scotia's Climate Change Action Plan followed by the 2010 *Renewable Electricity Plan.* These reports describe an approach to integrate progressively larger amounts of low-emission renewable energy into the provincial electrical grid. The *Climate Change Action Plan* contains goals for meeting a target greenhouse gas reduction of 5 megatonnes annually in order to meet the 2020 GHG reductions regulated in *EGSPA*. To achieve these reductions, the Government of Nova Scotia has imposed emissions caps on electricity generation sector and worked to increase the efficiency of the transportation sector.

7.1.4 Effects of the Project on Air Quality

Dust emissions (total particulate matter [TPM], total suspended particulate [TSP], particulate matter up to particle size 10 microns [PM_{10}] and particulate matter up to particle size 2.5 microns [$PM_{2.5}$]) are the main air quality issue for quarry construction and operation. These particulate matters emissions have the potential to be transported off-site and if not mitigated may reduce visibility or contribute to a number of health problems, such as asthma, decreased lung function and coughing or difficulty breathing.

The dust emission sources associated with the Project are:

- wind erosion of material storage piles and exposed areas
- crushers
- screens
- material loading/unloading
- material conveyors and transfer
- blasting
- overburden removal, and
- vehicle traffic (haul roads).

Combustion emissions from equipment, vehicles, and ships occur during construction and operation of the Project. Criteria air contaminants associated with combustion emissions are sulphur dioxide (SO_2), nitrogen oxides (NO_X), volatile organic compounds (VOCs), carbon monoxide (CO), and particulate matter (PM). Fuel combustion in equipment, vehicles, and ships are sources of Project greenhouse gas emissions, which include carbon dioxide (CO_2), methane (CH_4), and nitrous oxide (N_2O).

On a temporary basis, a minimal amount of air pollutants are also generated from wind-blown dust and fuel combustion during the construction and decommissioning phases.

The emissions from the project are summarized in Table 7.1-2 below. These emission rates represent peak production anticipated for each phase.

Table 7.1-2:
Total Criteria Pollutant Emissions from Quarry and Processing Plant

tonnes/year							
Project Phase	Total Suspended Particulate (TSP)	Particulate Matter <10 microns (PM10)	Particulate Matter <2.5 microns (PM2.5)	Nitrogen Dioxide (NO2)	Carbon Monoxide (CO)	Volatile Organic Compounds (VOCs)	Sulfur Dioxide (SO2)
Phase I	6.16	1.83	0.76	30.64	24.99	3.39	1.48
Phase 2	22.78	6.31	2.70	54.12	36.15	6.12	1.60
Phase 3	47.09	14.58	2.92	77.50	62.48	8.33	2.00
Phase 4	99.84	33.42	6.19	91.76	92.15	9.87	2.00
Phase 5	114.56	37.44	7.28	105.35	109.07	11.08	2.80

(source: Vulcan Materials Company)

These estimates were calculated using emissions factors from Environment Canada[1] and US EPA[2], and Tier 4 Off-Road engine emission standards from US EPA document Emissions Factors for Nonroad Engine Compression-Ignition Engines[3]. The emissions address the sources described previously for the quarry and processing plant. Greenhouse gas emissions are described in Sections 3.3.10 (Air Emissions) and 3.3.12 (Emissions to Atmosphere from Marine Operations).

Emissions from aggregate transport vessels while they are maneuvering for berthing and while berthed for loading are provided in Table 7.1.3. These emission levels are not significant as the ships operate on auxiliary power when berthed and are only in transit for berthing a short period of time.

[1] Website Archived Content –"Environment Canada – Pit and Quarries Guidance – NPRI Toolbox."

[2] U.S.EPA AP42, Fifth Edition, Volume I Chapter 11: Mineral Products Industry.

[3] US EPA NR-009d Exhaust and Crankcase Emission Factors for Nonroad Engine Modeling Compression-Ignition, July 2010.

Table 7.1-3:
Total Criteria Pollutant Emissions from Marine Vessel Operations

	tonnes/year						
Project Phase	Total Suspended Particulate (TSP)	Particulate Matter <10 microns (PM10)	Particulate Matter <2.5 microns (PM2.5)	Nitrogen Dioxide (NO2)	Carbon Monoxide (CO)	Sulfur Dioxide (SO2)	Volatile Organic Compounds (VOCs)
Phase I	0.24	0.24	0.21	0.27	0.53	0.21	0.11
Phase 2	0.34	0.34	0.30	0.39	0.77	0.30	0.17
Phase 3	0.51	0.51	0.45	0.58	1.14	0.44	0.25
Phase 4	0.76	0.76	0.67	0.86	1.70	0.66	0.36
Phase 5	1.14	1.14	1.00	1.29	2.55	0.98	0.55

(source: Vulcan Materials Company)

In general, based on the source release type, emissions quantity, and meteorological conditions, concentrations will likely dissipate well below significant levels within 500 m of the source (see results from air dispersion modelling study below). This means most of the effects of the Project on air quality will be within the Project Area and may extend up to 500 m into the Affected Area. The processing plant sources and stock piles are located well within 500 m of the Property boundary. Quarrying may occur near the property boundary, but the nearest public receptors are 720 to 750 m away from the boundary and even farther from quarry face. The emissions from the shipping lane will be beyond the Project Area; however, the vessels are not significant sources of emissions and the impacts from these are expected to be insignificant.

The highest concentrations at the Property boundary from all fugitive dust sources (except wind erosion off disturbed areas and piles) are, somewhat counterintuitively, usually generated during times of low wind speeds when the air is calm. With respect to wind erosion, high winds may push dust further afield, but the additional turbulence keeps concentrations low. High wind speeds (winds greater than 8.8 m/s), which occur about 24% of the time, will cause greater wind erosion and dust transport. Nearly half of these winds come from west-northwest and northwest. However, it is just over 1 km to the nearest public receptor in this direction and additional mitigation will be implemented at wind speeds greater than 8.8 m/s. Low winds blowing during calm conditions to the east, west, and south produce the highest dust concentrations at the Property boundary; these wind conditions occur approximately 6% of the time (EC 2006a; 2009).

Fugitive dust emissions are greatest during hot and dry conditions. The proximity of the Project site to the ocean leads to relatively high moisture and low temperature; and both high and low speed winds blowing toward the ocean from the sea breeze effect. The hottest daily maximums (greater than 20° C) occur in July and August and the average rainfall during these months is still above 80 mm. The majority (over 50%) of the winds during these two months are blowing

from the south or southwest, carrying emissions into the Bay and away from the nearest receptors (residential buildings and roads).

In order to quantify air contaminant dispersion during quarry operations, an air dispersion modelling study was undertaken (**Appendix O**). Dispersion modeling was completed using AERMOD, developed by the American Meteorological Society (AMS) and United States Environmental Protection Agency (US EPA). AERMOD is the US EPA preferred model for regulatory air dispersion modelling of industrial sources and Nova Scotia Environment (NSE) has approved its use in various modelling projects to demonstrate compliance in Nova Scotia.

The air dispersion model simulated the transport of contaminants released from the quarry and compared the predicted concentrations at nearby residences to the applicable limits. The model captures the potential "worse case" operating scenario: Phase 5, which represents peak production and maximum vehicular traffic as well as Phase 3 when generators will be used before the electrical line is constructed. Vessel emissions are also included.

The modelling results demonstrate that even under worse case scenarios, Project-related air contaminants at the nearest residences are far below the maximum acceptable concentrations established by provincial and federal regulation. In particular, the predicted 1-hour and 24- hour maximum, and the annual average concentrations for nitrogen dioxide (NO2), sulphur dioxide (SO2), and particulate matter (including TSP, PM10 and PM2.5), as well as the 1-hour and the 8-hour maximum concentrations for carbon monoxide (CO) were found to be at least 50% below their respective objectives.

With respect to GHGs, calculations presented in Sections 3.3.10 (Air Emissions) and 3.3.12 (Emissions to Atmosphere from Marine Operations).

The Canadian National GHG Inventory for the 2012 calendar year shows the carbon dioxide equivalent emission levels for Nova Scotia to be 17,400 kt, of which the mining and oil and gas industrial category generated 201 kt of emissions, a very small proportion. The Project's total GHG emission level at the maximum generation rate during Phase 5 is estimated at 9,464 tonnes per year CO_2e (Sections 3.3.10 - Air Emissions). For comparison, this level would be roughly 0.05% of the Province's total GHG emissions for 2012.

Given these findings, changes to the atmospheric environment resulting from Project activities will not have a measureable effect on federal lands (i.e., the Canso Islands National Historic Site) or on area of federal jurisdiction (i.e., lands currently used by Aboriginal peoples).

7.1.5 Mitigation & Monitoring

7.1.5.1 *Mitigation*

The mitigation measures used to minimize and control the air pollutants from the construction, operations, and decommissioning activities are outlined in Table 7.1-4. Standard best management practices for air quality mitigation that apply to the entire Project site are:

- Regular maintenance of all equipment and emission control devices;
- Wet sprays on conveyor transfer points to reduce the fugitive releases of dust during the transfer of material;

- The application of water to the access and haul roads and aggregate stockpiles as needed. A water truck will be available on site to transport water where needed;

- Use of qualified blasting contractors with blast design plans that incorporate dust emission controls;

- Construction of the haul roads using material with low silt content;

- Use high quality low sulphur diesel or standard unleaded gasoline for mobile equipment; and

- Use of a binder substance within the dust suppression application (e.g. calcium chloride) during drier periods of the year to aid in keeping the roads moist for longer periods of time.

Additional controls will be implemented through the process of adaptive management. Adaptive management is an iterative process where future actions are taken based on observation and/or measurement. For example, dust generation from haul roads is related to moisture in the roadway and speed of the vehicle. Through adaptive management, the Proponent may learn that immediate dust reductions are possible through limiting vehicle speed so that water trucks can be used less often. The Proponent will use adaptive management to evaluate changing conditions at the operation due to weather such as temperature, wind speed and direction, sun intensity, time since last rain and snow cover as well as operating rates and location of mining activities at the time. This information will allow quarry managers to make decisions on how to adjust dust control techniques (such as rate of water application to haul roads and stock piles), and also modify operational parameters such as production levels and haul truck speeds to ensure dust generation is controlled.

Some of the control measures that will be implemented based on management determination of need include:

- Increase in watering frequency of haul roads and stock piles.
- Application of dust suppressants to the haul and access roads.
- Reduction in allowable speed on haul and access roads.
- Restriction or suspension of operation of part or all of the processing plant until dust can be controlled.
- Suspension or modification of overburden handling activities.
- Addition or modification of dust suppression systems to address specific points where dust is being generated, including spray nozzle additions and/or modifications.
- Modify operation and dust controls during high wind events (>30 km/h) to control dust, if it cannot be controlled suspend operation until it can.

The Proponent will take steps to reduce GHG emissions including purchasing of heavy off-road mining equipment that meet the US EPA and Canadian Tier 4 engine standards, operating mobile equipment with fuel efficiency in mind by eliminating unnecessary idling, shutting off equipment when parked unless this is precluded for safety or maintenance reasons, utilizing conveyors to reduce the need for mobile equipment, and through the use of marine vessels, which are much more energy efficient (and so produce less GHGs) than ground transportation options (Table 3.8).

7.1.5.2 *Monitoring*

Although air quality impacts are expected to be negligible, regular inspection and air quality monitoring (as needed) are typically used to ensure dust emissions are minimized. Additional monitoring programs are outlined on Table 7.1-4. For example:

- Perform daily visible emissions inspection at the property line. If visible emissions are observed or are reported off-site, the operator will investigate the condition and take appropriate corrective actions within the site to reduce dust emissions through measures such as wetting of dust sources with water, use of covers or other approaches. Records of the inspections and excess dust events will be kept, along with corrective actions taken which will be reported as appropriate to government agencies.
- To ensure that public concerns are part of daily management of the site the Proponent will have a telephone number at the site that can be used to report issues that the public may have with the facility, such as dust emissions observed beyond the Property boundary.
- If requested by Nova Scotia Department of Environment, measure Suspended Particulate Matter at the property line of the Project site or other location as directed.
- Monitor weather for conditions that contribute to adverse air quality in the area (e.g. inversions, high winds, dry) and take additional precautions to minimize emissions during these events.
- Monitoring of worker exposure to dust through the regular use of dust dosimeters carried by workers during the course of their shift.

Table 7.1-4:
Best Practice Mitigation for Air Quality

Project Activity	Mitigation	Record Keeping and Monitoring
Construction		
Site Preparation	• Prior to burning, explore options to reduce, reuse, or recycle as much material as possible. • Limit burning to periods with adequate atmospheric dispersion. • Apply water or chemical dust suppressant on all disturbed areas, as necessary. • Limit the amount of vegetation clearing to the smallest extent possible. • Suspend activities during periods of sustained high winds (> 30 km/h) if fugitive dust emissions cannot be controlled. • Compact the soil on disturbed areas that will not be surfaced with gravel or re-vegetate as soon as practicable following construction.	• Inspect burning pile for material that can be reused or recycled. • Record location and date of burning events. • Perform daily visible emissions inspection and maintain records. • If visible emissions are observed or reported, the operator will investigate the condition and take appropriate corrective actions. • Record hours of operation for the water truck and areas of the facility where water and/or chemical dust suppressants were applied. • Document sustained periods of high wind speeds.
Soil and Aggregate Handling and Storage	• Apply water on all disturbed areas, as necessary. • Locate piles in areas sheltered from wind where possible. • Minimize rock drop distances. • Minimize storage and handling of soil/aggregate. • Suspend soil/aggregate handling activities during sustained periods of high winds (> 30 km/h). • Restrict access to soil/aggregate piles during periods of inactivity using gates, fencing, and/or onsite security personnel.	• Perform daily visible emissions inspection and maintain records. If visible emissions are observed or are reported, the operator will investigate the condition and take appropriate corrective actions. • Record the application of water and/or chemical dust suppressant. • Document periods of high wind speeds.
Portable Processing Plant	• Ensure efficient operation of dust suppression equipment on portable units. • Minimize drop distances as far as practicable. • Water spray during non-freezing conditions. • Minimize transfers of material. • Suspend activities during periods of sustained high winds (> 30 km/h) if fugitive dust emissions cannot be controlled.	• Maintain a record of equipment maintenance and inspections of dust control equipment. • Document periods of high wind speeds. • As requested by NSE, install monitoring stations to record dust levels.

Project Activity	Mitigation	Record Keeping and Monitoring
Access Road/Haul Roads	• Utilize multi-passenger vehicles to transport crew when possible. • Reduce vehicle speeds. • Post speed limit signs in sensitive areas. • Apply water or dust suppressants during dry conditions. • Restrict traffic during unusually windy times when dust formation is enhanced. • Restrict vehicular access during periods of inactivity using gates, fencing, and/or onsite security personnel. • Ensure that water trucks are available when needed.	• Perform daily visible emissions inspection and maintain records. If visible emissions are observed exceeding opacity limits specified in the permit, or are reported, the operator will investigate the condition and take appropriate corrective actions. • Record the application of water and/or chemical dust suppressant. • Document location of residences and other sensitive areas.
Engines and Vehicles	• Maintain equipment regularly following manufacturer guidelines. • Maximize equipment use when running and minimize unnecessary idling of equipment. • Consider fuel efficiency when purchasing, upgrading, and maintaining the vehicle fleet. • Use high quality, ultra-low sulphur diesel fuels or standard unleaded gasoline. • Schedule and arrange construction activities to minimize transport time for vehicles and ensure that construction activities are sequenced in a manner to enhance vehicle use. • Turn off equipment that is idling and not in use.	• Maintain engine certifications for off-road equipment and diesel generators and compare against applicable provincial or national standards. • Check maintenance is up to date on each vehicle, equipment, and diesel generator based on the maintenance schedule. • Record date of any maintenance, inspections, and tuning of equipment.
Operation		
Drilling and Blasting	• Utilize drill rig that has dust suppression incorporated into its design. • Apply water to shot rock pile as needed to reduce emissions from loading and conveyance of material to the process. • Suspend blasting activities during periods of sustained high winds (> 30 km/hr).	• Record the number of blasts. • Record the application of water. • Document periods of sustained high wind speeds. • As requested by NSE, install monitoring stations to record dust levels.

Project Activity	Mitigation	Record Keeping and Monitoring
Access and Haul Roads	• Same as during construction	• Same as during construction
Permanent Processing Plant	• Same as with portable plant	• Same as with portable plant
Storage Piles	• Apply water or chemical dust suppressant on stockpiles, as necessary. • Locate piles in areas sheltered from wind where possible	• Perform daily visible emissions inspection and maintain records. If visible emissions are observed or are reported, the operator will investigate the condition and take appropriate corrective actions. • Record the application of water and/or chemical dust suppressant.
Exhaust Emissions from Equipment and Vehicles	• Maintain equipment following manufacturer guidelines. • Maximize equipment use when running and minimize unnecessary idling of equipment. • Consider fuel efficiency when purchasing, upgrading, and maintaining the vehicle fleet. • Ensure power generation via diesel generators meet applicable provincial standards. • Use multi-passenger vehicles to transport crew to site to the extent practical. • Use high quality, ultra-low sulphur diesel fuels or standard unleaded gasoline.	• Maintain engine certifications for off-road equipment and diesel generators and compare against applicable provincial standards. • Check maintenance is up to date on each vehicle, equipment, and diesel generator based on the maintenance schedule. • Look for excessive emissions (soot) from vehicle exhaust. • Record date of any maintenance, inspections, and tuning of equipment.
Marine Engines	• Ships must comply with International Marine Organization limits on NO_X, VOC, and SO_2. • Optimize load times to limit auxiliary engine idling on ships at dock.	• Record all emission tests/certifications. • Record fuel sulfur content of ships.
Decommissioning		
Decommissioning activities are expected to be comparable to construction activities. Therefore, the same mitigation and monitoring procedures will apply.		

7.1.1 Residual Effects and Significance

The Project is expected to have a minimal adverse residual impact on the local air shed. Table 7.1-5 provides a summary of the residual environmental effects and demonstrates the Project is not likely to have significant adverse effects on Air Quality and Climate Change.

Table 7.1-5:
Residual Environmental Effects for Air Quality and Climate Change

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction									
Site Preparation: dust and combustion emissions	A	See Mitigation Section	1	1	3/6	R	1	Dust and Combustion Emissions	Not Signif.
Soil and Aggregate Handling and Storage: dust and combustion emissions	A	See Mitigation Section	1	1	3/6	R	1	Dust and Combustion Emissions	Not Signif.
Portable Processing Plant: dust and combustion emissions	A	See Mitigation Section	1	1	3/6	R	1	Dust and Combustion Emissions	Not Signif.
Access Road/Haul Roads: dust emissions	A	See Mitigation Section	1	1	3/6	R	1	Dust Emissions	Not Signif.
Engines and Vehicles: combustion emissions	A	See Mitigation Section	1	1	3/6	R	1	Combustion Emissions	Not Signif.
Operation (Full Scale Phase 5)									
Blasting: dust and combustion emissions	A	See Mitigation Section	1	1	1/4	R	1	Dust and Combustion Emissions	Not Signif.
Access Road/Haul Roads: dust emissions	A	See Mitigation Section	1	1	5/6	R	1	Dust Emissions	Not Signif.

Permanent Plant: dust emissions	A	See Mitigation Section	1	1	5/6	R	1	Dust Emissions	Not Signif.
Storage Piles	A	See Mitigation Section	1	1	5/6	R	1	Dust Emissions	Not Signif.
Exhaust Emissions from Equipment and Vehicles: combustion emissions	A	See Mitigation Section	1	1	5/6	R	1	Combustion Emissions	Not Signif.
Marine Engines: combustion emissions	A	See Mitigation Section	1	1	1/4	R	1	Combustion Emissions	Not Signif.
Decommissioning									
Decommissioning activities are expected to be comparable to construction activities. Therefore, the same analyses apply.									Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

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

Reversibility:
R = Reversible
I = Irreversible

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

N/A = Not applicable
A = Adverse
P = Positive

7.2 NOISE AND VIBRATION

7.2.1 Overview

Activities such as blasting and aggregate processing will undoubtedly produce noise and have the potential to alter the ambient noise conditions of the local area. Noise concerns have been raised by residents living to the east and west of the property. Changes to ambient noise may also affect a variety of wildlife, migratory birds and SAR through driving them out of the area and/or other effects on their behaviour. Noise associated with quarry activities is regulated by the Province of Nova Scotia.

Construction of the marine terminal will likely result in temporary increases to noise in the marine environment, which may in turn affect nearby marine biota. Noise may alter the behaviour patterns of certain marine species, which may in turn affect these species at different times of their life cycles. Shipping associated with the marine terminal will add to the noise already present in the marine environment.

7.2.2 Boundaries

7.2.2.1 *Temporal Boundaries*

Temporal boundaries reflect the duration of Project-related impacts. With respect to Noise and Vibration, the temporal boundaries are:

- Construction (Phase 1)
  - Establish access and haul roads, site preparation: 3 years (2017-2020)
  - Establish portable processing plant (Phase 1): 1 year (2017-2018)
- Operation (Phases 2-5)
  - Establish portable processing plant (Phase 2): 2 year (2018-2020)
  - Construction of marine terminal: 1 year (2019-2020)
  - Expansion of portable processing plant (Phase 3): 2 years (2020-2022)
  - Construction of fixed processing plant (Phase 4): 1 year (2021-2022)
  - Expansion of fixed processing plant (Phases 5): 4 years (2026-2030)
  - Operation of access and haul roads, marine terminal, quarry: end of construction to end of life (~2065)
- Closure, decommissioning, and final reclamation: estimated at 2 years but may be extended.

Daytime, evening and night time periods, described below, are also considered temporal boundaries for the purposes of the noise and vibration assessment.

7.2.2.2 *Spatial Boundaries*

The spatial boundaries for the noise and vibration assessment consist of the Project Area (within the Project property boundary where workplace health and safety regulations dominate), the Affected Area extending to nearby residential properties where provincial noise limits must be met, and the larger Study Area, including the shipping routes between the marine terminal and established shipping lanes, where more diffuse Project impacts may be expected.

7.2.2.3 *Administrative Boundaries*

Noise within the Project site is regulated by the province through the *Workplace Health and Safety Regulations*, which establishes the noise environment needed to maintain worker health. The *Pit and Quarry Guidelines* (NSE 1999) require that noise levels at the boundaries of the project site are not to exceed the following levels:

- L_{eq} ≤ 65 dBA between 0700 to 1900 hours (daytime)
- L_{eq} ≤ 60 dBA between 1900 to 2300 hours (evening)
- L_{eq} ≤ 55 dBA between 2300 to 0700 hours (night-time, Sunday and statutory holidays)

The *Guidelines for Environmental Noise Measurement and Assessment* (NSE 1990) also require these noise levels to be met at locations where people normally live, work, or take part in recreation.

7.2.2.4 *Technical Boundaries*

No technical boundaries are defined for noise.

7.2.3 Threshold for Determination of Significance

A significant adverse effect is defined as an exceedance of the maximum noise or vibration limits listed in the *Pit and Quarry Guidelines* at or beyond the property boundary, where the exceedance is due to noise from the operation and the event occurs more than twice in the period of time that the standard is based.

7.2.4 Effects of the Project on Noise

Project noise and vibration effects were considered in the following potential areas:

- Construction noise and vibration, both terrestrial and underwater;
- Noise from on-going aggregate production and shiploading operations; and
- Noise and vibration from blasting, including impacts on people and structures and the potential for underwater impacts on wildlife.

This assessment also identifies the potential *perceived* noise and vibration effects from the Project, since impacts on people may exist even if compliance with numerical noise and vibration criteria is achieved.

This section summarizes the noise and vibration impacts of the Project. More detail is contained in the Noise and Vibration Technical Report attached as **Appendix D** to this EIS.

7.2.4.1 *Project Construction Noise and Vibration Impacts*

The site development and initial rock processing during the construction phase of the Black Point operation will involve activities similar to those that will occur during full facility operation. Equipment used for the construction will be similar to that used for site operation. Noise generated during construction is anticipated to be similar to or less than the noise generated from facility operations; however, the duration of noise during construction will be less than the fully operational quarry.

For example, the number of heavy vehicles accessing the quarry site by road may be higher during some periods of construction than during operations. Trucks will be used to transport processing equipment to the site and this activity will cease before full operations begin. Increased heavy vehicle noise on local roads may be noticeable at times during construction, but this is expected to be temporary and will be confined to normal working hours.

The construction of the marine terminal has the potential to affect marine receptors including marine mammals due to underwater noise and vibrations produced during construction. These effects would be temporary and localised to the immediate construction area. It is estimated that the underwater noise criteria applicable to fish habitats (including shellfish and crustaceans) may be exceeded during pile driving in an area around the pile locations extending seaward up to 10 m (**Appendix D**). Behavioural modification may occur at greater distances, for the duration of the construction.

7.2.4.2 *Project Operational Noise Impacts*

The Black Point operation will generate noise from the operation of mobile equipment, the operation of the processing plant, blasting and product loadout at the marine terminal. As noted above, the *Pit and Quarry Guidelines* (NSE 1999) require that noise levels at the boundaries of the project site are not to exceed the following levels:

- $L_{eq} \leq 65$ dBA between 0700 to 1900 hours (daytime)
- $L_{eq} \leq 60$ dBA between 1900 to 2300 hours (evening)
- $L_{eq} \leq 55$ dBA between 2300 to 0700 hours (night-time, Sunday and statutory holidays)

The *Guidelines for Environmental Noise Measurement and Assessment* (NSE 1990) also require these noise levels to be met at locations where people normally live, work, or take part in recreation.

In order to calculate the noise emission levels at the site boundary and at residential receiver locations an environmental computer model was developed using SoundPLAN. This software enables compilation of a sophisticated computer model comprising a digitised ground map, the location and acoustic sound power levels of potentially critical noise sources on site and the location of receivers for assessment purposes.

The noise model developed is representative of a “worst-case” scenario for noise impacts. As the detailed design is not yet completed, a number of assumptions have been made in order to predict the maximum potential for operational noise impacts and need to consider noise mitigation:

- Impacts are predicted for a future operational scenario, with all equipment operating at the maximum anticipated capacity.
- The pit has been modelled as expanded to its maximum size, when it will provide a minimum of shielding effect.
- The model assumes all noise sources and equipment are operational continuously throughout a daily production schedule of 16 hours, with a maintenance schedule of 8 hours.
- Shiploading is modelled as occurring continuously at all times of the day or night, when in fact this would be expected to occur on less than a third of all days or nights.

- Downwind sound propagation has been assumed – under calm conditions, noise would propagate less.
- Hard ground (bedrock) was assumed across the Project site and over the ocean, with soft ground (soil and surficial deposits) to the east, west and south.
- Equipment sound power levels have been derived from SLR's experience of the unmitigated noise emissions of equipment in similar applications. The source levels assumed are considered to be conservative. There is potential to mitigate the noise emissions of equipment during the detail design of the Project to minimise noise impacts.

The predicted worst-case, unmitigated noise effects in the future operational scenario are summarised in Table 7.2-1 at the site boundary and in Table 7.2-2 at residential receiver locations.

Table 7.2-1:
Predicted Worst Case Project Noise Levels – Site Boundary

	Leq Sound Level (dBA)	
Location	**Daytime and Evening (7am to 11pm)**	**Night-time (11pm to 7am)**
Western Boundary	66-67	47-57
Southern Boundary	47-64	29-39
Eastern Boundary	56-73	34-58

Maximum permitted at nearest residence: 65 dBA daytime / 60 dBA evening / 55 dBA night-time

Table 7.2-2:
Predicted Worst Case Project Noise Levels – Residential Receivers

	Leq Sound Level (dBA)	
Location	**Daytime and Evening (7am to 11pm)**	**Night-time (11pm to 7am)**
272 Half Island Cove Road	51	40
267 Half Island Cove Road	53	41
257 Half Island Cove Road	52	40
246 Half Island Cove Road	52	40
230 Half Island Cove Road	51	39
215 Half Island Cove Road	52	40
212 Half Island Cove Road	51	39
155 Half Island Cove Road	50	38
3595 Highway 16	47	25
3596 Highway 16	48	25
3581 Highway 16	45	26
3421 Highway 16	55	26
2927 Highway 16	54	30
2823 Upper Fox Island	52	35
2574 Highway 16	48	34
48 Fox Island Main Road	48	33
59 Fox Island Main, Canso	49	34

	Leq Sound Level (dBA)	
Location	**Daytime and Evening (7am to 11pm)**	**Night-time (11pm to 7am)**
79 Fox Island Main Road	49	34
75 Fox Island Main Road	49	34
130 Fox Island Main Road	49	34
149 Fox Island Main Road	49	35
169 Fox Island Main Road	50	35
235 Fox Island Main Rd	48	34
RR 1 Canso	50	35

Maximum permitted at nearest residence: 65 dBA daytime / 60 dBA evening / 55 dBA night-time

7.2.4.3 *Daytime and Evening Noise Impacts on Residences*

Under the worst case scenario, the predicted noise levels at the nearest residences during the daytime and evening range from 47 dBA to 55 dBA, complying with the most stringent noise limit of 55 dBA. At the commencement of quarry construction and operation, noise levels would be expected to be considerably less than indicated in this assessment.

While compliance with the numeric noise limits at residences is expected, the noise of the quarry will be noticeable at residences during the daytime and evening, particularly during otherwise quiet periods. Quarry production noise is generally characterised by low-frequency "rumbling" noise that does not vary much with time. At the levels predicted in this assessment, it is anticipated that noise from the quarry would dominate the background noise environment in the local area during the daytime and evening periods, and will be audible at a "moderate to quiet" level in nearby residential areas.

7.2.4.4 *Night-time Noise Impacts on Residences*

The predicted noise levels at the nearest residences during night-time shiploading and site maintenance activities range from 25 dBA to 41 dBA, complying with the night-time limit of 55 dBA. Shiploading is expected to occur on around 100 nights per year once operations reach full capacity.

While compliance with the numeric night-time noise limits at residences is expected, the noise impact of night-time shiploading will be noticeable at nearby residences. At the levels predicted in this assessment, it is anticipated that noise from night-time shiploading would contribute to the background noise environment in the local area, and will be audible at a "quiet" level in nearby residential areas during calm weather. The character of night-time noise would be a steady low-frequency "rumbling" noise. The night-time noise level would not be expected to disturb the sleep of most people in the long term.

7.2.4.5 *Noise Impacts at Project Boundary*

The predicted noise levels around the project boundary indicate there is potential for exceedances of the noise goals at the project boundary both during daytime operations and during night-time shiploading and site maintenance activities. These predicted noise impacts represent a worst-case scenario with no noise mitigation measures included in the detailed

design. The highest noise levels are predicted at the boundary on the coast both to the east and to the west of the site – this is because these project boundaries are closest to the dominant production equipment noise sources, and do not benefit from as much shielding by the terrain as the areas south of the site.

7.2.4.6 *Blasting Noise and Vibration Impacts*

Blasting will occur anywhere from 30 to 120 days per year, depending on aggregate sales demand. The Pit and Quarry Guidelines (NSE 1999) define acceptable limits for blast overpressure (noise) and vibration, and also require a minimum distance from blasting to the nearest off-site structure greater than 800 m. Minimum blasting distances are respected in all directions from the Property boundary.

The assessment indicates that exceedance of the airblast overpressure limit and vibration limit at sensitive receivers is unlikely throughout the life of the quarry.

While underwater blasting is not anticipated to be required by the Project, the location of the quarry adjacent to the ocean means that there is potential for quarry blasting noise and vibration to impact on the underwater environment and marine fauna. Blasting effects in the marine environment are described in Section 7.11.

7.2.5 Mitigation & Monitoring

7.2.5.1 *Mitigation*

As noted, there is potential for exceedances of the noise limits at the project boundary both during daytime operations and during night-time shiploading and site maintenance activities. These predicted noise impacts represent a worst-case scenario with no noise mitigation measures included in the detailed design. As required by the Pit and Quarry Guidelines (NSEL 1999) a Technical Blast Design must be prepared before blasting begins. The blast design must demonstrate the concussion and ground vibration criteria in the Pit and Quarry Guidelines can be met within the site.

There is considerable opportunity to reduce the effects from noise below the levels described in the tables above by design and implementation of noise mitigation measures. Reasonable and feasible mitigation options include the procurement of equipment that meets best practices in terms of noise emissions, and the placement of equipment within the quarry and/or behind stockpiles such that these measures block noise during operations. More generally, the following noise mitigation measures (NSW 2008) will be evaluated during the final design phase and later when construction and operation are beginning.

<u>General</u>

- Procure equipment that meets US EPA Category IV air emission standards for off-road diesel equipment which tend to generate less noise than older equipment;
- Equipment that operates in the quarry pit should stay in the pit to the extent possible so that the pit walls attenuate the noise levels;
- Locate product stockpiles and other structures such as buildings and conveyors to the extent possible to attenuate the noise from the processing equipment;

- Restrict operating hours for the quarry and processing plants to 16-hours per day so that noise levels are reduced during night time;
- Restrict blasting to daytime hours and weekdays;
- Place as much distance as possible between the plant or equipment and residences;;
- Use natural landforms as noise barriers. Place fixed equipment behind earth berms;
- Include clauses in tenders, subcontractor agreements and work method statements that assure the minimization of noise and compliance with directions from management to minimize noise;
- Regularly train workers and contractors (such as at toolbox talks) to use equipment in ways that minimize noise;
- Ensure that site managers periodically check the site, nearby residences and other sensitive receptors for noise problems so that solutions can be quickly applied;
- Keep truck drivers informed of designated vehicle routes, parking locations, acceptable delivery hours and other relevant practices (e.g. minimizing the use of engine brakes and engine idling); and
- Minimize the use of reversing alarms by designing the site layout to avoid reversing, such as by including drive-through for parking and deliveries.
- Ensure the site office is manned 24 hours per day so that complaints can be logged and follow up responses initiated.

Night-time Mitigation Measures

- Minimize the need for reversing alarms; and
- Avoid metal-to-metal contact on equipment.

The Community Liaison Committee will also provide a forum to discuss issues such as quarry and ship loading noise and offer opportunities to find innovative solutions to local concerns. A noise notification procedure will be discussed and, if found to be warranted, implanted at the site. Such a procedure may include for example:

- Provide information/advance notification to neighbors before and during construction through media such as letterbox drops or meetings;
- Defining activities that are expected to be noisy and their expected duration, what noise mitigation measures are being applied, and when noise respite periods will occur; and
- Upon request, residents will be alerted to upcoming production shots (blasts) via automated telephone notifications (“robo-calls”).

7.2.5.2 *Monitoring*

The staged development of the quarry means that there is scope to monitor noise emissions as the quarry expands and to include additional noise mitigation in the later stages if required to comply with the noise limits at the site boundary.

As required by the NSE Pit and Quarry Guidelines, all blasts will be monitored to ensure overpressure and vibration levels remain within maximum acceptable limits. This monitoring would be used to develop site-specific propagation constants to enable refinement of the blast overpressure and vibration predictions as the quarry develops. In this manner, blast designs can be adopted that comply with the overpressure and vibration limits at sensitive receivers throughout the life of the quarry.

As part of the workplace health and safety program, noise monitors will be attached to workers on a regular basis to measure and monitor noise exposure over an eight hour shift.

At the request of NSE, additional noise monitoring may be undertaken during daytime, evening and night-time during the early operational phase to verify compliance with regulatory guidelines. Methodologies will follow those described in the Nova Scotia Department of Environment and Labour Guidelines for Environmental Noise Measurement and Assessment (NSEL 1990).

The Noise and Vibration Technical Report (**Appendix D**) identifies indicative offset distances between a blast and the ocean to meet the underwater noise and vibration limits defined in Guidelines for the Use of Explosives In or Near Canadian Fisheries Waters (Wright and Hopky 1998). These indicative setback distances will be refined following monitoring of initial test blasts at the site. Depending on their proximity to ocean habitats, these initial blasts may need to be designed to limit their intensity. Initial blasts would identify the site-specific vibration transmission characteristics to enable blast design to comply with the underwater noise and vibration limits.

The Project is expected to have a low adverse residual impact on ambient noise. Table 7.2-3 provides a summary of the residual environmental effects and demonstrates the Project is not likely to have significant adverse effects on Noise and Vibration.

Table 7.2-3:
Residual Environmental Effects for Noise

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction									
Site Preparation, Trucking	A	See Mitigation Section	1	2	3/3	R	1	Increased ambient noise	Not Signif.
Operation of the Temporary Processing Plant	A	See Mitigation Section	1	2	3/6	R	1	Increased ambient noise	Not Signif.
Initial Blasting	A	See Mitigation Section	2	3	3/3	R	2	Increased ambient noise	Not Signif.
Marine Terminal Construction	A	See Mitigation Section	1	1	3/2	R	2	Increased ambient noise	Not Signif.
Marine Construction Vessel Operation	A	See Mitigation Section	1	2	3/2	R	1	Increased ambient noise	Not Signif.
Operation (Full Scale Phase 5)									
Operation of the Permanent Processing Plant	A	See Mitigation Section	1	1	1/4	R	1	Increased ambient noise	Not Signif.
Operation of the Shiploader	A	See Mitigation Section	2	2	5/3	R	1	Increased ambient noise	Not Signif.

Blasting	A	See Mitigation Section	2	3	5/4	R	1	Increased ambient noise	Not Signif.
Marine Vessel Operation	A	See Mitigation Section	1	1	5/3	R	1	Increased ambient noise	Not Signif.
Decommissioning									
Decommissioning activities are expected to be comparable to construction activities. Therefore, the same analyses apply.								Increased ambient noise	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

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

Reversibility:
R = Reversible
I = Irreversible

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

N/A = Not applicable
A = Adverse
P = Positive

7.3 AMBIENT LIGHT

Ambient light was identified in the EIS Guidelines as a potential VC. The Project site is currently undeveloped and night time ambient light conditions are low. As the site is developed into a quarry, artificial light will be introduced in the form of vehicle headlights, work area illumination lighting, and lights installed on the marine terminal to ensure safe navigation. Changes to ambient light conditions have the potential to negatively affect wildlife, including birds from the immediate area as well as those birds from much further away. Increases in night time light levels may also be perceived as a nuisance by local residents.

The lighting design for the quarry has not yet been completed but it is possible to make assumptions about the location and intensity of the site lighting. Site lighting will consider the following:

- Safety of those working on the site;
- Government regulations and design standards;
- Equipment and layouts that minimise the impact of new lighting on the surrounding environment; and
- Equipment and layouts that maximise the efficiency of the lighting system.

Details of ambient light existing conditions on the Project site are presented in Section 6.3.

7.3.1 Boundaries

7.3.1.1 *Temporal Boundaries*

The temporal boundaries for the assessment of impacts upon ambient light begin at the construction phase and continue through the operational phase, ending with the final decommissioning of the quarry. Construction time is estimated at three years, quarry operations are expected to continue for at least 50 years and closure and decommissioning is expected to require an additional two years but may be extended if needed.

7.3.1.2 *Spatial Boundaries*

The spatial boundaries for the assessment of this VC include the Project footprint, adjacent lands to the east and west (the Affected Area - up to and including residents along Half Island Cove and in Fox Island Main) and Chedabucto Bay south of the established shipping lanes.

7.3.1.3 *Technical Boundaries*

Under the Canada Labour Code, the minimum illumination levels required at various workplace locations are directed by the *Canada Occupational Health and Safety Regulations* (SOR/86-304). To the extent that migrating birds may be affected by the Project, the federal *Migratory Birds Convention Act 1994* and the *Species at Risk Act* are applicable.

7.3.1.4 *Administrative Boundaries*

No administrative boundaries were identified for the Ambient Light VC.

7.3.2 Threshold for Determination of Significance

On human receptors the adverse effects of light trespass are due both to an increase in general illuminance that may cause annoyance and may disrupt sleeping patterns, and from the direct view of the light source that can cause glare issues. The adverse effects of light trespass from exterior lighting are influenced by a number of factors:

- The topology of the area. Light trespass is more likely to be perceived as obtrusive if the lighting installation is located above the observer. Lighting installations are usually directed towards the ground and an observer could hence have a direct view of the luminaire.
- The surrounding topography and existing installations. Hills, trees, buildings, fences and vegetation generally have a positive effect by shielding the observer from the light source.
- Pre-existing lighting in the area. Light from a particular light source is seen as less obtrusive if it is located in, or perceived in, an area where the lighting levels are already high, e.g. along roads and near built up areas. .
- The zoning of the area. A residential area is seen as more sensitive compared to commercial areas where high lighting levels are seen as more acceptable.
- Time of use. Clearly light will be seen as being more obtrusive during night time. This is generally considered to be between 11:00pm and sunrise.

A significant impact is defined as direct light trespass that according to the affected resident regularly interferes with the use and enjoyment of nearby residential properties on a permanent basis and/or evidence of unacceptable levels of bird mortality associated with Project lighting (unacceptable levels are defined in Section 7.3.5.1).

7.3.3 Effects of the Project of Ambient Light

7.3.3.1 *Construction*

With the installation of safety lighting, ambient light levels will increase during the construction of the processing plant, associated infrastructure and the marine terminal. Other lighting introduced to the site will come from vehicle headlights moving around the site as well as entering and exiting the site at the intersection with Route 16.

Temporary lighting systems (including portable lights) may be used during construction to illuminate specific areas and ensure the safety of staff.

As vehicles enter and exit the site, vehicle head lights could be aimed in directions other than on the road. The intersection of Route 16 and the quarry access road is approximately halfway between the nearest residences to the east and west. The vegetation at the sides of the road in this area is quite dense so there should be no light trespass from headlights onto the closest buildings.

7.3.3.2 *Operation*

Potential Effects on Residents

In addition to permanent safety lighting and vehicular headlights, ambient light levels will increase during the operation of stockpiles, load-out facility and marine terminal.

The following areas will require new lighting as part of the operational phase of the Project. Included is the minimum illumination required for those areas (taken from the Canada Occupational Health and Safety Regulations (SOR/86-304), Section 6.11).

1. Marine terminal – an illumination of 150 lux[4] is required.
2. Crusher and processing areas – an illumination of 100 lux is required for the immediate area and 50 lux in the nearby surrounding area.
3. Other work areas – While not specifically referred to in the regulations it is likely that these areas will require at least 200-500 lux depending on how each work area is defined.
4. Site Offices – Offices should have an illumination of 100 lux around the exterior of any entrances and 50 lux around other exterior areas.
5. Roadways – These require 20 lux in high activity areas and 10 lux in low activity areas.
6. Storage areas - These require 30 lux in high activity areas and 10 lux in low activity areas.
7. Parking – Open parking areas should have an illumination of at least 10 lux.

The processing plant and stockpiles will be built on the northern side of the site near the coast at 22 metres above sea level (masl). From here, the quarry will be excavated south towards Route 16. Between the lower coastal platform hosting the processing plant and Route 16, the ground rises to 50 masl and to maximum of about 95 masl. This will provide significant shielding from the east southeast clockwise around to the west southwest and should mean that there will be no significant light trespass on any buildings along Route 16.

There are some buildings along the coast that may have direct line of sight to the marine terminal and, to a lesser degree, main work area. From the west (Yellow Rocks/Half Island Cove Road), the topography prevents direct line of sight view to the quarry, processing plant and marine terminal, except for viewers standing directly on the coast and those who may look toward Black Point from the east side of Gaulman Point. From these vantage points, the marine terminal and stockpiles will be visible, but the quarry will be largely concealed behind a vegetated coastal buffer. Lower Half Island Cove Beach on the east side of Gaulman Point is about 2.9 km from the marine terminal.

There are two topographic ridges between the Property boundary and the houses along Half Island Cove Road. These ridges block direct views from these houses to all work areas. The nearest residence (an abandoned trailer currently for sale) is located approximately 750 m from the property boundary and over 900 m from work areas.

[4] Lux is the SI unit of luminance and luminous emittance as perceived by the human eye.

To the east, direct line of sight viewers are located on the east side of Indian Cove along Fox Island Cove Road. Black Point can also be seen from the beach at Indian Cove, located 3.5 km east of the proposed processing plant. From this direction, much of the processing plant, quarry and marine terminal is expected to be shielded from view by Black Point itself (which is not part of the quarry property and which will remain forested), as well as a 30 m wide vegetated buffer left along the coast. It is likely the tallest components of the processing plant (conveyers, tops of stockpiles, and lighting fixtures) may be visible from these eastern viewpoints.

Potential Effects on Fauna

Reflected light is used by animals to collect a wide range of information within their environment. At night, many nocturnal animals use moonlight and starlight to forage for food and detect predators. Objects in the night sky may be used as aids to navigation for migrating birds. Patterns of light and darkness are also used to regulate circadian cycles; to control the behavior of diurnal, nocturnal and crepuscular animals[5]; to determine day length; and as a directional cue for navigation (Gaston *et al.* 2012).

Lighting needed to illuminate working areas and for navigational purposes at the marine terminal can have an adverse effect on migrating birds. Under conditions of poor visibility, nocturnal migrating birds may be attracted to bright lights. Under cloudy or foggy conditions water droplets in the air refract light creating an illuminated area around the lights. Birds that have lost their celestial navigation aids may enter these illuminated areas and become confused possibly resulting in collisions, exhaustion and mortality (JWEL 2004). Environment Canada has noted that in Atlantic Canada, nocturnal migrants and night-flying seabirds (e.g. storm-petrels) are the birds most at risk of attraction to lights. Attraction to lights may result in collision with lit structures or their support structures, or with other birds. Disoriented birds are prone to circling a light source and may deplete their energy reserves and either die of exhaustion or drop to the ground where they are at risk of depredation.

Strong unidirectional or rotating light sources are most likely to create this problem. Flood lights are associated with bird mortality since the strong lighting attracts birds close to the lighted structure where collisions occur. Navigational beacons may also affect birds since this lighting is typically positioned at heights where night migrating birds are more likely to encounter them. Solid or pulsing red navigation beacons have the strongest ability to attract birds while slow strobe lights have the weakest ability (JWEL 2004).

Decreasing the duration of lighting may alleviate some but not all impacts on nocturnal and crepuscular animals, since peak lighting demand periods often coincide with the peak activities of these species (Gaston *et al.* 2012). Reducing lighting trespass will maintain shadows in otherwise well-lit areas, providing dark refuges that animals can make use of. Decreasing lighting intensity will limit both skyglow (thus reducing the risk to migrating birds) and reduce the surface area impacted by high-intensity direct light. Lowering light intensity also reduces the trespass of reflected light into otherwise unlit areas. Flexible lighting control systems can also be used to mitigate ecological impacts by providing dark periods of sufficient duration for normal ecological function (Gaston *et al.* 2012).

[5] Diurnal animals are most active during the day; nocturnal animals are most active at night; crepuscular animals are most active at dusk and dawn.

7.3.3.3 *Decommissioning*

The effects on ambient light during the decommissioning phase of the Project are anticipated to be similar to construction.

7.3.4 Mitigation and Monitoring

The lighting design will aim to mitigate light trespass from the site and minimise the increase in ambient lighting. At this early development stage mitigation techniques are relatively easy to incorporate into equipment design and work area layouts. In order to achieve the best performance outcome for the quarry while having a minimal impact on the surrounding environment both general and site specific mitigation measures are described.

7.3.4.1 *General Mitigation*

The following general mitigation methods can be incorporated into the detail design to minimise adverse effects of the lighting installations.

- Use luminaires that are aimed to minimise light trespass, e.g. full cut off luminaires where no light is emitted above the horizontal plane (where their use does not compromise worker safety). Less trespass light means that more of the light output can be used to illuminate the area and a lower power output can be used. The energy consumption for the fitting can thus be reduced without decreasing the illuminance of the area (**Figure 7.3-1)**.

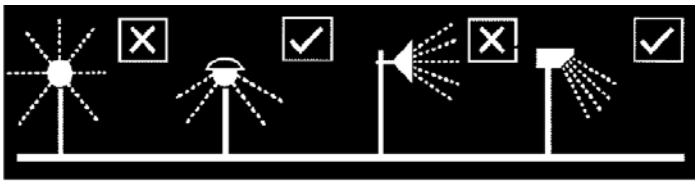

Figure 7.3-1:
Minimise Light Trespass

- Do not waste energy and increase light pollution by over-lighting; use only the lights needed to meet local lighting objectives.
- Keep glare to a minimum by keeping the main beam angle less than 70°, where practical (**Figure 7.3-2**).

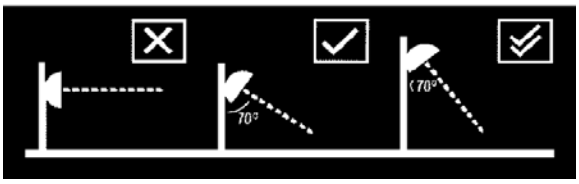

Figure 7.3-2:
Minimise Glare

- Use floodlights with asymmetric beams where possible.
- Direct the site lighting away from sensitive locations such as residential properties.
- Where possible position lights as far away from site boundaries as practical.

7.3.5 Site Specific Mitigation

Bird collisions with Project lighting and subsequent mortality are expected to be rare but if it occurs, it would not likely have significant effects on migrating bird populations. Even so, efforts will be made to reduce the effect of lighting on migrating birds. Lighting requirements at the marine terminal will be more fully defined at later stages in the Project design. Where possible, lighting will be kept at low heights to reduce the chance of illuminating migrating birds as they pass through the area. Pole mounted lighting will be pointed downward and shielded from the top and sides. To the extent possible, low intensity lighting will be used rather than high intensity lighting.

In an effort to minimise the light trespass from the site and the increase in ambient light, the following mitigation measures will be employed where warranted and where their use does not compromise worker safety:

- As noted above, all lighting will be aimed down as much as possible and light sources will be shielded to prevent light escaping above the horizontal plane (known as full cut off luminaires). Lights will also be kept as close to the required area as possible.
- Lights placed on the outside of the quarry work areas will be kept as low as possible and correctly aimed to prevent lighting areas where it is not needed.
- Lights for the marine terminal will be chosen and aimed to prevent where possible light shining directly into the water. Marine terminal lighting will be controlled so that minimal lighting will be used when the terminal is not in operation.
- If lighting is required at the perimeter of the site it will be aimed inward to prevent off site light trespass. Full cut off luminaires will be considered to reduce and prevent off site light trespass.
- Temporary lighting used during construction will be focussed on the intended work area and will be shielded to minimize spillage.
- To reduce night time ambient lighting effects, operations will be routinely monitored so that lighting can be switched off by work area when it is not needed.
- Consideration will be given to using light sources such as directional LEDs to give a better spread of lighting and reduce the overall intensity of the lighting systems.
- The emission spectrums of light sources can vary depending on the bulb type; certain lights can have a greater effect on some species of wildlife. Consideration will be given to selecting lights that have a lesser effect on the wildlife to help reduce lighting effects on nocturnal species.

7.3.5.1 *Monitoring*

Should complaints regarding Project lighting be received at the site office, monitoring of site activity will be undertaken to allow for reduction of light levels in non-active work areas, and/or redirection of lighting installation. In addition to the Complaints / Response Protocol established at the site office, the CLC will provide a forum to register concerns and discuss them with Project representatives.

Routine site monitoring as described in the Environmental Management Plan will include maintaining records of bird mortality so developing issues related to lighting can be identified.

The Environmental Management Plan will include instructions on implementing the protocol "*Best practices for stranded birds encountered offshore Atlantic Canada*" (EC 2014e) for responding to avian strandings related to activities in the marine environment. It is noted that a permit is required to implement this type of protocol; prior to proposed activities, the proponent will contact EC-CWS (email: Permi.atl@ec.gc.ca) to obtain a permit application form.

In the event of the mortality or injury of ten or more migratory birds in a single event, or of any number of species at risk birds, EC-CWS will be notified within 24 hours. Notification will include specific details about the event, including the name and location of the facility, number and species of birds affected, meteorological conditions during the previous night(s), status of lights/flares, and details of any other factor which may have influenced the event. If significant lighting-related bird fatalities are recorded, EC-CWS will be consulted to discuss additional mitigation measures.

7.3.6 Residual Effects and Significance

The ambient lighting on the site will be increased during the construction and operation of the quarry. This may be noticeable at first since the site is currently undeveloped and the only ambient lighting is of natural origin. Increases in ambient light levels and associated effects of light increases on nearby residents and wildlife can be minimized through effective lighting design and lighting layout, combined with ongoing monitoring of site activity to allow for reduction of light levels in non-active work areas when needed.

It is unlikely that surrounding properties and buildings will experience significant adverse effects due to light trespass from the site or vehicle headlights entering and exiting the site. This is largely due to the distance between the properties and the site as well as shielding from the local vegetation and natural topographic and landscape features.

The result of the effects assessment for the ambient light VC is provided in Table 7.3-1: the Project is not likely to have significant adverse effects on Ambient Light.

Table 7.3-1:
Residual Environmental Effects for Ambient Light

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction									
Light trespass from the temporary plants	A	See Mitigation Section	1	1	3/3	R	2	Increased ambient light	Not Signif.
Light trespass from the construction of the marine terminal including marine construction vessel operation	A	See Mitigation Section	1	2	3/6	R	2	Increased ambient light	Not Signif.
Operation (Full Scale Phase 5)									
Light trespass from the permanent plant	A	See Mitigation Section	1	2	5/6	R	2	Increased ambient light	Not Signif.
Light trespass from other site lighting including the marine terminal	A	See Mitigation Section	1	2	5/6	R	2	Increased ambient light	Not Signif.
Marine Vessel Operation	A	See Mitigation Section	1	1	5/4	R	2	Increased ambient light	Not Signif.
Decommissioning									
Decommissioning activities are expected to be comparable to construction activities. Therefore, the same analyses apply.								Increased ambient light	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

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

Reversibility:
R = Reversible
I = Irreversible

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

N/A = Not applicable
A = Adverse
P = Positive

7.4 GEOLOGY, SOIL AND SEDIMENT QUALITY

7.4.1 Overview

There is no evidence to suggest that contaminated soils or sediment are present on the site. Geology, Soil and Sediment quality was identified as a VC primarily due to the anticipated disturbance of potentially acid generating rock, as well as concerns expressed by fishermen with respect to the discharge of sediment-laden water from the Project site and the consequent effects on lobster and their habitat. Sediment quality is described here while marine water quality is described in Section 7.6 and effects on marine species in Section 7.11.

7.4.2 Boundaries

7.4.2.1 *Temporal Boundaries*

With respect to the disturbance of potentially acid generating rock, Project-related effects to Geology, Soil and Sediments may occur during the construction phase when this rock is originally exposed, and the during the early operations phase until the rock stabilizes in an oxygenated environment. With respect to potential discharge of sediment-laden water (and by extension, to offshore sediment quality), potential Project-related impacts may occur during construction, operation and decommissioning.

7.4.2.2 *Spatial Boundaries*

Project-related effects are not expected within the Project Area (i.e., within the Property boundary) but may be observed in the marine environment immediately offshore (the Affected Area). The extent of the Affected Area is defined by the zone within the marine environment where elevated concentrations of acidified surface water and/or suspended sediment may be measured above background values, or in the case of suspended sediments, above values that are typically observed during storms and other high wave events.

7.4.2.3 *Administrative Boundaries*

In Nova Scotia, activities that may result in acid rock drainage, as well as the management of excavated acid generating rock itself, are regulated by the *Sulphide Bearing Materials Disposal Regulations*. Additional guidance is provided in Guidelines for Development on Slates in Nova Scotia (NSE and EC 1991).

There are no marine sediment quality criteria as such. Maximum values for total suspended solids in water in the marine environment are provided in the CCME (1999) Water Quality Guidelines for the Protection of Aquatic Life (Marine). The Nova Scotia Pit and Quarry Guidelines also provide liquid effluent discharge criteria for suspended solids (NSEL 1999). Please see Section 7.6 for a full description of these criteria and their applicability to the Black Point Project.

7.4.2.4 *Technical Boundaries*

Although a number of rock samples from the Project site have been analyzed for sulphur content to determine acid generating potential (Appendix B), a sampling program as outlined in

the *Sulphide Bearing Materials Disposal Regulations* has not been completed due to difficulty in accessing the coastal area of this undeveloped property. Additional sampling and geotechnical study is planned once access is available, as described below. For the purposes of this assessment, it is assumed that the Halifax Formation rocks are potentially acid-generating and thus will require appropriate management.

Given anticipated results of the topographic modifications on surface drainage patterns described below, no sediment dispersion modeling in the marine environment was deemed necessary to predict environmental effects on marine sediment quality.

7.4.3 Threshold for Determination of Significance

Rocks that exhibit total sulphide content in excess of 0.4%, and which lack other minerals that can neutralize acidity as measured through chemical analysis, are considered potentially acid generating. A significant effect would be an accidental release of low pH, acid rock drainage (pH <4.5) to the marine environment.

With respect to sediment quality, a significant effect would be an accidental release of total suspended solids in excess of the maximum values listed in the CCME (1999) Water Quality Guidelines for the Protection of Aquatic Life (Marine) and/or the Nova Scotia Pit and Quarry Guidelines (NSEL 1999).

7.4.4 Effects of the Project on Geology, Soil and Sediment Quality

The granite rock that will be quarried for aggregate is not acid generating. In contrast, Halifax Formation sedimentary rocks that underlay a small portion of the site (approximately 11.8 of 28.2 ha, see Figure 3.0-26) near the coast may generate acid and/or leach metals when exposed to oxygen. Excavation of Halifax Formation rocks will be required in preparation for the installation of the processing plant and aggregate stockpiles. Five of the six surface samples of rocks collected in the coastal zone and analyzed in 2011 had a sulphide content below the 0.4% threshold. One sample had a sulphide content above the threshold (i.e., 0.935%); however, the material was found to contain some neutralizing capacity with a pH of 7.4. At this time, it is assumed that disturbance of this rock may leach metals and/or generate acid, which if allowed to drain naturally to the marine environment, may negatively affect water quality in the local area. Despite this, the disturbed surface area will be relatively small (i.e., 11.8 ha). Surface water runoff will collected in stormwater ponds where it will be retained for use as wash water and further diluted by precipitation, runoff from non-acid generating areas, and runoff from non-disturbed areas. Given this, water in the stormwater ponds is not expected to be acidic or contain metals. In the event an accidental release to the marine environment occurs, rapid dilution in the nearshore will result and so no significant effects to marine water quality or biota are expected.

As noted, sedimentation in the marine environment has been identified by fishermen and nearby coastal residents as a potential concern, since the discharge or runoff of sediment-laden water during construction and operation may have harmful effects on nearby lobster habitat or lobster life stages. In addition, residents and fishermen have expressed concern regarding the transport of suspended sediment along the shore and into neighbouring bays.

Only a small portion of ground cover on the coastal platform will be disturbed during initial construction (20.7 ha – **Figure 3.0-26**). This limited disturbance, combined with the

maintenance of a 30 m wide buffer at the coast and the use of standard construction erosion and control measures will help prevent sediment laden runoff from entering the marine environment. More importantly, during the ground preparation for the processing plant and product storage areas the ground surface will be contoured so that storm water runoff and process water used to wash the aggregate will flow back into the property and be collected in sumps or impoundments. Based on this design significant effects to the marine environment are not anticipated.

There is a risk of small amounts of aggregate spillage during the transfer of material from the terminal onto the ships. This is not anticipated to have significant effects on the marine environment since the aggregate is washed to remove fine rock fractions, thus minimizing the sediment that would be released to the environment in the event of a spill. The material that would be released during a spill will consist of granite, a rock type common in the area.

7.4.5 Mitigation & Monitoring

7.4.5.1 *Mitigation*

A geotechnical drilling and sampling program will be required for the detailed design of processing plant foundations. The sampling program will define areas that contain rocks that are potentially acid generating when excavated. Standard mitigation measures used to manage acid generating rock will be applied. This will include controlling and containing drainage, and managing excavated rock to prevent further oxidation. This may include placing the excavated rock underwater to prevent oxidation and acid generation. This option will be explored with NSE and DFO if additional sampling and analysis demonstrates the presence of significant volumes of acid generating rock.

These mitigation and control measures will be described in the site-specific Environmental Management Plan. The Environmental Management Plan will also describe standard construction best management practices and will include Erosion and Sediment Control Plan and a Stormwater Management Plan to describe erosion control measures and surface water collection and control at the site.

Initial site preparation activities require the construction of stormwater management ponds and a protective berm along coast, inside a 30 m undisturbed coastal buffer. This is followed by contouring and sloping of the processing plant/stockpile area (i.e., the entire coastal platform, excluding a 30 m coastal buffer) so that surface water flows south to settling ponds rather than north to Chedabucto Bay. Once quarry expansion begins in a southerly directly, a sump pit will be excavated to collect water within the quarry. The water collected will be used for dust control and aggregate washing. The capacity of the sump pit will be adequate to contain the collected water so that discharges due to normal operations will not be required. There is the possibility that as a result of extreme storm events a portion of the water would need to be discharged following settling and clarification. In these events, the discharge will be fully controlled and will be tested to ensure it meets applicable water quality requirements prior to discharge. Given these topographic modifications and the excessive storage volumes thus created, the possibly of accidental, unmonitored discharges is essentially eliminated.

7.4.5.2 *Monitoring*

To ensure that discharges meet maximum limits listed in the applicable guidelines described above, as well as in the provincial operating permit that will be required for this Project, stormwater pond discharges will be monitored on an as-needed basis, as stipulated in the provincial permit.

7.4.6 Residual Effects & Significance

With the use of standard mitigation measures in the event that acid generating rock is present, no significant adverse residual effects are likely with respect to acid drainage and sedimentation in the marine environment. Residual effects are summarized in Table 7.4-1.

Table 7.4-1:
Residual Environmental Effects for Geology, Soils and Sediment

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction									
Preparation of the plant area; impacts to marine water quality from acid rock drainage	A	See Mitigation Section	1	1	1/1	R	1	Surface water discharge to the marine environment	Not Signif.
Preparation of the plant area; impacts to marine water quality from sediment discharge	A	See Mitigation Section	1	1	1/1	R	1	Surface water discharge to the marine environment	Not Signif.
Operation (Full Scale Phase 5)									
Discharge from the sedimentation ponds	A	See Mitigation Section	1	1	1/1	R	1	Surface water discharge to the marine environment	Not Signif.
Decommissioning									
Decommissioning activities are expected to be comparable to construction activities. Therefore, the same analyses apply.								Surface water discharge to the marine environment	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

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

Reversibility:
R = Reversible
I = Irreversible

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

N/A = Not applicable
A = Adverse
P = Positive

7.5 GROUNDWATER RESOURCES

7.5.1 Groundwater Resources

Groundwater extracted from dug and drilled wells is used for drinking water purposes by the nearest residents living to the east, west and south of the Project site. A total of 23 residences are located in the vicinity of the Project (within 2 to 3.5 km); of these, 17 employ dug wells while 6 employ drilled wells. No water wells are installed in the granite rock that will be quarried.

Three distinct hydrostratigraphic units have been identified in the vicinity of the Project: (1) the granite bedrock present within the Property boundary and extending outside the boundary to the limits of the local granite pluton[6] The limits of the granite pluton are shown on **Figure 6.1-6**. A certain degree of connectivity is expected between the water bearing fractured granite and (2) the fractured metasedimentary bedrock that surrounds the local granite pluton, and (3) a relatively shallow, unconfined aquifer situated within the granular glacial till overburden where present overlying the bedrock.

7.5.2 Summary of Conceptual Hydrogeologic Model

The site is characterized by the topographic high created by an erosion resistant granitic pluton, some 95 m above sea level and extending to depth. This feature was intruded up into metasediments of the Meguma Formation and is the target for aggregate extraction. The metasediments surround the site and granite and host six residential wells that extend into the bedrock. Seventeen shallow private wells tap the more permeable glacial till overburden. Wells are found from 1.0 to 3.5 km away, the nearest being 815 m to the southwest.

Groundwater quality in the two bedrock types (granite and metasediments) is similar with the exception of higher levels of dissolved metals (e.g., iron, aluminium and lead) in the granite. As noted there are no water supply wells in the granite. Naturally occurring uranium is present in the granite at concentrations consistent with distribution of this element in granite rock formations throughout Nova Scotia (MacDonald *et al.* 1992; Ford and Ballantyne 1983). Arsenic is present in the groundwater in both the granite and the metasediments. The metals present in the bedrock are entirely from natural mineralization. The overburden groundwater is much more dilute, reflects local recharge of meteoric water, and exhibits a salt signature close to the marine shore (Section 6.1).

The relatively low permeability of the bedrock (even when fractured) at this site restricts surface water movement to depth and is responsible for the high water table, which is generally never deeper than 6 m below ground surface. Groundwater recharge occurs in all the upland areas of the site, with lateral discharge occurring in localized low areas and in some creeks. Horizontal groundwater flow is outward from the granite, primarily along the upper more weathered bedrock. Fracture frequency analysis shows there is a stronger presence of fracturing in the upper granite bedrock, typically above about 40 m. This line is in fact gradational and fracturing occurs throughout the geologic profile. Stream water quality shows little influence of the bedrock. The distinct difference in the metals concentrations between the granite and the metasediments indicates there is little mixing of groundwater between the two rock types.

[6] A pluton is a discrete, well defined body of igneous intrusive rock.

There will however be exchange of the shallow groundwater along the boundary between the two units, based on the higher degree of fracturing at the bedrock surface. All local water wells are very far away from this boundary and there are many intervening wetlands and creeks that act as discharge zones.

From a conceptual model point of view most groundwater recharge joins the shallow unconfined groundwater system and moves laterally to onsite low areas and ultimately offsite via creek systems. An analysis of the water budget (**Appendix A)** compares the average annual recharge to the ability of the ground to convey it. The groundwater flow was calculated based on measured hydraulic conductivity, lateral hydraulic gradients and the depth of fracturing (and thickness of overburden where present). The "water-in to water-out" balanced very well for this conceptual model. The fractured portion of the granite can easily convey recharge falling on the pluton to wetlands and creeks located at lower elevations. The overburden on the flatter lands surrounding the pluton can also convey a large portion of the infiltrating precipitation, and the fractured bedrock below can accommodate the remainder.

As described in **Appendix A**, a conservative approach for the impact assessment assumes an elevated hydraulic conductivity (1.2×10^{-7} m/s) extending to depth throughout the quarry. Under these assumptions the drawdown from the completed quarry will be felt at a distance of 400 m or less from the quarry face. Realistically, the average hydraulic conductivity is likely less than the upper range assumed above, and fracture density (and hence transmissivity) decreases significantly at depth, suggesting drawdown is not likely to be observed at 400 m from the quarry face.

7.5.3 Boundaries

7.5.3.1 *Temporal Boundaries*

Changes to groundwater will occur during the construction phase but are expected to be more pronounced during quarrying, especially during the latter phases when the quarry is approaching maximum lateral extent and depth. The finished (closed) quarry will continue to affect local groundwater flow patterns into the future.

7.5.3.2 *Spatial Boundaries*

Project-related changes to localized groundwater can be expected within the Project Area (i.e., within the Property boundary) since granite will be quarried within this area. Effects of granite removal on the groundwater regime may extend to areas immediately offsite (the Affected Area). The extent of the Affected Area is defined by the maximum limit of the drawdown cone at full quarry build out. A drawdown cone is defined as the area where the water table is lowered due to the quarry, and is typically conical in shape with the degree of drawdown reducing exponentially away from the quarry. The drawdown cone is constrained by the rate of recharge in the Affected Area, may be irregularly shaped depending upon geologic conditions, and does not extend great distances in these types of rocks. In this case, the drawdown cone will not extend to the nearest drilled well (please see below) and so the Affected Area falls between the property and nearest residence.

7.5.3.3 *Administrative Boundaries*

Potable groundwater quality and surface or groundwater water takings greater than 23 m^3/day are regulated by the Province of Nova Scotia. For municipal water supply systems, the province in 2000 adopted the Guidelines for Canadian Drinking Water Quality to ensure that potable water meets national water quality standards (HC 2012). Large scale water takings (much larger than required for residential use) are regulated in the provincial *Activities Designation Regulations*. Water taking is permitted as long as an adverse unmitigable impact does not occur.

7.5.3.4 *Technical Boundaries*

Although preliminary drawdown tests were conducted on boreholes installed in the granite within the limits of the property, these holes were not designed as groundwater monitoring wells but rather to gather samples of the granite resource. Because the boreholes were not screened to restrict groundwater flow into the well, it is not possible to precisely determine the depths in which groundwater was entering the borehole. In addition, the relatively narrow diameter holes did not permit the use of a sufficiently powerful pump to fully stress the water bearing fractures. Despite this, data collected during the summer work programs provide sufficient information to confirm the conceptual model of the local groundwater system, and provided reasonably reliable data regarding the hydrogeological characteristics of the granite aquifer.

With respect to the residential wells, very little information is available regarding the construction of dug and drilled wells. This is not seen as a limitation, given the distance away of the wells and the intervening features that dictate a lack of connection with the site.

Very few drilled water supply wells are present in the vicinity of the Project Area, and with a single exception, all are found east or west of the Property, at a minimum distance of 2.7 km. The lack of groundwater wells within the granite, combined with the paucity of drilled wells in the vicinity and their distance from the Project site, limits the applicability of data collected at these residential wells when investigating the zone near the pit where Project impacts might occur.

The sheer size of the site dictates that investigation points are widely spaced. However the similarity of conditions and uniformity of findings where examples have been investigated allows the analyst to extrapolate conditions with minimal risk.

7.5.4 Threshold for Determination of Significance

As noted, groundwater quality and quantity contributes to local ecological systems as well as to potable groundwater supply. With respect to local ecological systems, a significant effect is defined as a decrease in groundwater supply to Affected Areas by 20% and/or an impairment in water quality such that groundwater discharge to surface waterbodies no longer meets Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 1999 as updated).

With respect to potable water supply, a significant effect is defined as any decrease in water availability caused by the Project and/or impairment to water quality such that the potable water no longer meets the criteria listed in Guidelines for Canadian Drinking Water Quality.

7.5.5 Effects on Groundwater

Groundwater can play an important role in sustaining streams and wetlands and the habitats and wildlife that depend on them. Project activities also have the potential to affect groundwater supply and quality outside of the Property boundary. Groundwater is also a potential pathway that can transport contaminants offsite, although in this instance, groundwater will be flowing *towards* the site.

The Project will remove granite from within the Property boundaries, ultimately creating a pit approximately 130 m deep. Once pit development begins, surface precipitation that originally landed on the granite, infiltrated surface fractures, and flowed laterally to help recharge wetlands and lakes near the Property boundaries, will be redirected into the pit and collected in the main sump. At the same time, granite will be removed from below the groundwater table and groundwater inflows to the pit will also be collected in the main sump. Initially, the redirection of surface and groundwater will be minimal since the pit will be small and shallow. As the pit develops over time this effect will become more pronounced as more surface and groundwater is diverted away from existing flow patterns and into the pit. Ultimately, the pit itself acts to draw groundwater from the surrounding granite, since the empty pit represents a region of low pressure towards which groundwater will naturally flow.

Despite this, the magnitude and environmental effects of the redirection of surface and groundwater are expected to limited and localised. Currently, precipitation falling on 54.7% of the site's surface area is directed by topography to the north, and is lost to Chedabucto Bay through surface water runoff and groundwater flow. This accounts for all precipitation (minus evapotranspiration) within catchment areas F1-F4, M1 and N1-N6 (**Figure 6.2-1**). Some of these catchments, such as F2 and M1, provide surface water and shallow groundwater recharge to Fogherty and Murphys Lake, and the wetlands associated with these lakes before discharging into Chedabucto Bay. Flow from the remaining 45.4% of the site is directed south to tributaries of Reynolds Brook. The portion of the site that will be developed into the quarry contributes 18% of the flows within catchment of Reynolds Brook above Hendsbee Lake will be developed into the quarry. At full development, this surface water will be captured in the pit and will no longer flow to Reynolds Brook.

Under these circumstances, it can be seen that the precipitation falling on roughly 50% of site's surface supports local, rather than regional, ecological features and functions (i.e., on-site and adjacent wetlands and waterbodies) before discharging into the ocean. Removal of granite will, over time, affect local groundwater flows to the north, and by extension, these local wetlands and waterbodies will be affected by the loss of surface water and shallow groundwater recharge.

Precipitation falling on the remaining 50% of the site flows south and contributes to Reynolds Brook. This includes that portion that infiltrates into the groundwater system. However, this overall contribution is small compared to the size of the catchment area that drains to Reynolds Brook. Even at full pit build out, with the maximum amount of surface water diverted into the pit and away from Reynolds Brook is only about 18% of the total Reynolds Brook catchment area measured at the inflow to Hendsbee Lake. The lands adjacent to the pit will continue to contribute locally to offsite watercourses and wetlands; however base flow in these watercourses will be lower at the Property boundary. Given the size of the catchment area removed (portions of subcatchments S1 and S3 totalling 106 ha) compared to the overall watershed that drains to the Hendsbee Lake to the southwest (578.5 ha) is relatively small

(18%), the overall Project impact on groundwater flow to the south, and by extension to downstream features and functions in a southerly direction is considered to be not significant.

With respect to potential Project effects on the localised surface water aquifers that support dug wells, no Project-related impacts are expected. This is because these aquifers are fed by surface precipitation falling within the subcatchment that hosts the wells and not by precipitation falling on areas that will be developed for the Project. As shown on **Figure 6.2.1**, none of the subcatchments affected by Project activities host dug wells and so no effects are possible.

For those who use drilled bedrock wells to obtain potable groundwater, the conceptual groundwater model, supported by groundwater quality data and initial hydraulic conductivity testing, demonstrates that Project-related impacts to potable groundwater supply and quality will be negligible. This can be seen by considering the following:

1. There is no potable groundwater wells drilled in the granite.

2. Drilled wells within the highly fractured metasedimentary rocks access a chemically different groundwater than the one present within the granite (the bedrock unit that will be affected by the Project). These aquifers are not only chemically different, they are structurally different. While certain connectivity can be expected at the boundaries between the granite and metasedimentary bedrock, the fact that the water chemistry is different indicates that the connectivity is minimal and slow to occur.

3. Drill logs indicate that the granite does not exhibit a great number of fractures at depth and so water movement within is expected to be slow. Even at full pit build out, a thick barrier of granite (over 400 m wide) will remain between the pit wall and nearest metasedimentary bedrock where drilled wells are located (even further away). This thick barrier helps to isolate Project-related effects within the granite from affecting the aquifer tapped by wells in the metasedimentary bedrock.

4. The nearest drilled groundwater well is located 815 m from the 50-year pit boundary, far outside of the maximum potential drawdown cone resulting from the pit (400 m); the next nearest drilled well is more than 2.5 km from the pit boundary. The sheer distance provides a significant measure of security for drilled wells in the vicinity of the Project.

5. As noted, because the groundwater movement within the granite is expected to be limited, no groundwater dewatering will be needed to prevent groundwater inflow into the pit (inflows will be simply collected in the sump). The lack of active dewatering wells means that the cone of influence is limited the zone caused by passive drainage into the pit.

Together, these factors demonstrate that impacts to groundwater feeding nearby dug and drilled wells will be not significant.

7.5.6 Mitigation & Monitoring

7.5.6.1 *Mitigation*

With respect to potential effects on nearby groundwater users, no mitigation measures are proposed at this time since no effects are predicted. In the event that unexpected impacts are detected in the groundwater monitoring program (described below), mitigation measures can be

implemented as required, depending on the nature of the impact. Such measures may include for example, provision of drinking water or artificial recharge near affected ecologic features. In addition, as described in more detail in Section 7.8, wetland and watercourse alteration permits will be required in advance of any damage to these features. The permitting process requires that damaged wetlands are replaced elsewhere through a Wetland Compensation Plan; if this is not feasible or desirable, then other forms of compensation may be considered.

7.5.6.2 *Monitoring*

An adaptive groundwater monitoring program is proposed for the life of the quarry, or until it can be conclusively demonstrated that the quarry will have no measurable effects on potable water quality or quantity. A total of ten pairs of wells may be monitored over the life of the Project; the program would use newly installed wells as well as existing boreholes are present on the site. The wells would be installed over time as the quarry expands, rather than all at once. As the results become known and actual quarry drawdowns compared against predicted values, monitoring well locations can be optimized or eliminated and monitoring frequency reduced if no effects are observed. The groundwater monitoring program is described in more detail in **Appendix A.**

Each groundwater monitoring station would consist of at least a pair of drilled monitoring wells into the bedrock. One of the two wells would be equipped with a water level monitor in the upper 10 m of bedrock (the weathered zone), while the second well would be drilled to the anticipated final quarry depth. Packer testing would be used to select an appropriate permeable horizon within the deeper well to host a water level monitor. If the overburden is found to be substantive and water bearing, a shallow standpipe would be installed in the overburden for monitoring purposes.

The first two sentry well pairs to the south and east of the five year quarry face would be drilled in year zero to establish and monitor the drawdown condition to the south and east of the quarry face, since quarry expansion between years zero and five will occur in the south and easterly directions. If drawdown effects are observed in the eastern well, a third well pair would be installed in year three or four at 400 m east from the quarry face to again test the predicted drawdown condition. Should no effects be measured at 50 m, then no wells would be required at 400 m.

All groundwater monitors would be tested for field permeability for comparison to the original studies. Additional well pairs to the south and west would be installed progressively over the years in keeping with quarry expansion and depending on results of previous well testing, as shown in **Appendix A**.

Groundwater monitoring would consist of seasonal (quarterly) water level measurements plus the use of dataloggers in key sentry wells in line with residential wells. Since no impacts are predicted on private wells over a kilometre away and there is a high level of confidence with this prediction, no private well monitoring program is proposed at this time. However, the groundwater monitoring program is adaptive and if drawdowns at the sentry wells were greater than predicted, additional sentry wells could be added and/or a private well monitoring program could be instituted if deemed necessary following discussions with NSE. Once seasonal baseline conditions (water quality and water level fluctuations) are established the results would be used to determine future seasonal monitoring frequency.

Two baseline water samples per year would be collected, one each in the wet and dry seasons. Samples would be analysed for a basic suite of water quality parameters. Water quality samples would be taken again if/when quarry effects are observed in the sentry wells to determine if the drawdown has had adverse effects on water quality. The need for future water quality sampling would be re-evaluated based on these initial results.

Each well location would be monitored seasonally for a minimum of two years to establish variations over differing meteorological conditions. At the end of two years, the results of program would be discussed with NSE to determine if changes to monitoring frequency and future well locations are warranted.

The monitoring of ground-to-surface water interaction will be achieved using the existing shallow drive point piezometers located in key wetlands plus in Fogherty and Murphys Lakes. The objective of this program is to establish if there is a drying out of wetlands from their baseline conditions. Water level monitoring would be undertaken at the same frequency as in the groundwater monitors but no water samples would be taken. This methodology is non-intrusive to the ecologic features and largely employs drive point piezometers already in place.

In summary, the adaptive groundwater monitoring approach is designed to verify the drawdown predictions described above and in **Appendix A**. It will be progressively implemented as the quarry expands over time and has the additional advantage of being adaptive and flexible, in terms of well locations and monitoring effort, to initial results. This in turn results in a groundwater monitoring program that is reflective of actual quarry expansion and measured Project effects on groundwater.

7.5.7 Residual Effects and Significance

Once the quarry is completed the excavation will be allowed to flood and equilibrate with the existing water table. A residual drawdown cone will result. The depth of the flooded area below the present water table is about 75 m, implying a 300-400 m wide drawdown cone of irregular shape. No residual effects on local wells are predicted (the nearest drilled well is 815 m from the 50-year pit face). Wetlands and watercourses in the 300-400 m area may be affected by some form of depletion by leakage of water out through the groundwater. The significance of this will be in the form of a transition of vegetation types from wetland to upland around the margins of the wetlands closest to the pit, with the effect receding with distance from the pit. Residual effects are summarized in Table 7.5-1.

Table 7.5-1:
Residual Environmental Effects for Groundwater

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction and Operation									
Quarry expansion over 50 years; reduction in groundwater recharge to offsite surface water features; changes to water quality	A	See Mitigation Section	1	1	5/6	R	1	Limited reduction in groundwater recharge to offsite surface water features	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

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

Reversibility:
R = Reversible
I = Irreversible

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

N/A = Not applicable
A = Adverse
P = Positive

7.6 MARINE AND SURFACE WATER RESOURCES

7.6.1 Overview

Surface Water Resources including watercourses and lakes on and immediately adjacent to the site are considered to be a VC because they sustain aquatic and support terrestrial ecosystems, convey stormwater, and can either recharge groundwater resources or drain excess groundwater away from an area. Marine water quality may be negatively affected by sediment laden water in the form of discharge or stormwater runoff. Acid rock drainage generated from the disturbance of Halifax Formation rocks may also affect marine water quality. Good quality water is essential to the wellbeing of a large variety of marine organisms, and is also critical to the long term success and sustainability of the commercial fishery.

Potential impacts of the proposed quarry development upon the baseline hydrological regime are twofold. Firstly, the development may impact upon the baseline hydrological regime by increasing or decreasing flows to, or water levels within surface water resources. This in turn may impact upon established aquatic ecosystems, or (during extreme events) additional runoff may increase the risk of flooding within the downstream environment. Secondly, the development may impact upon the quality of surface water which may in turn affect established aquatic ecosystems.

Details of potential impacts to wetlands are presented in Section 7.8 (Wetlands), while anticipated effects to freshwater and marine species and habitats are described in Section 7.10 and 7.11, respectively. Section 7.4 (Geology, Soil and Sediment Quality) addresses discharges to the marine environment from acid generating rock and sediment-laden stormwater.

7.6.2 Boundaries

7.6.2.1 *Temporal Boundaries*

The temporal boundaries for the assessment of impacts upon surface water resources are the construction phase (two to three years) and the operational lifetime of the development (50 years). The impacts of climate change have been considered up to 70 years into the future.

7.6.2.2 *Spatial Boundaries*

The spatial boundaries used for the impact assessment are local (within the site boundary called the Project Area), extending to surface watercourses immediately adjacent that receive drainage from the Project site (the Affected Area). In addition, a more regional boundary is described, which includes potential effects to downstream watercourses within 2 km of the property boundary, provided these watercourses currently receive drainage from the site. In this case, only Reynolds Brook and Hendsbee Lake to the south are located within this regional boundary.

7.6.2.3 *Administrative Boundaries*

The Nova Scotia *Contaminated Sites Regulations* refers to a number of Ministerial Protocols which include numerical Environmental Quality Standards (EQS). These Standards are

applicable for comparison of analytical results of any spills of petroleum hydrocarbons which may occur on the property.

The Canadian Environmental Quality Guidelines published by Canadian Council of Ministers of the Environment (CCME) are also applicable (i.e., CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, both freshwater and marine – CCME 1999).

The Nova Scotia Pit and Quarry Guidelines also provide liquid effluent discharge criteria that are applicable to this Project, in this case for suspended solids (NSEL 1999).

7.6.2.4 *Technical Boundaries*

No numerical or quantitative modeling was undertaken to assess the impacts of the development on baseline water quality, instead a qualitative assessment is presented. No technical boundaries were identified for the Surface Water Resources VC.

7.6.3 Threshold for Determination of Significance

Water Quantity

The quarry development has the potential to impact upon the baseline hydrology in the following ways:

- Mean Annual Runoff – As noted, alteration of topography / drainage routes, removal of topsoil / vegetation, and use of water for processing may impact the volumes of runoff discharged from the site, thereby affecting downstream flow-dependent receptors such as streams and wetlands. A significant impact is defined as a predicted change in the mean annual runoff within any off-site watercourse, or flow into any water body, which changes by 20%.
- Peak Flow – Project-related alterations to topography and drainage may increase the peak storm flow discharged from the site thereby increasing the risk of downstream flooding. A significant impact is defined as a predicted change in peak flow of water discharged from the site which will measurably increase the risk of flooding to downstream watercourses.

Water Quality

The use of fuels, lubricants and explosives at the site and disturbance of soils and bedrock has the potential to negatively affect water quality discharged from the site thereby impacting downstream receptors. A significant adverse impact on water quality is defined as repeated or sustained surface water discharge from the site exceeds the liquid effluent discharge standards in the Pit and Quarry Guidelines (NSEL 1999) or criteria listed in the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, both freshwater and marine (CCME 1999).

The Pit and Quarry Guidelines (NSEL 1999) stipulate that:

> "All storm run-off from the operating site and all liquid effluents resulting from the operation shall be collected and treated to meet the following suspended solids concentrations prior to discharge into a watercourse or beyond the property boundaries:

(a) maximum suspended solids concentration in an grab sample – 50 mg/l;

(b) maximum arithmetic monthly average suspended solids concentration - 25 mg/l"

CCME Guidelines for water quality (1999) recommend the following suspended solids criteria for the protection of aquatic life (both freshwater and marine):

- 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).
- 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.

For contaminated surface water (i.e., such as might exist following a hydrocarbon spill or other incident at the site) environmental quality standards (EQS) have been developed by NSE and a list of potential contaminants of concern is also available (NSE 2014). NSE's Table 3 Tier 1 Environmental Quality Standards for Surface Water (ug/L) is applicable at this site. Table 3 provides criteria for a variety of potential contaminants in both fresh and marine surface waters. All criteria are for the protection of aquatic life.

7.6.4 Effects on Surface Water Resources

Freshwater

Of the total site area, the development will affect approximately 180 ha of quarry and a 28 ha coastal platform for the processing plant and aggregate stockpiles. The vegetation and soils in these areas are likely to be stripped leaving bare rock surfaces and thereby increasing the volume and peak rate of runoff discharged from the site.

Following development, the mean annual runoff is expected to increase by 10% on average across the 354.5 ha site, giving an increase in annual runoff from 1 865 592 m^3 to 2 171 500m^3 when the site is fully developed (**Appendix C**).

Measures are recommended to convey runoff from operational areas to retention ponds reducing the number of discharge points from the site. The mean annual runoff from catchments N4, N5 and S3 (**Figure 6.2-1**) will be increased significantly. The mean annual runoff of catchment F4, M1, N2, N3 and N6 will be reduced as flow is diverted from these to catchments N4, N5 and S3.

The impact upon the hydrological regime of off-site surface water resources is expected to be as follows:

- Murphy's Lake – the mean annual runoff into this water body is expected to be reduced by about 15% at full pit build out.
- Watercourse 3 – the mean annual runoff discharged from the site into this watercourse is expected to be reduced by 70% as development of the pit progressively redirects runoff away from this watercourse and into the pit sump. This watercourse discharges into a wetland that eventually drains to Reynolds Brook. At full build out, the quarry will occupy

106 ha or 18% of the Reynolds Brook catchment above Hendsbee Lake, which has a surface area of 578.5 ha at the inflow to Hendsbee Lake.

- South-West (off-site) Watercourse – the mean annual runoff from the site into this watercourse is expected to decrease by 5%. This watercourse and Reynolds Brook are tributaries to Hendsbee Lake.

Stripping of vegetation and soils across the site is expected to lead to an increase in the peak flows leaving the site by 11% for a 1:25 year event and 8% for a 1:100 year event while the volume of runoff generated post development will be increased by 17% for a 1:25 year event and 13% for a 1:100 year event.

The increase in peak flow and flood volumes attributable to the development are relatively minor and given that there are no downstream watercourses susceptible to flooding, these increases are not considered significant. Therefore, it is not considered necessary to attenuate peak flows on-site to ensure that the pre-development discharge rates are not exceeded.

It is not possible to quantitatively assess the un-mitigated impact of the development upon the baseline water quality conditions. Nonetheless qualitatively the impacts could be as follows:

- Geochemistry – quarrying may expose elements naturally occurring within soils and geology to rainfall and oxidation, potentially mobilizing elements into any discharge from the site. From the water quality monitoring it can be seen that pH is low and aluminum, iron and lead are already found at elevated levels within the surface water environment. On the other hand, whole rock chemistry data collected on site indicates the granite is chemically stable and ideally suited to aggregate production.
- Ammonia and Nitrate - the use of Ammonium Nitrate-Fuel Oil (ANFO) blasting agents leave explosives residues high in ammonia and nitrate within areas where blasting has occurred. These dissolved compounds are easily mobilised by runoff.
- Suspended Solids – quarrying activities will include vegetation removal potentially increasing concentrations of suspended solids within stormwater runoff. Dust will be produced when rock is blasted and later crushed; when this dust comes into contact with stormwater runoff, increased suspended solids concentrations may result.

Since surface water flows will be collected in sedimentation ponds and pit sumps, both of which can overflow harmlessly in the event of a prolonged storm event (Section 3.3.7), the operation will permit water quality monitoring and treatment as needed prior to controlled discharge. The volume of sedimentation ponds and sump pits will be sufficient to contain water on-site for reuse. Given these considerations, no significant adverse effect on surface water quality is predicted.

Marine Water

The potential Project-related effects on marine biota are described in Section 7.11 (Marine Species and Habitats). Section 7.4 (Geology, Soil and Sediment Quality) addresses discharges to the marine environment from acid generating rock and sediment-laden stormwater.

Surface water flows that currently discharge north into Chedabucto Bay will be diverted into retention ponds near the processing plant and additionally (later) into a pit sump located in the quarry floor. Approximately 55% of the Black Point Project site currently flows north into the

Bay. The retention of this water and use for dust suppression and aggregate washing will not affect the water quality or water chemistry in Chedabucto Bay.

Surface water that collects in the ponds and sump is retained until suspended particles settle out of the water column. Water will not be discharged on a continuous basis; when discharge is required to lower the level in the ponds or sump, water will be tested to ensure it meets water quality standards listed in the operating permit, which in turn will be based on the guidelines cited in Section 7.6.3 (Threshold for Determination of Significance) above. Apart from potential effects described elsewhere in the EIS, no Project related effects on Marine Water Resources are anticipated.

7.6.5 Mitigation & Monitoring

In order to reduce the potential impacts of the development on the baseline surface water environment as identified above, the following mitigation measures will be applied:

- Retention or sedimentation ponds will be used near the processing plant while the quarry pit will employ sumps to collect water inflows. Topographic controls (sloping the ground to the south) will ensure that overflow, should it occur, will collect against the south cliff and in the pit, rather than be permitted to discharge directly to the ocean;

- Double walled and or/fully bermed fuel and chemical storage reservoirs will be used;

- The Environmental Management Plan will include a discrete Erosion and Sediment Control Plan to ensure the proper management of stormwater flows during construction and operation. The EMP will also contain a Stormwater Management Plan that describes the construction and operation of drainage swales and stormwater management ponds.

- The EMP will include an Emergency Response and Spill Contingency Plan combined with incident prevention and emergency response training to minimize the risk of accidental spills and to rapidly react to any incident that may occur;

- The Emergency Response and Spill Contingency Plan will include spill dispersion modelling in the marine environment to aid in rapid and effect emergency response.

- The Proponent will contract with a local emergency response consultant to ensure that additional resources and expertise are available in the event of an accidental spill in the marine environment;

- To mitigate reductions in surface flows that supply nearby wetlands, the Proponent in collaboration with NSE implement a Wetland Compensation Plan and associated inspection/monitoring program; and

- All surface water discharges from retention ponds and pits will be sampled as per requirements listed in the industrial operating permit and the Pit and Quarry Guidelines to ensure water quality conforms to applicable guidelines.

7.6.6 Retention Ponds

Runoff from the working areas of the quarry and associated infrastructure will be conveyed to flow retention ponds as shown in the Figures of the Surface Water Assessment Technical Report (**Appendix C**). These retention ponds will be constructed upstream of the final discharge point to improve the quality of any water discharged from the site. Two ponds, each with a volume of approximately 6,000 m^3 are proposed for the processing plant area, while a pit sump will contain water generated within the quarry proper. These features are connected through pumps and piping, allowing water transfer between them to ensure that stormwater can be managed and aggregate wash water is always available.

The retention ponds will be designed in accordance with Nova Scotia Department of the Environment Erosion and Sedimentation Control Handbook guidelines (NSE 1988) to intercept sediment laden runoff and allow sediment to settle out, thereby reducing the amount of sediment leaving the disturbed area and protecting local watercourses and Chedabucto Bay from excessive sedimentation.

The proposed design features are as follows:

- Permanent Pool – a permanent volume of water will be retained within the pond at all times to ensure treatment of stormwater discharged from the site. The permanent pool will be sized to contain at least 190 m^3 per ha of catchment. Based on the mean annual runoff, this equates to at least 11 days of residence time within the pond prior to discharge.
- Flood Conveyance – flood events up to and including a 1:100 year event + 16 % to account for increases in precipitation due to climate change can be conveyed through the pond. Discharge will occur via pumps from the pit once water testing has been conducted.

For the purposes of stormwater management, the quarry development will progress in two phases, and measures will be implemented accordingly:

- Initial Construction: Construction of the lower platform and access road, years 1-3 (2017-2020). During this phase, runoff from the lower coastal platform area (28 ha) will be conveyed to Plant Pond 1 and Plant Pond 2 situated against the south side of the lower platform. Discharge (if needed) will be into the marine environment, likely via the western property limit. Water will be re-used for processing or tested to ensure water quality guidelines are met and discharged when needed.
- Operations: Not including initial quarrying for site preparation, full quarrying will commence in year 3 (2020), progressing from north to south. Runoff and infiltration within the quarry will be collected within sumps (ponds) with excessively large volumes to ensure sufficient water is available for processing. Discharge would only be effected following analysis, and if needed, treatment.

As noted, the settling ponds and pit sump are designed to serve as an integrated water management system, allowing transfer of water between them to ensure ample processing water is available and allowing treatment of stormwater prior to discharge. At this stage of the Project, the above measures and design detail are considered preliminary, based on current designs. The drainage strategy will be revisited during the detailed site design that precedes permitting.

7.6.7 Fuel and Chemical Storage

All fuels and chemicals stored or used on site will be contained within fit-for-purpose containers and stored within designated storage areas. In order to prevent pollution of the surrounding environment due to an accidental spillage, the designated storage areas will be situated on impermeable surfaces with containment provided. The volume of the berm and sump will be sized to contain at least 110% of the largest tank being stored within the designated storage area, as per fuel storage regulations.

7.6.8 Monitoring

The normal operating procedure will be to reuse water within the operation and not have direct discharges to Chedabucto Bay. In the event a discharge is needed, the water will be sampled prior to discharge and the sample submitted for laboratory testing, as described in the Surface Water Monitoring Program included within the Environmental Management Plan. The sampling and testing will be done in accordance with site discharge monitoring requirements applicable to the operation. The analysis will include parameters required by the effluent discharge standards of the Nova Scotia Pit and Quarry Guidelines (NSEL 1999) and any other parameters or conditions listed in the industrial operating permit.

Where monitoring results exceed the guideline values listed in the Pit and Quarry Guidelines, a review of site activities will be undertaken to identify the source of pollution and remedial measures will be implemented.

The success of the Wetland Compensation Plan will be monitored over time as determined in collaboration with NSE; other water features not directly included in the Plan will be inspected to detect hydrological changes potentially caused by the Project – the frequency and timing of these inspections will be outlined in the Plan.

7.6.9 Residual Effects & Significance

Taking into account the mitigation measures outlined above, the residual impacts of the development are:

- Mean Annual Runoff – stripping of vegetation and soils from the operational areas is expected to increase the mean annual runoff discharged from the site by 10%. Much of this will flow north into Chedabucto Bay as is currently the case. Given this, the impacts on nearby surface water resources and associated downstream aquatic ecosystems are not considered to be significant (i.e., less than 20% change). Diversion of flows into sumps and retention ponds will reduce flows to some off site surface water resources (Murphys Lake and Reynolds Brook) and increase flows to others. The impacts of these changes will be felt slowly as the quarry development proceeds. Estimates indicate that there may be 15% decrease to Murphy's Lake by year 20 although the exact timing is difficult to predict. With respect to Reynolds Brook and Hendsbee Lakes, the effects from gradually reduced inflows as surface water is diverted into the quarry will be not significant, given that current flows from the site make up only about 18% and 13% of total flows to these water features, respectively.
- Peak Flow – vegetation and soil removal from operational areas is expected to increase the peak flows leaving the site by 13% for a 1:25 year and 16% for a 1:100 year event. Post development runoff volume will be increased by 18% for both 1:25 and 1:100 year

events. Given that these increases are relatively minor and that there are no downstream receptors susceptible to flooding, the impacts of these effects are not considered to be significant.

- Water Quality – Standard pollution prevention measures will be adopted at site to prevent accidental spills. Runoff from the working areas of the quarry and associated infrastructure will be conveyed to flow retention ponds and sumps. The retention ponds and sumps will allow the water to be reused on-site for dust control; discharges will be restricted to periods of extreme storm events. These discharges will be sampled and tested to ensure the applicable discharge standards are achieved. Given this, the residual adverse impacts on surface water are not expected to be significant.

Table 7.6-1:
Residual Environmental Effects for Surface Water

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Construction									
Preparation of the plant area; impacts to fresh and marine water quality and habitats from erosion, siltation and accidental spills	A	See Mitigation Section	1	1	1/1	R	1	Changes to surface water quality	Not Signif.
Operation									
Impacts to fresh and marine water quality and related environments from erosion, siltation and accidental spills	A	See Mitigation Section	1	1	1/1	R	1	Changes to surface water quality	Not Signif.
Effects to on-site watercourses, Murphys Lake and Reynolds Brook from diversion of surface and groundwater into the pit over time	A	See Mitigation Section	1	2	5/6	I	1	Limited reduction in flow; potential improvement in water quality	Not Signif.
Decommissioning									

Decommissioning activities are expected to be comparable to construction activities. Therefore, the same analyses apply.	Changes to surface water quality; Creation of new freshwater habitat	Not Signif./Positive

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

Frequency:
1 = < 11 events/year
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3 = 51 – 100 events/year
4 = 101 – 200 events/year
5 = > 200 events/year
6 = continuous

Reversibility:
R = Reversible
I = Irreversible

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

N/A = Not applicable
A = Adverse
P = Positive

7.7 TERRESTRIAL ECOSYSTEMS, HABITAT AND VEGETATION

This section discusses the potential impacts of the Project on terrestrial habitat, as well as vascular plants and non-vascular vegetation. Freshwater aquatic vascular plants are also included here because of expected similarity of effects and mitigation to those for terrestrial vegetation. Marine vegetation is discussed in Section 7.11 and flora SAR is discussed in Section 7.12. Effects on terrestrial flora are a pathway to other VECs including wetlands, SAR, wildlife, hunting or gathering activities, and land-use. These are discussed respectively in Sections 7.8, 7.12, 7.9, 7.13 and 7.14.

7.7.1 Boundaries

The spatial boundaries include all terrestrial habitats within the Black Point Quarry property boundary including the access road.

The temporal boundaries will include all three phases of the Project including construction, operation and decommissioning. No administrative or technical boundaries were employed in the effects assessment of this VC.

7.7.2 Threshold for Determination of Significance

A significant adverse effect on terrestrial habitat and vegetation would be 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 (3-5) generations.

7.7.3 Effects on Terrestrial Habitat and Vegetation

7.7.3.1 *Construction*

Most if not all of the direct interactions between the Project and terrestrial vegetation will occur as a result of the ground disturbance and other activities associated with the construction phase and progressive development of the Quarry. As described in the Project Description (Section 3.0), the construction phase of the Project is planned in a phased approach where portions of the site will be progressively cleared the open pit mine expanded. Despite this temporal component of the construction activities, this assessment examines the effects construction activities will have on terrestrial vegetation regardless of when, relative to the life of the project, these effects will occur.

Construction activities associated with the Project will result in temporary or permanent adverse effects on terrestrial and freshwater aquatic flora. Potential detrimental effects to terrestrial flora will result from site preparation (clearing/grubbing/grading/blasting), road, power line and building construction, and may also be caused by associated dust, erosion/sedimentation, and possible introduction of invasive species. Potential adverse effects on terrestrial and aquatic flora, habitat, communities, and individuals during construction may also occur as a result of accidental events. Effects can be limited to the footprint of the Project, or extend to adjacent lands as indicated below. Specifically, during construction, potential adverse effects on vegetation and habitat include:

- Direct and indirect mortality of plants;
- Temporary or permanent loss or alteration of habitat and habitat availability;
- Impairment from changes to wind exposure and microclimatic conditions; and
- Mortality or impaired growth due to accidental events.

Mortality of Plants and Loss or Alteration of Habitat

Site clearing/grubbing/grading will result in the removal of vegetation. This represents a loss of availability of vegetation habitat, as well as direct mortality of the vascular and non-vascular plants in the area affected. For the purpose of this EA, it is assumed that all the existing vegetation in the entire footprint of the Black Point Quarry, fill areas and plant location will be permanently lost over the lifetime of the Project (over 50 Years), though the development may integrate small amounts of habitat, such as amenity green space (ornamental plantings and turf). Habitat loss within the footprint of the Project area will amount to 212.48 ha (including wetland habitat); however, since the open pit development is progressive over the life of the quarry, the entire 213 ha will not be exposed until the last few years of quarry operations. Site rehabilitation will enable partial recovery of habitat at that time. Lay-down areas will be located within the planned footprint and therefore will not require additional space. As the quarry activities progress, the affected habitats will be replaced with exposed soil / rock surfaces and buildings. In sections where quarrying has been completed, site rehabilitation measures will be implemented to initiate re-vegetation in exposed areas that will not be disturbed further by the operation.

Clearing may also change wind exposure and microclimatic conditions in adjacent forests, resulting in some die-off and reduced growth of forest species until edge vegetation matures. The area surrounding the Project site consists of primarily open habitat including a mix of forest, barren and tall shrub habitat and as such there is little potential for this type of edge effects on forests.

These effects are not considered to be significant for common flora populations, and no mitigation beyond standard environmental protection measures is recommended.

Erosion and Sedimentation

Clearing and grubbing required for all Project components, results in disturbed soil surfaces without cover of vegetation. Exposed soil is vulnerable to erosion, and the resulting sedimentation may smother vegetation or impair plant growth in adjacent terrestrial and aquatic habitats. With the implementation of standard sediment and erosion control measures as outlined in Section 7.4, effects on common terrestrial and aquatic vegetation are not considered significant, and no further specific mitigation is recommended.

Fugitive Dust

Earthwork, movement of construction and transportation machinery, and storage of soil and construction materials may result in development of fugitive dust. The deposition of dust on the leaf surfaces of near-by vegetation may have temporary inhibiting effects on photosynthesis and transpiration in the affected plants, potentially resulting in slower growth rates. Noticeable dust

deposition is expected to not exceed a few metres. Standard dust-abatement measures and measures for the protection of air quality as outlined in Section 7.1 will reduce the effects of dust on vegetation in all habitats. Given the site's climate (relatively frequent and extensive precipitation, these effects are not considered to be significant for common vegetation, and plants will recover. No special mitigation is recommended.

Spills, Malfunctions and Accidents

The potential effects of spills, malfunctions and accidents and recommended mitigation measures are discussed in more detail in Section 7.18. Spills could directly kill vegetation and also create soil conditions unsuitable for vegetation growth.

7.7.3.2 *Operation*

No significant direct effects (mortality, loss of habitat) on vegetation communities are expected during operation beyond those associated with the progressive quarry development as discussed above for the construction phase. Possible adverse effects on terrestrial and aquatic flora of a minor nature may, however, occur due to fugitive dust, road maintenance and traffic. There is also potential for adverse effects on flora during operation from spills and accidental events, which are further discussed in Section 7.18.

During operation, potential adverse effects on flora habitat, communities and individuals include:

- Fugitive dust;
- Impairment from chemicals; and
- Mortality or impaired growth due to accidental events.

Fugitive Dust

Effects on terrestrial and aquatic flora during the operation phase of the project are similar to the construction phase. These effects are not considered to be significant for common vegetation, and plants will recover. No special mitigation is recommended.

Increased Levels of Toxic and Deleterious Substances (Salt)

Road salt used on roads within the Black Point Quarry may adversely affect immediately adjacent terrestrial vegetation and soil quality. Salt will be used sparingly and only when crushed stone cannot be used effectively. With the application of mitigation measures, significant adverse effects on vegetation from road salt are not expected.

Spills, Malfunctions and Accidents

The potential effects would be similar to construction, above.

7.7.3.3 *Decommissioning*

Potential effects of Project activities during the decommissioning phase are somewhat similar to the potential effects during the construction phase. Re-vegetation of reclaimed areas after the decommissioning of the pit, facilities and roads will occur. This activity will have positive effects on the vegetation of the area by initiating re-establishment of vegetation in disturbed areas.

Temporary adverse effects on terrestrial and freshwater aquatic flora, habitat, communities and individuals could occur from infrastructure removal and associated soil disturbance, associated dust, erosion and sedimentation. Potential adverse effects on flora could also arise from spills and accidental events, further discussed in Section 7.18.

7.7.4 Mitigation & Monitoring

A general set of environmental mitigation measures specific to the three project phases (construction, operation, decommissioning/rehabilitation) will be defined in an Environmental Management Plan (EMP). The EMP will also establish monitoring plans to ensure mitigation measures are implemented and effective. Specific monitoring commitments are also specified in the summary table below (Table 7.7-1). The following mitigation measures are recommended specifically to avoid and minimize impacts on terrestrial habitat and vegetation:

During Construction:

- Reduce area of Project footprint and temporary lay-down areas to that which is absolutely necessary;
- Mark Project boundaries to prevent accidental impacts outside the work area;
- Remove/ and salvage topsoil (i.e., approximately upper 30 cm); store separately and reuse for site restoration where possible;
- Control erosion and sedimentation as outlined in Section 7.4;
- Dust-prevention measures and dust abatement measures outlined in Section 7.1, will also protect local flora and habitats;
- Stabilize and rehabilitate areas of disturbance;
- Use local native vegetation in restoration – consideration will be given to the preferential use of vegetation types of interest to the Mi'kmaq; and
- Efficacy of the erosion and sediment control measures, as well the establishment of native flora should be monitored through an EMP (see Section 10.0).

During Operation:

- Vegetation management will be conducted by mechanical cutting (e.g., mower, brush cutter);
- Mitigation measures for the protection of watercourses (see Section 7.6 and 7.10) will help to protect terrestrial and freshwater aquatic vegetation and habitats; and
- Mitigation measures pertaining to air emissions pollution control as outlined in Section 7.1 will also protect common lichen species.

Mitigation measures for potential impacts during decommissioning are similar to those for construction. Decommissioning activities will be conducted in accordance with all applicable regulatory requirements at the time and a decommissioning plan. The decommissioning plan will include a detailed rehabilitation plan. The proponent is committed to implement as part of the rehabilitation specific habitat enhancement measures that maximize terrestrial and freshwater habitat diversity and quality.

7.7.5 Residual Effects & Significance

Table 7.7-1 provides a summary of recommended mitigation measures and residual environmental effects after successful implementation of the mitigation measures described above.

With the implementation of the recommended mitigation measures, Project activities are not likely to result in significant adverse residual effects on terrestrial ecosystems, habitat and vegetation.

Table 7.7-1:
Residual Environmental Effects for Terrestrial Habitat and Vegetation

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Direct plant mortality, habitat removal or alteration due to site preparation, clearing and grubbing.	A	See Mitigation Section	1	2	3/1	R	1	Habitat loss	Not Signif.
Indirect plant mortality as a result of potential erosion, sediment loading, stormwater discharges	A	See Mitigation Section	1	1	3/1	R	1	Habitat loss	Not Signif.
Displacement or loss of natural / native habitat due to the introduction of invasive species.	A	See Mitigation Section	1	2	5/7	R	1	Displacement / Habitat loss	Not Signif.
Indirect plant mortality and impairment as a result of fugitive dust emissions during construction and operation.	A	See Mitigation Section	1	2	5/2	R	1	Plant mortality	Not Signif.

Increase in levels of toxic and deleterious substances due to infrastructure maintenance (salt).	A	See Mitigation Section	1	1	5/1	R	1	Plant mortality	Not Signif.
Decommissioning									
Decommissioning will see habitat recreation and restoration.								Habitat recreation	Positive

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

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

Reversibility:
R = Reversible
I = Irreversible

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

N/A = Not applicable
A = Adverse
P = Positive

7.8 WETLANDS

7.8.1 Boundaries

The spatial ecological boundaries for wetlands include all wetlands within the footprint of the proposed quarry, plant, fill areas and access road. Wetlands that are hydrologically connected to areas located in the footprint of Project infrastructure are also included in the ecological boundaries as these are considered to be within the zone of influence of the Project.

Temporal ecological boundaries encompass the entire year, since interactions between wetlands and project components, or effects of short-term project activities, can occur or can extend year round. However, wetlands are less sensitive during the winter, when they are frozen and less susceptible to substrate disturbance. Wetlands are more sensitive during spring, summer and fall when they tend to be utilized by numerous wildlife species including birds. The temporal boundaries extend over all three phases of the Project including construction, operation and decommissioning. No administrative or technical boundaries were identified for the Wetland VC.

7.8.2 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.

7.8.3 Effects on Wetlands

Most if not all of the direct interactions between the Project and wetlands will occur as a result of the ground disturbance and other activities associated with the construction phase and progressive development of the Quarry. As described in the Project Description (Section 3.0), the construction phase of the Project is planned in a phased approach where portions of the site will be progressively cleared and prepared for the open pit development. This will extend over most of the Project's lifespan and will be accompanied by expansion of the open pit mine. Despite this temporal component of the construction activities, this assessment examines the effects construction activities will have on wetlands regardless of when, relative to the life of the project, these effects will occur.

As described in Section 6.4.2, field surveys have identified 22 wetlands within the Black Point Study Area (Figure 6.4-2). The majority of wetland habitat identified consists of open bogs and riparian fens which range in size from approximately 16.5 ha to <0.5 ha. Sixteen of the wetlands identified will be partially or completely infilled / removed, totalling approximately 17.5 ha (Figure 7.8-1). These are summarized in Table 7.8-1 below.

Table 7.8-1:
Summary of Predicted Loss of Wetland Habitat

Wetland #	Type	Size ha)	Estimated Area Lost (ha)	Predicted Impact
WL1	Bog/Swamp Complex	16.5	0.2	Partially infilled (0.2 ha) during construction
WL2	Fen/Swamp/Marsh Complex	6	0.7	Partially infilled (0.7 ha) during construction.
WL3	Riparian Fen	0.5	0.5	Infilled during construction
WL4	Bog	0.2	0.2	Infilled during construction
WL5	Riparian Fen	0.5	0.4	Partially infilled (0.4 ha) during construction.
WL6	Bog	0.3	0.3	Infilled during construction
WL7	Riparian Treed Swamp	0.5	0.2	Partially infilled (0.2 ha) during construction.
WL8	Swamp/Bog/Fen Complex	10.3	-	Currently avoided but near the Project boundary.
WL9	Bog	4.6	-	Currently avoided but near the Project boundary.
WL10	Riparian Treed Swamp	0.1	-	Currently avoided but near the Project boundary.
WL11	Bog	9.0	8.1	Partially removed (8.1 ha) during construction.
WL12	Bog/Fen Complex	0.3	0.3	Removed during construction.
WL13	Treed Swamp	0.6	0.6	Removed during construction.
WL14	Fen/Bog Complex	6.2	6.2	Removed during construction.
WL15	Riparian Fen	0.07	0.07	Removed during construction.
WL16	Bog	0.45	-	Crossed by Power line corridor.
WL17	Bog/Swamp Complex	0.74	-	Currently avoided but near the Project boundary.
WL18	Bog	0.07	0.04	Partially infilled (0.04 ha) during construction
WL19	Bog	0.04	0.03	Partially infilled (0.03 ha) during construction
WL20	Bog	0.15	0.02	Partially infilled (0.02ha) during construction
WL21	Fen	0.19	-	Currently avoided but near the Project boundary.

Wetland #	Type	Size ha)	Estimated Area Lost (ha)	Predicted Impact
WL22	Riparian Fen	0.1	0.02	Partially infilled (0.02 ha) during construction.
	Total Area	57.3	17.5	

Wetlands can be adversely affected by direct removal, fragmentation, disturbance, erosion/ sedimentation, and 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.

7.8.3.1 *Construction*

The following discussion of potential impacts applies to all wetland areas in close proximity to the Project footprint.

Wetlands depend on a certain level of soil humidity. If the water regime is changed, changes will occur to the vegetation, character and functionality of the wetland. In addition to the direct impacts due to localized infilling or removal, wetlands surrounding the Project footprint could potentially be adversely affected by changes to the hydrology, due to impeded or redirected drainage caused by the construction of the Project infrastructure and pit. Wetlands located up-gradient of the proposed construction may be flooded if drainage is impeded. Wetlands located down-gradient could be adversely affected if surface water flow, including stream flow, decreases. If stormwater from the roads which is collected in roadside ditches is allowed to enter these wetlands in amounts exceeding natural pre-construction flow, similar adverse effects are likely.

All of the above wetlands could also be adversely affected by sediment entrained in surface water runoff during construction activities. Exposed soil associated with 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 road runoff may have similar effects. 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 close proximity to the Project footprint may be adversely affected if accidental spills of deleterious substances such as fuels, lubricants or engine oil occur during the operation of construction and transportation equipment (see discussion in section 7.18).

Where construction activities occur in wetlands, there is potential for introduction of invasive species. 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 wetlands directly when equipment or people access the wetlands, or indirectly via runoff 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 down-gradient of those areas. Since the amount of traffic during construction will be increased over current levels, especially long distance traffic, the likelihood of introduction of invasive species is elevated. However, during the field surveys carried out in 2010 and 2014, no Purple Loosestrife was noted in the Project area.

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 and transportation equipment during the construction and decommissioning phases. These effects are discussed in Section 7.9 and Section 7.12.

Runoff from acid generating slates exposed due to construction activities is a potential and may negatively impact wetland habitat should runoff from this material enter this habitat type.

Directly Impacted Wetlands

Wetlands 1, 3, 6, 14 and 17 occur near or form the headwaters of small watercourses throughout the Site and therefore provide critical hydrological functions. It is notable that none of the watercourses present within the Study Area are fish bearing streams. Wetlands 11, 18, 19 and 20 may serve as groundwater recharge sites. As such they were found to provide critical hydrogeological functions. Wetland 2 likely provides critical shoreline protection function during storm events.

Wetlands 1, 2, 3, 6, 11, 14, 18, 19, and 20 represent common wetland types in the region. Wetlands 3 and 6 will be completely infilled / removed. Wetlands 1, 2, 11, 14, 18, 19 and 20 will be partially infilled (15 ha combined) therefore approximately 15.8 ha of wetland habitat providing "critical wetland function" will be lost. These functions represent red rated significant functions based on the NovaWET assessment and are typically unique or rare or associated with a high risk to the watershed if lost (see Section 6.4 for further details).

Wetlands 4, 5, 7, 12, 13, 15 and 22 are not of high value in terms of wetland function, and belong to a wetland class that is common both to the local area and throughout Nova Scotia. One lichen species of conservation concern was found in WL12 although this species is ranked S2S3 by ACCDC and as such is not considered a "Red Rated Significant Function". All of these common relatively "low value" wetlands do not support plant species at risk, and are not considered providing critical wildlife habitat. Wetlands 4, 12, 13 and 15 will be completely infilled / removed while wetlands 5, 7 and 22 will be partially infilled resulting therefore in the loss of approximately 1.7 ha of relatively common "low value" wetland habitat.

A wetland alteration approval will be obtained from NSE prior to construction in any of these wetlands. In conjunction with this approval, compensation will be developed for the loss of these wetlands, as NS aims to prevent net loss of wetland function. The compensation plan will be subject to approval by NSE.

Potentially Indirectly Impacted Wetlands

A number of wetlands have been identified in close proximity to the Project footprint (WL8, WL9, WL10, WL16, WL17 and WL21). These wetlands are considered to be potentially impacted through indirect means such as increased sedimentation, alterations to hydrology, disturbance and impacts resulting from accidental spills or dust / runoff from roads.

Wetland 21 (0.19 ha) is located in the northern end of the Study Area, downstream from the Project footprint and has the potential to be indirectly impacted.

WL 16 (0.45 ha) is located in the southeast corner of the Study Area. The power transmission corridor is proposed to run through this wetland and may result in changes to vegetation structure, soil compaction or alteration to hydrology.

Wetland 17 (0.7 ha) is located at the southeastern end of the Study Area. The access road will be constructed adjacent to the east boundary of this wetland which may alter hydrology. This wetland may also be indirectly impacted by uncontrolled site runoff leading to sedimentation, dust deposition, or accidental spills.

Wetlands 8, 9 and 10 (10.3 ha, 4.6 ha and 0.1 ha respectively) are located along the western end of the Study Area in close proximity to the proposed footprints of the pit and fill areas. These wetlands could be indirectly impacted by uncontrolled site runoff leading to sedimentation, changes in hydrology, dust deposition, or accidental spills.

Wetland alteration approvals will be obtained from NSE for those wetlands where indirect adverse effects are considered likely to occur. Indirect adverse effects will be detected through the implementation of the EMP. Compensation for indirect adverse effects to wetlands will be discussed with NSE during the wetland alteration approval process.

7.8.3.2 *Operation*

During the operation phase, wetlands located in close proximity to the Project footprint can be adversely affected by alteration of hydrology, release of hazardous materials during maintenance activities or accidents and malfunctions, dust/ sedimentation, introduction of invasive species, as well as disturbance.

Activities during the operation phase of the Project such as open pit quarrying, dewatering, water treatment and release and waste rock disposal may result in alteration to wetland hydrology in adjacent wetlands.

Project-related groundwater collection may affect the hydrology in adjacent wetlands in particular wetlands that rely on groundwater discharge to maintain hydrology. This is unlikely to affect wetlands located within the Study Area, however, as these wetlands are largely precipitation driven and/or associated with surface water features such as lakes and streams; as such they do not necessarily rely solely or primarily on groundwater inputs.

The unmanaged use of road salt for winter safety may adversely affect vegetation and water quality in wetlands. Road salt is a toxic substance, controlled under the *Canadian Environmental Protection Act* (CEPA), and can harm wildlife if overused. Road salt runoff can

influence vegetation species composition in wetlands, though the affected area would be very small.

Fugitive dust and sediment runoff generated from road traffic during operation are not likely to adversely affect wetlands, since the amount of material lost is expected to be very small. Dust originating from quarrying and rock crushing may land on native vegetation and interfere with plant respiration, but this effect is expected to be limited in time and space and will be mitigated by natural precipitation events that wash dust onto the soil. Dust may also deposit minerals and nutrients in the wetlands.

The potential for introduction of invasive species carried on vehicles operated on roads is much lower during operation, since disturbed wetland soils will be re-vegetated. During maintenance of the power line right-of-way, the potential for introducing invasive species would be similar to construction.

During the operation phase, wildlife in wetlands may be disturbed by noise and lights from the Quarry operation. Potential impacts on terrestrial fauna are described in Section 7.9, below.

Similarly to the construction phase, wetlands in close proximity to the Project footprint may be adversely affected if accidental spills of deleterious substances such as fuels, lubricants or engine oil occur. Downstream wetlands cannot be affected by a failure in the sediment pond containment system since sedimentation ponds and pit sumps will be located within back-graded work areas; they may flood but they will not overflow.

7.8.3.3 *Decommissioning*

The effects of Project activities during the construction and the decommissioning phase are similar.

7.8.4 Mitigation and Monitoring

Mitigation measures are outlined below for each potential adverse effect. Mitigation measures developed for the protection of surface water quality will also protect wetlands (Sections 7.6). The potential effects of spills, malfunctions and accidents and recommended mitigation measures are discussed in Section 7.18. A wetland specific monitoring program will be implemented immediately post-construction to confirm the predictions of the environmental assessment and to identify any unforeseen wetland impacts.

To reduce disturbance and eliminate loss of wetland function in directly impacted wetlands:

- Wetland areas will be avoided to the extent feasible during Project design and planning.
- Where wetlands cannot be completely avoided, the Project footprint in the wetland area will be minimised to the extent possible.
- A wetland alteration permit will be obtained from NSE prior to construction.
- Wetland functions have been assessed for all potentially disturbed wetlands and the amount and type of functions lost (if any) will be determined.
- Where a permanent loss of wetland function is identified, a Compensation Plan will be developed, subject to approval by NSE.

To prevent impacts on wetland hydrology:

- Maintain a 30 m buffer around all undisturbed wetlands.
- Where the access road cuts across diffuse natural drainage paths, water conveyance structures of sufficient size (culverts or drainage swales) will be installed to maintain water flow to and from wetlands at pre-construction levels.
- To the extent feasible, clean site runoff will be managed so that the amount of water entering adjacent wetlands is similar to pre-construction levels.
- Runoff collected along the roads will not be allowed to enter directly into wetlands, but shall be directed into vegetation buffers around wetlands.
- Integration of existing/remnant wetlands into the quarry's stormwater management system will be considered in the Stormwater Management Plan and in the EMP.
- The monitoring program enacted under the Wetland Compensation Plan will identify vegetation changes or new formation of wet areas within and adjacent to the Project site. This would be a sign of a disrupted hydrologic regime and further investigated to determine the need for management adjustments.

To prevent impacts on wetlands from erosion/sedimentation or dust:

- General erosion and sediment control measures will be established in the Project EMP and 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.
- Prior to construction, a site-specific erosion and sediment control plan will be developed, including a description of the proper installation of silt fences and cofferdams.
- Uncontaminated drainage will be directed away from areas under construction.
- Ground disturbance will be kept to a minimum and standard erosion control measures will be implemented for disturbed areas as needed.
- Dust control will be established in the Project EMP.
- Efficacy of the erosion and sediment control measures will be monitored regularly and when high precipitation events are forecast.

To prevent impacts on wetland habitat from contaminated runoff:

- Vegetation management in or near wetlands will be conducted by cutting (i.e., no use of herbicides).
- Potentially contaminated site runoff will be directed to the on-site wastewater treatment system.

7.8.5 Residual Effects & Significance

Project related activities are not likely to result in significant residual adverse impacts on wetland habitats after the successful implementation of the identified mitigation measures, including compensation. Table 7.8-2 provides a summary of the effects assessment.

Table 7.8-2:
Residual Environmental Effects for Wetlands

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Wetland removal or loss of wetland functions as a result of infilling and development activities.	A	See Mitigation Section	1	2	5/6	I	1	Habitat loss / Wetland compensation	Not Signif.
Alteration of wetland hydrology.	A	See Mitigation Section	1	2	5/6	I	1	Habitat loss	Not Signif.
Alteration of water quality from sediments and dust.	A	See Mitigation Section	1	2	5/1	R	1	Habitat loss	Not Signif.
Reduction in wetland functionality due to the introduction of invasive species.	A	See Mitigation Section	1	2	5/1	R	1	Habitat loss	Not Signif.
Impacts from contaminated site runoff and vegetation management.	A	See Mitigation Section	1	1	5/1	R	1	Habitat loss	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

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

Reversibility:
R = Reversible
I = Irreversible

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

N/A = Not applicable
A = Adverse
P = Positive

7.9 TERRESTRIAL WILDLIFE

Terrestrial fauna have ecological, aesthetic and recreational importance to the public and the Mi'kmaq as a food source and as an economic and recreational resource. Project development will diminish or eliminate the productive capacity of some terrestrial habitat within the Project footprint. Other indirect interactions (airborne dust, emissions, noise, vibration, light, water extraction, and consumption) may affect species and habitat within the area of influence of the Project. Most terrestrial species and habitat are regulated by the Province. Migratory bird species are regulated at the Federal level.

A discussion of potential impacts of the construction, operation and decommissioning phases of the Project on common terrestrial fauna is presented below.

7.9.1 Boundaries

Spatial boundaries establish the limits within which the Project interacts with the surrounding environment. The area of influence reflects an area beyond the Project footprint and incorporates aspects such as airborne plumes which can act to expand the physical area over which Project features interact with the receiving environment.

The spatial ecological boundaries for terrestrial wildlife include all undeveloped environments within the footprint of the Project, as well as all undeveloped environments within 500 m of the Project site and the shipping lanes offshore in habitats utilized by marine-associated bird species (including seabirds, waterfowl and shorebirds). This buffer is considered to be the maximum extent to which noticeable effects on birds, wildlife and SAR can be reasonably expected as a result of Project components and activities.

Temporal ecological boundaries encompass the entire year, since interactions between terrestrial fauna and Project components or activities can occur year round. This applies to every year of all phases of the Project. For terrestrial fauna, the breeding season is of particular concern. The breeding season for most migratory bird species in the region is between early April and the end of August (EC 2014f), although some migratory species nest outside of this timeframe. Owls, raptors and woodpeckers generally breed earlier in the season from late winter to early spring (February to May). Most other wildlife breeds in spring and summer.

With respect to the administrative and legislative boundaries, the federal the *Migratory Birds Convention Act* (MBCA) is an important regulatory mechanism to protect birds. At the provincial level, The NSDNR administers the Nova Scotia Wildlife Act (NSWA) which provides mechanisms for the preservation of wildlife species diversity and abundance, including migratory birds. Further protection of habitats that are critical to migratory birds and other wildlife species is provided by the federal *Canada Wildlife Act* and its regulations, which are administered by EC. Legal protection is offered to species that have been proclaimed as endangered, threatened or special concern under the federal *SARA*, and to species proclaimed as endangered, threatened or vulnerable under the *NSESA*.

7.9.2 Threshold for Determination of Significance

A significant adverse effect of Project components or activities on terrestrial fauna 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 (three to five) generations[7]. An adverse effect that does not cause such declines or changes is not considered to be significant in most instances. However, mortality of a single individual of a Species at Risk or a large number of migratory birds or other fauna could also be considered a significant adverse environmental effect.

Effects on critical habitat of a migratory bird SAR which cause breeding failure or abandonment of nesting may also be considered significant, even if the effects are temporary. This would include abandonment or nesting failure of a migratory bird SAR or at a seabird/waterbird colony due to an accidental event or the response to an accidental event associated with the Project.

7.9.3 Effects on Birds and Other Terrestrial Fauna

A discussion of potential impacts of the construction, operation and decommissioning phases of the Project on terrestrial fauna is presented below. Since the potential effects and mitigation for most avian SAR and SOCC is identical to non-SAR birds, they have been included in this discussion. Other SAR is addressed in Section 7.12.

7.9.3.1 *Construction*

Landbirds

The main impact on landbirds will be the loss of nesting and foraging habitat. Vegetation clearing and grubbing activities may also cause destruction of nests and nestlings or eggs if conducted during the breeding season (early April to end of August; EC 2014f).). Breeding evidence has been observed for several avian species within the Project footprint, including seven priority species with a Canadian General Status ranking of “Sensitive”: Bay-breasted Warbler, Black-backed Woodpecker, Blackpoll Warbler, Boreal Chickadee, Golden-crowned Kinglet, Ruby-crowned Kinglet, and Yellow-bellied Flycatcher. Up to 213 ha of terrestrial bird habitat may be removed. Habitat within the Project area consists mostly of barren vegetation, tall shrub barren, and some coniferous forest, with patches of mixed forest and wetlands; 22 wetlands totaling approximately 57 hectares were delineated within and adjacent to the Project site.

In addition to habitat loss, construction noise (including blasting) may have deleterious effects on animals in and near the Project area. Flushing of nesting birds may result in decreased productivity due to increased nest predation and stress to adult birds affecting foraging behaviour (Beale 2007); as well, birds may leave the Project area and be forced to move to less favourable nesting sites (Larkin 1996). The data regarding effective distance due to noise disturbance are relatively few and conflicting, with various field studies showing effects from edge of area of disturbance to 200 m. Construction noise can interfere with normal bird behaviour, such as feeding, migrating, and breeding. The distance of effect is of course related to noise volume and quality. Blasting noise is a type of impulse noise, which is defined as a sound with sudden onset and typically a short duration, and which differs from continuous noise in its physiological and behavioural effects on wildlife (Larkin 1996). In terms of behavioural

[7] This definition of significance does not apply to species of conservation concern, which are treated separately in Section 7.12.

effects, flushing of breeding birds from the nest in response to impulse noise and/or vibration is perhaps the most obvious and can have immediate negative consequences including predation of eggs and chicks (e.g., Burger 1981; Brown 1990; Bolduc and Guillemette 2003) and decreased incubation and brooding (Burger *et al.* 2010; Beale 2007). As well, young nestlings that are unable to thermoregulate may be vulnerable to exposure, and adults may inadvertently knock eggs and flightless young from the nest, which is of particular concern for cliff- and tree-nesting species (Burger 1981; Carney and Sydeman 1999). Research has shown that for birds, overt behavioural responses such as flushing typically occur at sound pressure levels above 80 - 85 dB SPL (sound pressure level) (Brown 1990).

Negative effects from noise vary from species to species, because of interspecies differences in both hearing abilities and in behavioural and physiological responses to stimuli. In addition to interspecies differences, there is considerable intraspecies variation in vulnerability to effects of noise, for example in different times of year (i.e., different stages of the breeding cycle) and different life stages (Blumstein *et al.* 2005). The effects of noise on the site due to construction are expected to be temporary and short-term.

Shorebirds

Disturbance due to construction noise (including blasting) is expected to have minor impacts on breeding, migrating and/or wintering shorebirds, depending on when the activities take place. Increased sedimentation from dust generated by construction, as well as changes to hydrology of Fogherty Lake, could potentially result in habitat alteration or habitat loss for shorebird species that could potentially be nesting in the area, such as Greater Yellowlegs and Spotted Sandpiper; however, no evidence of breeding shorebirds was reported during the field surveys.

Seabirds and Waterfowl

Waterfowl along the marine shoreline and inland ponds and lakes may be disturbed by noise from blasting and other construction activities, but these effects are likely to be temporary and minor. Waterfowl and loons are unlikely to nest in Fogherty Lake because of its low pH and low productivity; therefore, they are not anticipated to be negatively affected by habitat loss or alterations in water supply to the lake.

Seabirds nest on a number of offshore islands and other inaccessible coastal areas, notably the Country Island Complex. A large tern colony supporting a significant number of breeding Roseate Terns exists in the Country Island Complex IBA; however, the nearest point of this IBA is 13 km away, and Country Island itself (which supports the largest number of Roseate Terns as well as a significant colony of Leach's Storm-Petrel) is approximately 40 km away, which is sufficiently far from the Project area that no disturbance at the colony is anticipated. Minor disturbance of foraging terns from blasting and other construction noise is possible; however, the distance from the colony is such that it is unlikely that Roseate Terns will forage in the waters near the Project area. Large gulls and Common and Arctic Terns nesting on Fox Island and Half Island, both approximately 3 km from the Project site, could potentially be disturbed by blasting noise. However, this distance is greater than the 1 km buffer recommended by EC for high-disturbance activities including drilling and blasting (EC 2014).

Mammals

Habitat removal and fragmentation will result in displacement of wildlife within the Project footprint. Species that can move easily will likely move to similar habitats elsewhere, if such habitat is available; however, ultimately, there will be a detrimental effect on terrestrial wildlife populations within the Project area. These effects will be non-reversible for the duration of the Project lifetime. During construction activities, temporary and reversible effects from noise (including blasting) and dust generation may also affect terrestrial wildlife in and around the Project area. Potential effects on terrestrial fauna SAR and species of conservation concern are described in Section 7.12.

A number of furbearers have potential to occur in the Project area, and habitat removal and disturbance due to human activities may result in some or all of these species being extirpated from the area. Impacts on other mammals are also expected to be mainly related to loss and fragmentation of habitat.

Clearing and construction activities are expected to slightly reduce the available area used by terrestrial mammals and interrupt local movement to and from adjacent areas of suitable habitat. Project related noise (including blasting) may cause mammals in immediately adjacent areas to flee temporarily. The furbearers and other mammals in the local area may temporarily move elsewhere during the construction period. Local populations are likely to return to normal after construction is complete.

Mammal species with special status such as moose, fisher, and bats may occur in the Project area. Potential for impacts on such species are presented in Section 7.12.

Herpetiles

The loss of ponds, wetlands and riparian areas in the Project area will result in habitat loss for local amphibians and for turtles, and increased sedimentation from dust generated by construction may further impact aquatic habitats. Snakes may utilize much of the Project area, and will be impacted by habitat loss as well as increased fragmentation which may inhibit movement between areas of suitable habitat.

Invertebrates

Some loss of odonate (dragonfly and damselfly) breeding and feeding habitat is expected from the loss of wetlands, ponds and riparian areas within the Project area. Dust from construction activities may contribute to sediment loading in watercourses, potentially altering aquatic habitats. Lepidopterans (moths and butterflies) will be most affected by the loss of larval food plants, which varies from species to species; adults are highly mobile and therefore able to avoid areas impacted by Project activities.

7.9.3.2 *Operation*

Landbirds

Increased human activity associated with the operation phase is expected to result in an increase in populations of species that are adapted to human environments, including European Starlings, American Robins, Common Grackles and Rock Pigeons; these species may compete

with native woodland and forest edge birds, resulting in habitat loss for these species less adapted to human presence. Potential effects of blasting noise are the same as for the Construction phase.

The Project area will of necessity be well-lit with high intensity lighting at night, and although the lighting will be directed as narrowly as possible by shielding, these lights may have disorienting effects upon migrating landbirds, particularly on foggy and overcast nights, causing potentially fatal collisions.

Shorebirds

Potential effects of blasting noise are the same as for the Construction phase. The presence of sedimentation ponds on the site may provide some marginal habitat for shorebirds, although the high level of human activity makes it unlikely that these ponds will be utilized during the operations phase. Increased human activity around the marine terminal and load-out facility will result in increased disturbance to fauna in the surrounding coastal environment, including shorebirds that may feed in the area. Marine traffic associated with the quarry (an estimated 2 ships per week) will travel within existing domestic commercial shipping lanes, which pass to the south of the South Shore (Port Joli sector) IBA. This IBA supports breeding Piping Plovers in the summer and large numbers of migrating shorebirds in the fall months. While day-to-day shipping activities are unlikely to have any impact on shorebirds at the South Shore (Port Joli sector) IBA, accidental spills and releases from marine traffic could result in the direct physical exposure of birds to oil within the affected area; effects of accidents and malfunctions are discussed in Section 7.18.

Waterfowl and Seabirds

Potential effects of blasting noise are the same as for the Construction phase. The presence of sedimentation ponds on the site may provide some marginal habitat for waterfowl, although the high level of human activity makes it unlikely that these ponds will be utilized during the operations phase.

Increased shipping activity associated with the Project (an estimated 2 ships per week) will cause disturbance to seabirds and waterfowl in the waters off the Project site and along shipping routes. The possible effects of marine vessel traffic on birds in the offshore environment include behavioural changes (e.g., avoidance, stress response) that may have energetic consequences (Schummer and Eddleman 2003), and loss of suitable feeding habitat as vessel traffic can reduce bird use of vessel disturbed areas (Bramford *et al.* 1990), although this is mitigated by utilizing existing shipping lanes for most of the shipping route. Increased vessel traffic is not anticipated to cause disturbance at the Country Island Complex and South Shore (Port Joli sector) Important Bird Areas; however, foraging seabirds from these sites may encounter minor disturbance, and accidental spills and releases from marine traffic could result in the direct physical exposure of birds to oil within the affected area, with possible lethal and sublethal effects; effects of accidents and malfunctions are discussed in Section 10.17.

Mammals

Potential effects of the operation phase of the Project are anticipated from increased noise (including blasting) and disturbance from traffic and other human activities at the quarry. Local nocturnal species may be attracted to and/or disoriented by changes in ambient lighting.

Project operation may cause changes in the diversity and relative abundance of local mammal populations, such as potential increase in red fox, raccoon and striped skunk that are well adapted to human presence. This effect could be exacerbated if good housekeeping practices are not maintained on-site.

Herpetiles

No additional impacts on snakes are expected during the operation phase; additional impacts on turtles and amphibians may occur if water levels or surface water drainage patterns were to change, and/or if there is a change in water quality from operational procedures.

Invertebrates

No additional impacts on odonates and butterflies are expected during the operation phase. Moths may be attracted to new artificial lighting on the Project site, increasing the risk of predation.

7.9.3.3 *Decommissioning*

During decommissioning, increased human activity, noise and dust are expected to have temporary negative effects on local terrestrial wildlife populations (including birds). Local populations are expected to return to normal following decommissioning activities.

The lifespan of the quarry is anticipated to be 50 years or more. Impacts during decommissioning are expected to be similar to construction but of much shorter duration. The condition of the site after decommissioning will depend on the future use by the next owner or the municipality. Given that the Project location is relatively isolated, it is likely that the site will be rehabilitated to a natural state upon decommissioning. There is potential for new types of habitats, such as ponds and rocky cliffs, to remain on the site upon decommissioning.

7.9.4 Mitigation & Monitoring

Generic mitigation measures related to terrestrial fauna are listed below. For specifics mitigation measures related to terrestrial SAR and SOCC, please refer to Section 7.12. Mitigation for potential impacts on marine-associated birds from shipping is identical to other marine fauna, as described in Section 7.11.

Mitigation measures for potential impacts during decommissioning are similar to those outlined for the construction phase. Decommissioning activities will be carried out in accordance with all applicable regulatory requirements at the time, and a decommissioning plan will be developed.

During Construction:

- Reduce Project footprint and temporary work areas to the extent possible.
- Clearing of vegetation and overburden should be restricted to areas absolutely necessary to carry out the Project.
- Implement dust-prevention and dust abatement measures.
- Workers should be instructed to maintain good housekeeping practices and not leave any food or garbage at the Project site in order to avoid attracting wildlife, including

omnivorous predators which may disturb or cause direct mortality or injury to other wildlife (including birds).

- Mitigation measures are particularly important during the avian breeding season when nest failure could result if incubating adults are repeatedly flushed from active nests. To minimize impacts on nesting landbirds, clearing activities will take place outside of the breeding season for most bird species (April 1 to September 1) to prevent the disturbance of migratory birds or their nests. If some clearing is necessary during the breeding season the Proponent will assess if the work can be conducted without contravention of the *Migratory Birds Convention Act* and a contingency plan developed in consultation with CWS in order to maintain compliance with the *Act*. 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, even outside of the breeding season, a buffer zone appropriate to the species (as determined in consultation with NSDNR) will be placed around the nest and clearing will only occur outside of the buffer zone.
- To discourage ground-nesting or burrow-nesting species from nesting on disturbed soil during construction (e.g. Bank Swallow or Common Nighthawk), ensure that no large piles or patches of bare soil are left uncovered or un-vegetated during the breeding season.

  Should any ground- or burrow-nesting species (e.g. Bank Swallow or Common Nighthawk) initiate breeding activities on stockpiles or exposed areas despite efforts to deter them, the Proponent will establish a 20 m buffer around the nest location once identified and contact EC-CWS for further advice. Potentially disruptive activities such as use of machinery, disposal of additional material, removal of material and stabilization measures (e.g., hydroseeding) will be halted within the buffer area, non-disruptive measures will be taken to reduce potential for erosion of the pile, and the nest(s) will be protected. Periodic monitoring of the nest(s) will be undertaken until the chicks have fledged and left the area and the nest site is found to be inactive.
- Noise suppression equipment such as mufflers on mobile equipment and fixed/portable engines will be maintained in original OEM working condition.
- The duration of noise disturbance should be minimized.
- Lighting should be restricted to areas where it is necessary.
- To minimize interference of nesting activities from noise and human presence, workers will be encouraged to refrain from entering surrounding undisturbed habitat areas where no work is done, as those areas likely hold the largest number of birds.
- In the event that impacts on migratory birds are detected during construction, further mitigation will be developed in consultation with NSDNR and EC.

During Operation:

- Standard mitigation measures for noise (including blasting), as outlined in Section 7.2, will minimize impacts on terrestrial fauna.
- To discourage ground-nesting or burrow-nesting species from nesting on disturbed soil during construction, ensure that no large piles or patches of bare soil are left uncovered or un-vegetated during the breeding season.

Should any ground- or burrow-nesting species (e.g. Bank Swallow or Common Nighthawk) initiate breeding activities on stockpiles or exposed areas on site despite efforts to deter them, the Proponent will establish a 20 m buffer around the nest location once identified, and contact EC-CWS for further advice. Potentially disruptive activities such as hydroseeding will be halted within the buffer area, non-disruptive measures will be taken to reduce potential for erosion of the pile, and the nest(s) will be protected. Periodic monitoring of the nest(s) will be undertaken until the chicks have fledged and left the area and the nest site is found to be inactive.

- As recommended by EC (2014c; 2014e), ships should maintain a minimum distance of at least 300 m from any colony or island occupied by seabirds and waterbirds.
- To minimize the risk to migrant birds, the minimum amount of pilot warning and obstruction avoidance lighting will be used on tall structures. The use of solid-burning or slow pulsing warning lights at night will be avoided.
- A detailed avian management plan (including monitoring program) will be developed in consultation with EC-CWS in order to verify the effectiveness of mitigation measures related to lighting.
- Lighting for the safety of the employees should be shielded to shine down and only to where it is needed, without compromising safety.
- Street and parking lot lighting should also be shielded so that little escapes into the sky and it falls where it is required. LED lighting fixtures are generally less prone to light trespass and should be considered.
- Should seabirds or other species become stranded on vessels or on land, the proponent is expected to adhere to appropriate handling protocols. The protocol "*Best practices for stranded birds encountered offshore Atlantic Canada*" (EC 2014e) will be used for stranded seabirds. The proponent should also consider developing a similar-type protocol for birds other than seabirds (e.g. landbirds, shorebirds) which may become stranded on vessels. A permit is required to implement the Williams and Chardine protocol or other similar protocols, as well as to handle migratory bird carcasses during post-construction monitoring programs. Proponents should be advised that they are required to complete a permit application form prior to proposed activities. Permit application forms can be obtained by contacting Canadian Wildlife Service (email: Permi.atl@ec.gc.ca).
- White lights will be preferred for use on towers or high structures at night, as recommended by the US Fish and Wildlife Service (2003). Solid red or flashing red lights will be avoided as they appear to attract nocturnal migrants more than white flashing lights (US Fish and Wildlife Service 2003).
- Unless safety is a factor, the use of exterior decorative lights such as spotlights and floodlights, whose function is to highlight features of buildings or to illuminate an entire building, will be avoided or restricted because their glow can draw birds from far away, particularly on humid, foggy or rainy nights.
- High intensity lights, including floodlights, will be turned off at night outside of working hours, if possible, especially during the spring and fall migration period.
- Where feasible, tinted or frosted glass windows will be used in buildings to reduce bird mortality from collisions, as recommended by Erickson et al. 2005.

During Decommissioning:

Mitigation measures for potential impacts during decommissioning are similar to those outlined for the construction phase. Decommissioning activities will be carried out in accordance with all applicable regulatory requirements at the time and a decommissioning plan will be developed. The decommissioning plan will include a detailed rehabilitation plan. As part of the rehabilitation, the proponent is committed to implement specific habitat enhancement measures that maximize terrestrial and freshwater habitat diversity and quality.

7.9.5 Residual Effects & Significance

Table 7.9-1 provides a summary of recommended mitigation measures and residual environmental effects after successful implementation of the above mitigation measures.

With the successful implementation of these mitigation measures, Project activities related to construction, operation and decommissioning of Project components are not likely to result in significant adverse residual adverse effects on terrestrial fauna, excluding SAR, which are discussed in Section 7.12.

Table 7.9-1:
Residual Environmental Effects for Terrestrial Fauna

			Significance Criteria for Residual Environmental Effects						
Project-Environment Interaction	**Potential Positive (P) or Adverse (A) Effect**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological Context**	**Residual Effect**	**Significance**
Construction									
Loss of habitat for terrestrial wildlife, including landbirds.	A	• Minimize Project footprint; • Implement Wetland Compensation Plan. • See Mitigation above	Low	Limited to Project footprint (about 180 ha).	• Short- term loss: temporary work camp during construction phase. • Long-term alteration: water use (Fogherty Lake). • Permanent loss: quarry footprint (about 180 ha).	R but irreversible during lifetime of Project.	Similar habitat exists in the region. Area is affected by past human activity.	Habitat loss	Not Signif.
Fragmentation of terrestrial habitat in and around the Project area.	A	• Minimize Project footprint • Implement Wetland Compensation Plan • See Mitigation above	Low	Project footprint and adjacent areas of similar habitat.	• Construction and Operation Phase.	NR	Habitats in the Project footprint are not unique; fragmentation already exists from the presence of the	Minimal habitat fragmentation	Not Signif.

			Significance Criteria for Residual Environmental Effects						
Project-Environment Interaction	**Potential Positive (P) or Adverse (A) Effect**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological Context**	**Residual Effect**	**Significance**
							highway.		
Disturbance of terrestrial fauna due to construction activities (noise, blasting, dust generation).	A	• Implement an EMP • See Mitigation above	Low	Limited to Project footprint and a 200 m buffer (noise).	• Construction phase; Decommissioning phase.	R	Nearby areas are already subject to disturbance by human activities (highway).	Minimal wildlife disturbance	Not Signif.
Destruction of active migratory bird nests during vegetation clearing or other activities.	A	• Avoidance of clearing during the breeding bird season (early April to end of August). • Discouraging of ground- and burrow-nesting species from nesting on denuded soil (e.g. by covering unattended soil piles). • See Mitigation above	Low	Limited to Project footprint.	• Construction phase.	NR	Habitats in the Project footprint are not unique;	None anticipated	Not Signif.
Operation									
Disturbance of terrestrial fauna due to increased human presence and	A	• Implement an EMP • See Mitigation above	Low	Limited to Project footprint and a 200 m buffer (noise).	• Operations phase	R	Nearby areas are already subject to disturbance by human activities	Limited wildlife disturbance	Not Signif.

			Significance Criteria for Residual Environmental Effects						
Project-Environment Interaction	**Potential Positive (P) or Adverse (A) Effect**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological Context**	**Residual Effect**	**Significance**
noise (incl. blasting).							(highway).		
Destruction of active migratory bird nests during vegetation clearing, other project activities.	A	• Avoidance of clearing during the breeding bird season. • Discouraging of ground- and burrow-nesting species from nesting on unvegetated soil (e.g. by covering unattended soil piles)	Low	Limited to Project footprint.	• Operations phase.	NR	Habitats in the Project footprint are not unique;	None anticipated	Not Signif.
Loss or degradation of habitat for aquatic herpetiles and aquatic-nesting bird species (loons, waterfowl).	A	• Ensuring that water draw from Fogherty Lake does not result in a change in hydrology. • Implement an EMP Treatment of water to government standards prior to discharge. • Monitoring of discharge quality. • See Mitigation above	Low	Fogherty Lake and on-site watercourses.	• Operations phase	R	Not considered ideal habitat for birds and aquatic herpetiles of special status.	None anticipated	Not Signif.
Increased lighting attracting and/or	A	• Minimizing use of lighting to the greatest extent	Low	Project footprint	• Operations phase	R	Project site is not considered part of a major	None anticipated	Not Signif.

			Significance Criteria for Residual Environmental Effects						
Project-Environment Interaction	**Potential Positive (P) or Adverse (A) Effect**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility**	**Ecological Context**	**Residual Effect**	**Significance**
disorienting nocturnal wildlife, including migrating birds.		possible. • See Mitigation above					avian migration corridor. No protected moth species expected in Project area.		
Increased shipping activity causing disturbance to seabirds and waterfowl.	A	• Implement an EMP • Refer to marine fauna VC. • See Mitigation above	Low	Shipping routes offshore near the Project area.	• Operations phase • 2 ships/week	R	Considerable shipping activity is already present	None anticipated	Not Signif.
Increased numbers of human-adapted terrestrial species preying on/competing with native species.	A	• Implement an EMP; proper housekeeping practices and avoiding activities that may entice wildlife. • See Mitigation above	Low	Project footprint and adjacent habitat.	• Operations phase.	R	Relatively pristine area	None antic-pated	Not Signif.

7.10 FRESHWATER SPECIES AND HABITATS

Fish and fish habitat are valued for their ecological services as a renewable resource base, and for their economic, cultural, spiritual and ceremonial benefits. The watercourses and lakes on the Property do not contain fish due to acidic conditions. Nevertheless, other freshwater species and habitat are important biological components of larger ecological systems and are valued by the public and the Mi'kmaw. Project activities will remove some freshwater environment and may indirectly affect other areas. After quarrying ceases and the pit fills with water, the Project will ultimately create more freshwater habitat than currently exists on the site.

As described in Section 6.5, the freshwater environment within the Property boundary includes one waterbody, Fogherty Lake, and three watercourses. No fish were captured in Fogherty Lake or any of the watercourses during fish collection events. The field measured pH level in Fogherty Lake was 2.9 and in the watercourses pH levels ranged from 2.9 to 3.4. Based on the highly acidic conditions in freshwater environments, these water bodies do not support fish species (Robertson and Bryan 2004).

The majority of the effects to the freshwater environment are associated with the construction and operation of the quarry. The construction of quarry infrastructure is not anticipated to result in the removal of freshwater environments; one watercourse (Watercourse 2, which is ephemeral) will be lost during the operation of the quarry.

7.10.1 Effects Mechanics

Table 7.10.1 lists the probable interactions between the Project and Freshwater Species and Habitats.

Table 7.10-1:
Project Interactions with Freshwater Species and Habitats

Project Phase	Duration	Relevant Project Works and Activities
Construction Phase	2-3 Years	• Site Clearing, Grubbing grading in preparation of construction • Watercourse and wetland alteration • Surface water discharge
Operations Phase	50 years	• Domestic wash water supply: potential groundwater – surface water interaction • Rock removal (quarrying) that results in alterations in surface and groundwater flow patterns and water supply to down-gradient watercourses. • Storm water and wash water management and surface water discharge
Closure and Rehabilitation Phase	2+ Years	• Rehabilitation of the quarry

7.10.2 Boundaries

7.10.2.1 *Temporal Boundaries*

As noted, effects to Freshwater Species and Habitats are primarily associated with the Operations Phase, but may also occur during construction and during Closure and Rehabilitation.

7.10.2.2 *Spatial Boundaries*

Assessment boundaries have been characterized as the Project Area (PA), Affected Area (AA), and Study Area (SA).

The Project Area is defined as the freshwater environmental within the Project Property boundary. This includes three watercourses (Watercourse 1, ephemeral Watercourse 2 and Watercourse 3) and Fogherty Lake, but excludes wetlands since wetlands are described in a dedicated chapter of the EIS (Section7.8).

The Affected Area is the zone around the Property which could be affected by Project components or activities. With respect to Freshwater Species and Habitats, this will include all down-gradient freshwater ecological receptors that currently receive surface and groundwater flow from portions of the Property that will be developed for the quarry, since changes to water flow may negatively affect these receptors. It also includes areas immediately adjacent to the Property boundary where dust from quarrying activities may be expected to fall. Within this Area is Murphy's Lake. Given the acidic conditions measured at the lake outlet, Murphy's Lake likely does not directly support fish and fish habitat.

Outside of these zones, no additional Project-environment interactions are expected with respect to the Freshwater Species and Habitat VC.

7.10.2.3 *Relevant Legislation*

The federal Fisheries Act (Section 35) is the primary piece of legislation in Canada governing the protection, conservation and management of fish and fish habitat. This act is enforced by Fisheries and Oceans Canada. The Act prohibits serious harm to fish that are part of or support a commercial, recreational, or Aboriginal (CRA) fishery. Harm can be caused by proposed works, undertakings or activities that affect fish habitat, passage of fish or modify flow in watercourses. If serious harm to fish that is part of or support commercial, recreational or Aboriginal fisheries will occur as the result of a proposed undertaking, the proponent is required to prepare a habitat off-set plan and obtain an authorization under the Fisheries Act 35(2)(b) prior to commencing works.

7.10.2.4 *Technical Boundaries*

No technical boundaries were identified for this VC.

7.10.3 Threshold for Determination of Significance

Methods describing the spatial and temporal effects of the project activities and works on Freshwater Species and Habitat are described below. Presence and absence of fish and fish

habitat was determined through a sampling program described in Section 6.5. To the extent possible potential effects of the project on Freshwater Species and Habitat were quantified. These effects include:

- Direct removal of water bodies: assessed by querying the data layers with the anticipated disturbance areas within the Project boundaries. The amount (ha) of water body and length (m) of watercourses anticipated to be removed was tallied within the Project property boundaries.
- Indirect effects from changes in surface water quantity and quality: assessed based on results from available hydrologic modeling and the surface water quality assessment.

Relevant results from the terrestrial habitat assessment were integrated with the results from the fish and fish habitat assessment (i.e., effects on Freshwater Species and Habitat were cross-referenced with the effects on wildlife and wetlands and riparian habitat).

With respect to this VC, a significant effect is defined as a permanent, irreplaceable loss of Freshwater Species and Habitat that are part of or support a commercial, recreational or Aboriginal fishery.

7.10.4 Effects on Freshwater Environment

No freshwater fish or fish habitat occurs within the Project Area due to unsuitable acidic conditions observed in waterbodies and watercourses. Given this, Project activities will not result in negative effects to fish and fish habitat in these water bodies and watercourses. This is consistent with the highest objective in the planning hierarchy through the principle of avoidance.

The southern portion of the Property is situated within part of the surface water catchment of Reynolds Brook, located in the Affected Area approximately 1.0 km south of the site, immediately south of Route 16. For the purposes of the EIS, Reynolds Brook is assumed to support fish at some point between the headwaters wetland to the east and downstream Hendsbee Lake located approximately 3.0 km to the west. At full quarry build out after approximately 50 years of operation, approximately 106 ha of the Property which formerly drained south to Reynolds Brook will be diverted into the quarry pit for ultimate discharge north into Chedabucto Bay. This represents approximately 18% of the Reynolds Brook catchment above Hendsbee Lake, which totals 578.5 ha at the lake inflow. This eventual permanent reduction in flow may have negative effects on fish and fish habitat in Reynolds Brook during dry periods. Alternatively, the reduction of low pH inflows to Reynolds Brook from the Property may in fact improve water quality and promote higher quality fish habitat than is currently present.

In the absence of fish and fish habitat on the site, the following discussion relates to Project impacts on the freshwater environment including necessary watercourse removals, and crossings to Watercourse 2 and 3.

The next step in the environmental assessment process involves evaluating potential residual adverse environmental effects by Project phase. The evaluation of environmental effects, including cumulative environmental effects, included:

- The potential interaction between Project activities, for each Project phase, and their environmental effects in combination with those of other likely future projects;

- The mitigation strategies applicable to each of the interactions; and
- Evaluation criteria for characterizing the nature and extent of the environmental effects.

Environmental effects assessment matrices have been used to summarize the analysis of environmental effects, including cumulative environmental effects, by Project phase and include accidents, malfunctions and unplanned events. This allows for a comprehensive analysis of all Project-VC interactions. Supporting discussion in the accompanying text highlights particularly important relationships, data or assessment analyses results.

Projects effects are summarized in Table 7.10-2.

Table 7.10-2:
Project Interactions by Project Phase

Project Works and Activities	Interaction with VC (Yes / No)	Rationale
Site Preparation Phase		
Site Clearing, Grubbing and Pre-stripping	Yes	Site clearing, grubbing and pre-stripping will alter riparian habitat and may increase erosion and runoff to surface water bodies. These factors will increase the risk of sedimentation and may affect water quality in turn affecting this VC.
Topsoil and Overburden Stripping and Stockpiling	Yes	Surface water quality may be altered through erosion and runoff, which in turn may affect Freshwater Species and Habitats.
Construction of Enabling Infrastructure (i.e., offices, roads, electrical transmission lines and substation, process water supply system, sewage treatment system)	Yes	Construction of roads may require watercourse crossings and culvert installations (loss of habitat).
Construction of the Processing Plant (e.g. crusher, conveyor, plant facilities)	Yes	Construction of plant area components will alter drainage patterns, and may affect surface water quality.
Operations Phase		
Operations and Maintenance of Enabling Infrastructure (i.e., domestic water supply, sewage treatment and disposal, project roads)	Yes	Discharge of surface water may alter surface water quality which in turn may negatively affect Freshwater Species and Habitats. Operation and maintenance of roads may reduce water quality along roadways and affect this VC downstream of roadways.

Project Works and Activities	Interaction with VC (Yes / No)	Rationale
Pit development	Yes	Blasting residue may impair water quality and cause harm to Freshwater Species and Habitats. Removal of rock will alter surface and groundwater flow patterns and may reduce surface flows to downstream water bodies thereby negatively impacting Freshwater Species and Habitats. Full quarry development will reduce Reynolds Brook inflows by approximately 18%. This may impair fish survival during dry periods and/or improve habitat quality by reducing inflows of low pH surface water.
Closure and Rehabilitation Phase		
Final Rehabilitation of Quarry	Yes	Final rehabilitation and creation of the “Pit Lake” will create more freshwater habitat than will be lost during Project Operation. This will present opportunities for the creation of fish habitat and wetlands.

Construction and Operation

The construction of the open pit quarry will result in the loosening of vegetation, drilling and blasting to establish benches, roads, and stormwater management facilities. Stockpiling of overburden will also occur within the property area. Potable water will be supplied by drilled groundwater wells or bottled water.

The effects to freshwater environments as a result of the construction of access roads have largely been mitigated by design. The access roads will be a minimum of 30 m from waterbodies, including wetlands. A single watercourse crossing (Watercourse 3) will be required as a result of road construction. Best practices will be implemented into the design of the crossing to minimize effects to Freshwater Species and Habitat.

The primary effect of the quarry on Freshwater Habitats and Species will be indirect and due to changes in drainage patterns. As rock is removed through quarrying, surface and groundwater flow will be directed away from current freshwater habitats and into the pit. This altered flow will occur slowly over time as the quarry develops. For example, Watercourse 2 will not be affected until sometime after year 5 of pit development. By the end of year 10, drainage to Fogherty Lake and Murphy's Lake, as well as Reynolds Brook, will be affected by pit development. Complete removal of water bodies due to draw down effects is not anticipated.

Effects from stockpile runoff have been avoided with proper mitigation. Material will be stockpiled a minimum of 30 m from existing waterbodies and enclosed with perimeter silt fencing if warranted.

7.10.5 Mitigation and Monitoring

7.10.5.1 *Mitigation*

Although the waterbodies within and immediately adjacent to the property boundary (i.e., Fogherty and Murphys Lake) do not support fish, standard mitigation measures will be applied to prevent eroded sediment from reaching these water bodies, as well as Reynolds Brook, which is assumed to support fish.

- As described in the Erosion and Sediment Control Plan, erosion and sediment control measures will be implemented to ensure that discharge water quality meets all relevant regulatory standards prior to discharge to receiving environment.
- As described in the Stormwater Management Plan, stormwater will be collected in the pit and in ponds near the processing plant to ensure that uncontrolled runoff will not occur.
- Overburden stockpiles, fuel and chemical storage facilities, and construction equipment will be located a minimum of 30 m from any water body.
- Flagging tape will be used to delineate temporary work areas and control construction access near retained wetlands and water bodies to protect natural substrates and vegetation contributing to habitat and bank stability;
- An Emergency Response Spill Contingency Plan will be prepared to prevent and manage the effects of any malfunctions and accidents.

The primary mitigation measure for the loss of, or impact to, Freshwater Species and Habitat is the creation of a 30 ha lake when quarrying activities cease. This lake will be fed by surface precipitation and groundwater seepage, instead of receiving its primary water supply from the discharge of acidic wetlands. It is anticipated that water quality will be higher than that currently present in Fogherty and Murphy's Lake, and thus freshwater habitat may support fish and fish habitat.

7.10.5.2 *Monitoring*

Fish habitat assessment and a determination of fish presence/absence are proposed for Reynolds Brook above Hendsbee Lake. If fish are present in this reach, then a modest environmental effects monitoring program is proposed for such time as quarry development begins to divert water away from its natural drainage to the south. This is not expected to occur before year 10 of quarry development.

Within the site, monitoring will focus on verification of predicted effects and the effectiveness of mitigation. During construction and operation monitoring will focus on:

- Condition and location of erosion and sediment control intended to protect water features during soil stripping and grading and construction of site facilities;
- Water quality testing of stormwater discharges as outlined in the Surface Water Monitoring Program;
- Location and condition of fencing intended to protect sensitive retained features such as wetlands and water bodies to protect natural substrates and vegetation contributing to habitat and bank stability; and
- Ensuring overburden stockpiles, fuel and chemical storage facilities, and construction equipment are a minimum of 30 m from any water body.

7.10.6 Methodology for Determination of Significance

Potential effects of the project on the freshwater environment include changes in habitat suitability associated with physical habitat loss or alteration, and potential exposure to substances entering the water resulting from project activities. Effects are considered during construction, operation and decommissioning phases of the project. Effects are evaluated based on the definitions provided in Table 7.10-2 and presented in Table 7.10-3.

Given the existing freshwater environment, no significant adverse effects are likely to result due to project activities.

7.10.7 Residual Effects and Significance

Residual effects are evaluated after application of mitigation measures. These effects are assessed in the context of:

- Magnitude
- Geographic extent
- Duration
- Frequency

- Reversibility
- Ecological Context

Given the replacement of Freshwater Habitat and Species that will be undertaken at Project closure with the creation of the Pit Lake, no long term significant adverse residual effects to Freshwater Species and Habitat are anticipated as a result of Project activities.

Table 7.10-3:
Residual Effects on the Freshwater Species and Habitat

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Loss of catchment area and altered flow in Murphy's Lake	A	See Mitigation Section	1	1	5/6	I	1	Minimal; likely not observable	Not Signif.
Increased freshwater fish habitat resulting from filling of pit post closure	P	See Mitigation Section	2	1	5/6	I	1	Positive – creation of new habitat	Not Signif.
Reduced flow to Reynolds Brook	Positive (Reduced flow of low pH water may increase pH of downstream water) or Adverse (during low flow periods)	See Mitigation Section	1	2	5/6	I	1	Reduced flow (18%) and/or improved water quality	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

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

Reversibility:
R = Reversible
I = Irreversible

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

N/A = Not applicable
A = Adverse
P = Positive

7.11 MARINE SPECIES AND HABITATS

7.11.1 Overview

Marine species and habitats are valued for their aesthetic, cultural, ecological and economic attributes by First Nations and the public at large. Marine SAR are of interest to scientists, regulators and public due to their inherent biological and cultural value and are protected under federal provincial legislation.

The majority of the effects to marine species and habitat are associated with the construction and operation of the marine terminal since the construction of this feature will remove marine habitat. Potential environmental effects on marine sediment quality are described in Section 7.4 while potential effects on marine water quality are described in Section 7.6.

The marine habitat in Chedabucto Bay supports productive and diverse fisheries. A number of fish species reside within the Bay, and additional species migrate from nearby water bodies such as the Strait of Canso and St. Georges Bay to feed or may potentially spawn (Gromack *et al* 2010). Marine mammals associated with Chedabucto Bay typically include seals, whales and porpoise. Potential environmental effects to commercial fisheries are described in Section 7.15. Potential environmental impacts to marine SAR are described in Section 7.12.

Table 7.11-1 lists the potential interactions between the Project and this VC.

Table 7.11-1:
Project Interactions with Marine Species and Habitats

Project Phase	Duration	Relevant Project Works and Activities
Construction Phase	2-3 Years	• Site clearing and grading prior to construction • Pile driving in the marine environment • Blasting in the terrestrial environment • Construction of marine terminal (caisson & rubble mound)
Operations Phase	50 years	• Stormwater and wash water management and use • Blasting in the terrestrial environment • Ship loading and marine vessel operations • Waste water treatment system discharge • Groundwater and surface water runoff, collection, treatment and discharge
Closure and Rehabilitation Phase	2 Years, may be extended	• Closure of marine terminal • Rehabilitation of the processing plant and quarry

7.11.2 Boundaries

7.11.2.1 *Temporal Boundaries*

Potential effects to the Marine Species and Habitats are expected to occur primarily during construction of the marine terminal, as well as during the Operations Phase when loading and shipping are ongoing. Additional effects may be felt in the marine environment during Closure and Rehabilitation, as the terminal is partially or completely dismantled.

7.11.2.2 *Spatial Boundaries*

Assessment boundaries have been delineated as the Project Area (PA), Affected Area (AA), and Study Area (SA).

With respect to the marine environment, the Project Area is defined as the limits of the proposed seabed Crown Lands Lease that will be needed for the marine terminal (Section 1.0 and **Figure 4.0-1**). The Crown lease extends approximately 300 m seaward and will entirely contain the marine terminal.

The Affected Area encloses the zone which could potentially be affected by Project components or activities and routes to the main shipping lanes in Chedabucto Bay (Figure 6.11-3). For this VC, the Affected Area includes the footprint of the marine terminal occupying approximately 0.4 ha in water up to 26 m deep and extending up to 120 m from shore. Cobbles dominate the substrate with boulder patches in the vicinity of the marine terminal footprint. The amount of marine flora decreases at depths greater than 25 m. The Affected Area extends 6.8 km from the marine terminal to the established shipping routes.

The Study Area is defined as the area considering all Project-environment interaction, including effects that may occur as a result of shipping between the marine terminal and established shipping routes. For the purpose of the Marine Species and Habitat, assessment of the Study Area is defined as the Canso Ledges EBSA to the mouth of Chedabucto Bay, considered a functioning marine ecosystem in *Ecological and Human Use Information for Twenty Areas on the Atlantic Coast of Nova Scotia in Support of Conservation Planning* (Gromack et al. 2010).

7.11.2.3 *Administrative Boundaries*

Fish and fish habitat in general are regulated by DFO at the federal level. The federal Fisheries Act (Section 35) is the primary legislation in Canada governing the protection, conservation and management of fish and fish habitat. This Act is enforced by Fisheries and Oceans Canada and prohibits serious harm to fish that are part of or support a commercial, recreational, or Aboriginal (CRA) fishery. Harm can be caused by proposed works, undertakings or activities that affect fish habitat, passage of fish or modify flow in watercourses. If serious harm to fish that is part of or support commercial, recreational or Aboriginal fisheries will occur as the result of a proposed undertaking, the proponent is required to prepare a habitat off-set plan and obtain an authorization under the Fisheries Act 35(2)(b) prior to commencing works.

Marine flora is a component of fish habitat and therefore is subject to regulations under the federal *Fisheries Act*. Sections of the *Fisheries Act* prohibiting the introduction of deleterious substances into marine waters are governed by EC. Protection of marine fauna is subject to the same regulations.

7.11.2.4 *Technical Boundaries*

No technical boundaries were identified for this VC.

7.11.3 Threshold for Determination of Significance

Methods describing the spatial and temporal effects of the Project activities and works on Marine Species and Habitat, including marine fish and fish habitat are described below.

Presence and absence of fish and fish habitat was determined through a sampling program described in Section 6.6. Quantity and quality of fish habitat was estimated using GIS tools. To the extent possible, potential effects of the Project on fish and fish habitat were quantified.

- Direct removal of marine habitat was assessed by querying the data layers with the anticipated disturbance areas within the Project Area and tallied.
- Indirect effects from changes in surface water quantity were assessed based on results from available surface water quality assessment.
- Effects to fish and fish habitat from the use of explosives near water, i.e. blasting.
- Effects to fish and fish habitat from in water vibrations associated with pile driving.

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

- Adverse and irreversible changes to critical habitats;
- serious harm to fish that are part of a commercial, recreational or Aboriginal fishery, or to fish species that support such a fishery;
- permanent impairment of the ecological functioning of the biotic community; and/or
- increased ecological risk to a level that long term effects to the health of aquatic biota is predicted.

7.11.4 Effects on Marine Environment

As described in Section 3 (Project Description) the construction of the marine terminal will be based on a rubble mound approach with caissons installed to support the slewing or loading arm. Major components of the terminal will consist of:

- Rubble fill mound with an access road for maintenance
- Three breasting caissons.
- Two mooring dolphins.
- Eleven slewing rail piers, with piles installed in the seabed.
- One slewing rail caisson.
- Ship loader mounted on the slewing rail.

No refuelling facilities will be present.

There is limited information on coastal currents along the south shore of Chedabucto Bay in the Project area. Lawrence (1979) reports the results of five current meter moorings placed in Chedabucto Bay for 18 days in April 1970 following the *ARROW* oil spill. Mooring Station 3 was within several tens of meters from Black Point. The mean current amplitude in Chedabucto Bay was reported at 2.9 cm/sec with a large standard deviation (+- 3.0). The extreme current minimum is 0.9 cm/sec while the extreme maximum was 11.5 cm/sec. Lawrence (1979) notes a tendency for anticlockwise flow at all three depth levels with a ”strong topographic influence evident from directions at Station 3 near the southern coast” (i.e., near Black Point). He goes on to note “strong mean currents were recorded at Station 3”.

Owens and Rashid (1976) described the south shore zone of Chedabucto Bay ranging from "sheltered, low-energy beaches composed of poorly sorted till-derived sediments, cobble and boulder beaches, to resistant rock cliffs directly exposed to the Atlantic Ocean." In their discussion regarding the beach at Indian Cove (within Fox Bay immediately east of Black Point), they note "relatively little sediment is supplied to the littoral zone along this coast, due to the absence of till deposits along the shore zone, the resistant nature of the bedrock outcrops, and the steep offshore gradient." They go on to note "The shoreline at the entrance of (Indian) Cove is rock and is devoid of sediment. The only source for the littoral zone is material transported into the Cove on the sea-floor as bed-load or in suspension during periods of storm waves." Although the beach is prograding…the rate of accumulation is slow because of the low volume of sediment input. This is consistent with Project team subsea video observations (Appendix J) and sediment samples taken for granulometric analysis. The marine substrate at Fogerty Head is dominated by coarse materials including cobble, rock, and large boulders; granulometric analysis reported the samples were approximately 75-80% gravel (Section 6.6.2).

In summary, although currents may be significant off Black Point, observations and limited literature reports together suggest that the transport of sediments along shore is minimal in this area, largely due to the paucity of eroding sediments and the generally coarse grain size.

Project interactions with the VC are summarized in Table 7.11-2.

Table 7.11-2:
Potential Project Interactions with Marine Species and Habitat

Project Works and Activities	Interaction with VC (Yes / No)	Rationale
Site Preparation/Construction		
Construction of processing plant and associated infrastructure (offices, roads, electrical transmission lines and substation, etc.)	Yes	If uncontrolled, erosion may lead to sediment transport to the marine environment, negatively affecting water quality and near shore habitat.
Construction of the marine terminal	Yes	Marine terminal infrastructure will occupy habitat within the marine environment, killing or displacing the flora and fauna present. Marine construction activities may create or re-suspend bottom sediments, smothering nearby habitats
Operations Phase Works and Activities		
Operations and maintenance of terrestrial infrastructure	Yes	Discharge of sediment-laden surface water to the marine environment may negatively affect water quality; sediment may cover marine flora and harm benthic habitat and affect the quality of fish habitat function.
Pit development (including top soil and overburden stockpiling, explosives use, on-site materials transport)	Yes	Excessive use of explosives near water may cause serious harm to fish.
Ship loading	Yes	Aggregate spills during ship loading may cover marine flora, benthic habitat and affect the quality of fish and habitat function.
Aggregate transport by vessel	Yes	Ship noise and movement may affect the behaviour of marine species negatively affecting their survival; illegal bilge water discharge may introduce invasive species. Propeller wash can affect marine flora and fauna negatively by re-suspending sediments and causing siltation.

Project Works and Activities	Interaction with VC (Yes / No)	Rationale
Closure and Rehabilitation Phase Works and Activities		
Partial removal of the marine terminal infrastructure to ensure safety and security	Yes	Limited interactions with marine biota are anticipated during marine terminal decommissioning

Potential effects associated with the Project are:

1. Reduced habitat quality and habitat function due to altered water and sediment quality from sediments introduced to the marine environment during construction and operation. The potential effect of runoff from the terrestrial environment and mitigation measures designed to limit its occurrence are described in Sections 7.4 and 7.6.
2. Reduced habitat for fish that are part of or support commercial, recreational or Aboriginal fisheries resulting from construction of marine terminal.
3. Fish mortality due to the use of explosives within the pit; behavioural changes to fish, crustaceans and other marine species due to noise and vibrations associated with explosives use.
4. Mortality and/or the loss of benthic habitat due to aggregate spills when the ships are loaded.
5. Increased disturbance to marine flora and fauna and reduced habitat quality and function for marine species due to noise and vessel movement from increased ship traffic.
6. Invasive species that may be introduced through the illegal discharge of ballast water.

Effects of Construction

Construction of the marine terminal will remove sea bed habitat even as new habitat is created by the terminal rubble mound foundations. The total seafloor habitat lost will be approximately 11,100 m^2. The area includes the footprint and impact from rubble fill, caissons, and mooring dolphins. While this habitat is important to the marine biota (flora and fauna) it supports, it is not particularly rare within Chedabucto Bay and does not support any unique characteristics. Table 7.11-3 compares the surface area of the Project footprint within the study boundaries to the size of each of the study areas.

Table 7.11-3:
Percentage Occupied by the Terminal Within Each Boundary

Measure	Project Area	Affected Area	Study Area
Area of marine habitat (ha)	1.11	3.87	61, 200
Area of marine habitat affected (ha)	1.11	1.11	1.11
% area of marine habitat removed	100	28	0.002

The Study Area includes 61,200 ha of marine habitat. The habitat lost as a result of the terminal will be approximately 1.1 ha. The loss of marine habitat represents less than 0.002% of the total Study Area. The removal of this habitat for the project is not anticipated to limit the amount of suitable available habitat for American lobster or prey species.

Fisheries and Oceans Canada policy requires that Proponents replace or recreate fisheries productivity lost as a result of their projects. Following discussions with local fishermen under the auspices of the GCIFA, it appears likely that rocky substrate suitable for lobster habitat can be created immediately east or west of the Black Point Project site. In these areas, bathymetry restricts suitable lobster habitat to a narrow band in the nearshore. Local fishermen suggest that opportunities exist to widen this band in the immediate Project vicinity.

As noted above, construction of the terminal will disturb the substrate and re-suspend sediments into the water column. Although this may affect marine plants and cause reduced habitat quality leading to mortality of less mobile invertebrates, fish will likely re-locate to adjacent areas to avoid the disturbance. Within the Project Area, the marine substrate is dominated by coarse materials including cobble, rock, and large boulders with smaller areas of fine substrates (sand and silt). The density of marine flora reduces at depths greater than 25 m within and greater than 100 m from shore. The coarse grained nature of the substrate suggests that sediment resuspension during construction will be minimal and is so is not likely to produce a significant effect.

Vibrations associated with pile driving to install the slewing area foundations will result in a zone potentially lethal to fish extending 10 m from the piles (**Appendix D**). Pile driving is expected to occur over several months but will temporary in duration. Additional noise in the marine environment will be created by the placement of rocks making up the rubble mound, installation of the mooring dolphins (pile driving not required) and associated vessel traffic.

Effects of Operation

The detonation of explosives has the potential to cause injury or death to marine fish and mammals in the immediate nearshore area. Concerns regarding the use of explosives have also been raised by some local fishermen; specifically whether the noise and vibrations will affect lobster and mackerel behaviour. Blasting produces compressive shock waves in water followed by a rapid decay to below ambient hydrostatic pressure (Wright and Hopky 1998). Overpressure can damage fish swimbladders, rupture or haemorrhage internal organs, and kill or damage fish eggs and larvae, including crab and lobster eggs and larvae.

To avoid these effects, blasting charge size must be reduced if the location of blast is near the water's edge. For large blasts – on the order of 100 kg per hole – DFO guidelines stipulate a setback of about 150 m is required (Wright and Hopky 1998).

The Standard Shot Design prepared by the Proponent's blasting specialists demonstrates how different blasting configurations will be used closer and farther from water's edge (Table 3.3 in Section 3 - Project Description). These configurations will be used to ensure that maximum acceptable particle velocities for protection of fish will not be exceeded[8]. This is illustrated on **Figure 7.11-1**, which demonstrates that blasting needed to level the lower coastal platform ("cut and fill" on Figure 3.0-26) as well as blasting at the quarry face can be undertaken without exceeding the DFO guidelines.

[8] Table 2 in Wright and Hopky 1998: *Setback distance (m) from centre of detonation of a confined explosive to spawning habitat to achieve 13mm•sec-1 guideline criteria for all types of substrate.*

Ship loading may result in aggregate spills to the marine environment. Transport of aggregate via seagoing vessels will impact upon the marine environment through noise associated with vessel passage and potentially through accidental spills or other incidents at sea.

During operation, noise produced by ships may adversely affect the behaviour of marine species near the ship loading area and in the travel lanes from the marine terminal to the main shipping lanes. Fish or marine mammals may avoid the area, change migratory routes, and alter feeding habits (Lawson *et al.* 2000). Propeller wash may re-suspend sediment affecting marine plants and relatively immobile marine fauna in relatively shallow areas, although as noted, substrates in the vicinity of the marine terminal are relatively coarse and not likely susceptible to resuspension.

Accidental spills or the release of bilge, ballast or wastewater from ships can affect water quality and negatively affect species in the area. The release of ballast water can also facilitate the introduction of invasive species and potentially alter the aquatic food web structure.

Effects of Decommissioning

The effects are expected to be similar to the construction phase.

7.11.5 Mitigation and Monitoring

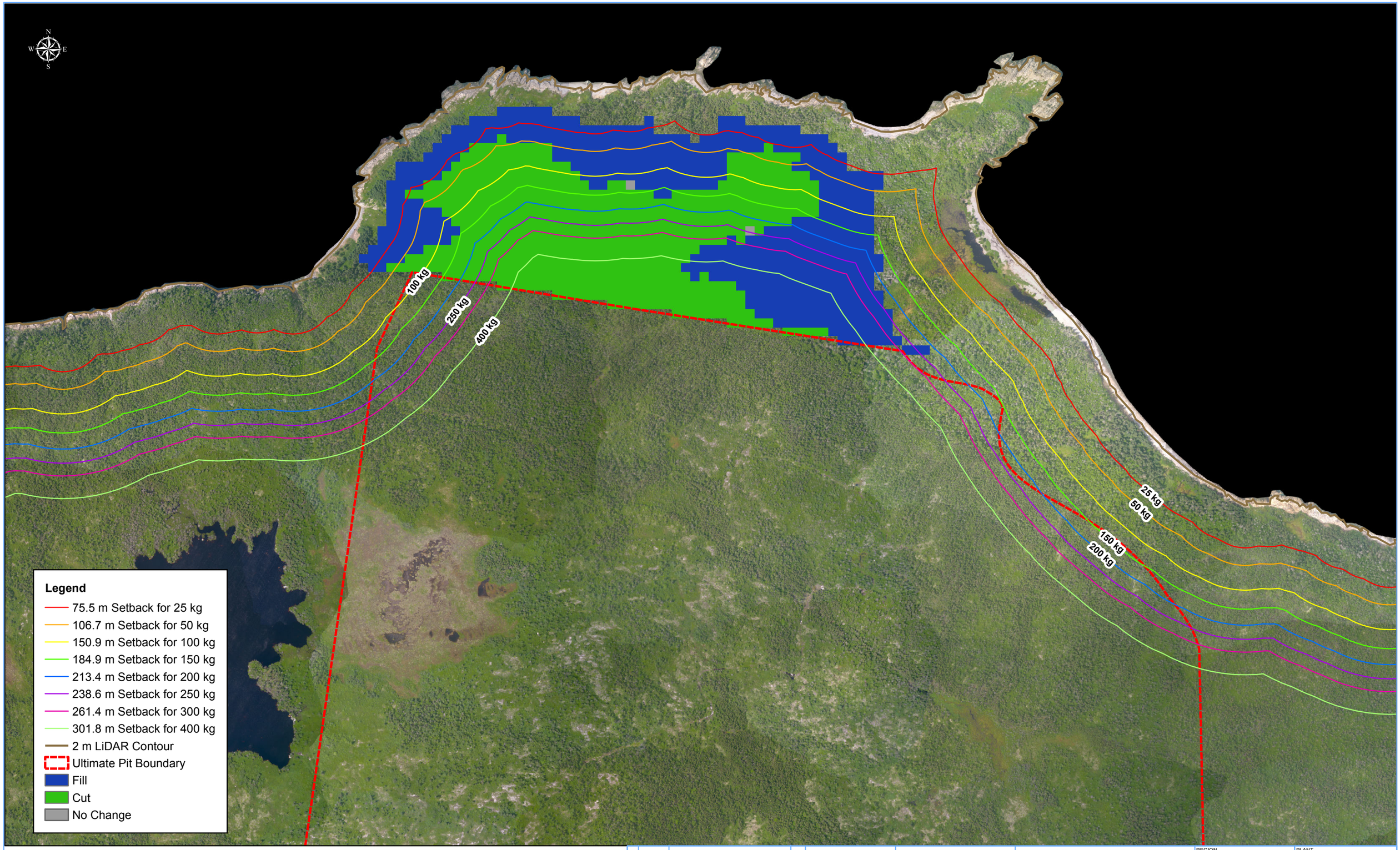
The following additional technically and economically feasible mitigation measures are identified to reduce the severity of adverse effects on Marine Species and Habitat.

Construction

An Environmental Management Plan will describe the following preventative and mitigation measures:

- Application of appropriate timing windows for all in-water work.
- Implementation of terrestrial erosion and sediment control measures.
- Use of surface water monitoring to ensure that quality meets all relevant regulatory standards prior to discharge to receiving environment.
- Installing overburden stockpiles, fuel and chemical storage facilities a minimum of 30 m from Chedabucto Bay.
- Implementation of an Emergency Response and Spill Contingency Plan for Accidents and Malfunctions.

Prior to commencing full blasting operations, field observations will be made to characterize the effects of vibrations on fish habitat. Observations will include measurements of peak particle velocity of substrates and over pressure in fish bearing waters. If peak particle velocities and overpressures meet DFO threshold values, then the Project will proceed with normal blasting operations as assumed for the base case in the vibration assessment. If effects from vibrations exceed the DFO thresholds, then a site specific standard to protect fish and an appropriately scaled fish and fish habitat offset plan will be implemented. This site specific standard may include modified blasting protocols (based on field testing and as currently described) and/or timing of blasts near the marine environment to avoid sensitive periods.



Morien Resources Corp.

Vulcan Materials Company

Minimum Setbacks per kg of Explosives

REGION: NOVA SCOTIA | PLANT: BLACK POINT

DWN BY: CKR | DATE: 10/22/2014 | CHK BY:

JOB NO: | SCALE: 1 in = 150 m

PATH:

DWG. NO. Figure 7.11-1

PLOTTED: | LAST UPDATE:

DATE | REVISION | BY | ISSUE DATE:

Operation

- Ensure that discharges of water from the operation comply with surface water quality standards
- Locate overburden stockpiles, fuel or chemical storage facilities, and construction equipment a minimum of 30 m from Chedabucto Bay.
- Preparing an Emergency Response and Spill Contingency Plan for Malfunctions and Accidents.
- Control ballast water release via the *Ballast Water Control and Management Regulations* and the requirements as per the International Convention for the control and Management of Ship's Ballast Water and Sediments.

7.11.6 Offset Strategies

Due to the nature of the project, unavoidable serious harm to marine fish and fish habitat will result from the construction of the marine terminal. To counter-balance unavoidable serious harm to fish and loss of fisheries productivity for species that are part of or support a commercial, recreational or Aboriginal fishery, the Proponent will prepare an Offset Plan pursuant to the Fisheries Act Section 35(2)(b). The Offset Plan will be prepared in consultation with Fisheries and Oceans Canada, Environment Canada, local commercial fisherman, and Mi'kmaq groups. Consideration will be given to DFO's four guiding principles, and the fisheries management values and objectives of local commercial fisherman and Mi'kmaq groups.

Offsets will be required for the destruction of approximately 1 ha of marine habitat. The habitat that will be displaced as a result of the marine terminal currently supports invertebrates' species including commercially harvested American Lobster. At present (following discussions with local fishermen), consideration is being given to the following offset measures:

- Artificial reefs
- Eel grass plantings
- Release juvenile lobster
- Improve juvenile lobster habitat

The Project team will evaluate potential offset opportunities that are consistent with local management plans, in proximity to lobster capture locations and have suitable depth, substrate, and vegetation near the Project site.

Artificial reefs can serve as habitat for lobsters and other invertebrates in the study area such as crabs and mussels. Reefs can be designed to incorporate the preferred substrate types such as rock over top of softer substrates. AMEC (2008) indicated that the placement of piles of 15 to 20 cm rock in patches 3 m in diameter and 0.5 m in height would attract adult lobsters. Similarly the placements of rock from 2 to 20 cm plus boulders of 45 to 100 cm would provide habitat within interstitial space for crabs and lobster of different life stages.

Monitoring of the effectiveness of the marine Fisheries Offset Program would be undertaken for at least three years until it can be demonstrated that the program objectives have been met.

7.11.7 Methodology for Determination of Significance

Potential effects of the project on the marine environment include changes in habitat suitability associated with physical habitat alteration, potential exposure to substances entering the water resulting from project activities and changes such as dissolved oxygen, water flow and water temperature regimes. Effects are considered during construction, operation and decommissioning phases of the project. Effects are summarized in a regional context in Table 7.11-4.

7.11.8 Residual Effects and Significance

Residual effects are evaluated after application of mitigation measures. These effects are assessed in the context of:

- Magnitude
- Geographic extent
- Duration
- Frequency
- Reversibility
- Ecological Context

Mitigation by design has been achieved through the evaluation of alternatives as it relates to the layout, construction, and operation of the various project components. Of particular importance was avoiding overprinting of any highly sensitive ecological components.

Provided that the current design plan is used, mitigation measures are followed, and appropriate offset strategies are developed and effective, no significant adverse residual environmental effects on the marine environment are likely to result.

Table 7.11-4:
Residual Effects on Marine Species and Habitat

Project Environment Interaction	Potential Residual Environmental Effects A=Adverse P= Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Effect
Noise and vibration effects to marine biota from blasting and pile driving	A	See Mitigation Section	1	2	1/6	R	1	Temporary disturbance	Not Signif.
Permanent loss of habitat (flora, substrates) resulting from the construction and operation of the marine terminal	A	See Mitigation Section	1	1	3/1	R	1	None anticipated following implementation of Offset	Not Signif.
Effects on marine water quality due to construction of the marine terminal and/or spills or discharges from the terrestrial environment	A	See Mitigation Section	1	1	1/1	R	1	None anticipated	Not Signif.
Re-suspension of sediments from propeller wash affecting marine flora and fauna and their habitat in relatively shallow water	A	See Mitigation Section	1	1	1/5	R	1	None anticipated	Not Signif.

Disturbance of seabirds and waterfowl marine terminal activity and vessel movement between the terminal and the main shipping lanes approximately 7 km from the terminal	A	See Mitigation Section	1	2	1/4	R	2	None anticipated	Not Signif.
Illegal discharge of ballast water	A	See Mitigation Section	1	2	1/1	I	1	None anticipated	Not Signif.

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

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

Reversibility:
R = Reversible
I = Irreversible

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

N/A = Not applicable
A = Adverse
P = Positive

7.12 SAR and SOCC

This section discusses the potential impacts of the Project on SAR and SOCC on the Project site. Existing flora and fauna SAR and SOCC are described in Section 6.7.

7.12.1 Boundaries

The Project Area and Affected Area spatial ecological boundaries for terrestrial wildlife include all environments within the footprint of the Project (including the access road), as well as all environments within 500 m of the Project site and the shipping routes offshore in habitats utilized by marine species (including mammals, fish, and reptiles). This buffer is considered to be the maximum extent to which noticeable effects on SAR can be reasonably expected as a result of Project components and activities.

The temporal ecological boundaries encompass every year of all phases of the Project, including construction, operation and decommission. Within each year, interactions between terrestrial fauna and Project components or activities can occur year round.

With respect to the administrative and legislative boundaries, the *Nova Scotia Endangered Species Act* (*NSESA*) and the federal *Species at Risk Act* (*SARA*) offer legal protection to species that have been proclaimed as endangered, threatened or vulnerable under these *Acts*.

7.12.2 Threshold for Determination of Significance

A significant adverse effect of Project components or activities on a SAR or SOCC 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. Mortality of a single individual of a Species at Risk could also be considered a significant adverse environmental effect.

Effects on critical habitat of a migratory bird SAR which cause breeding failure or abandonment of nesting may also be considered significant, even if the effects are temporary. This would include abandonment or nesting failure of a migratory bird SAR due to an accidental event or the response to an accidental event associated with the Project.

A significant adverse effect on sensitive/ critical 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.

7.12.3 Effects on Terrestrial Flora SAR/SOCC

Terrestrial SOCC on the project site include both vascular plants and lichens. Potential effects to each of these taxa are discussed separately in the following subsections.

Vascular Plants

Two vascular plant SOCC are known to occur in the Project footprint. These are Northern Commandra (*Geocaulon lividum*) (GSWSC 3 (Sensitive)) and Southern Twayblade (*Listera australis,* GSWSC 3 (Sensitive)). Northern Commandra occurs to the south of the main Project boundary, but lies along the proposed access road. Southern Twayblade was found in two areas, both within the planned Project footprint. Potential effects on Northern Commandra and Southern Twayblade are expected to be similar to effects on vascular plant species as a whole, which are discussed in detail in Section 7.7. Potential effects of the Project phases on flora SAR are summarized in Table 7.12-1.

Table 7.12-1:
Summary of Potential Impacts of the Black Point Quarry Project on Species at Risk (SAR) and Species of Conservation Concern (SOCC) by Project Phase

Priority Species in Project Area Potentially Affected by Project	Critical Habitat Present in Project Footprint	Potential Effects: Direct Mortality	Loss of Habitat	Habitat Alteration	Disturbance/ Displacement	Increased Noise	Increased Dust	Blasting Effects	Increased Human Presence	Sedimentation / Erosion	Decreased Air Quality	Decreased water Quality/Quantity	Alterations to Hydrology	Establishment of invasive Species	Increased Site Lighting	Exposure to Contaminant	Accidents and Malfunctions	Creation of Suitable Habitat	Specific Comments
Construction / Decommissioning Phase	**(Effects of Decommissioning and Reclamation Phase expected to be similar, but of lesser magnitude)**																		
FLORA SAR/SOCC																			
Vascular Plants • Northern Commandra, • Southern Twayblade	No	X	X	X						X				X			X		Effects and Mitigation similar to that for common Vascular Plants (Section 7.7)
Lichens • Angel Hair Ramalina, • Black-footed Reindeer Lichen, • Coastal Bushy Beard Lichen, and • Naked Kidney Lichen	No	X	X	X						X	X			X			X		Effects and Mitigation similar to that for common Lichens (Section 7.7)
Terrestrial Mammal SAR/SOCC																			
• Eastern Moose-Mainland NS population	No	X	X	X	X	X										X	X		Effects and Mitigation also similar to that for common Terrestrial Mammals (Section 7.9) and Accidental Events (Section 7.19).
Bird SAR/SOCC																			
Landbirds (including Passerines, Raptors & Owls): • Rusty Blackbird • Bay-breasted Warbler, • Black-backed Woodpecker, • Blackpoll Warbler, • Boreal Chickadee, • Golden-crowned Kinglet, • Gray Jay, • Ruby-crowned Kinglet; and • Yellow-bellied Flycatcher	No		X	X	X	X		X					X				X		Effects and Mitigation similar to that for common Birds (Section 7.9).

Priority Species in Project Area Potentially Affected by Project	Critical Habitat Present in Project Footprint	Potential Effects: Direct Mortality	Loss of Habitat	Habitat Alteration	Disturbance/ Displacement	Increased Noise	Increased Dust	Blasting Effects	Increased Human Presence	Sedimentation / Erosion	Decreased Air Quality	Decreased water Quality/Quantity	Alterations to Hydrology	Establishment of invasive Species	Increased Site Lighting	Exposure to Contaminant	Accidents and Malfunctions	Creation of Suitable Habitat	Specific Comments
• **Seabirds and Waterfowl**: • Common Loon, • Great Cormorant, • Harlequin Duck, • Common Tern, • Arctic Tern, and • Roseate Tern.	No		X		x	X			x							x	x		Effects and Mitigation similar to that for common Birds (Section 7.9), Marine Species (7.11) and Accidental Events (Section 7.19).
• **Shorebirds:** • Semipalmated Sandpiper, • Spotted Sandpiper, and • Greater Yellowlegs	No		x		x	x			x							x	x		Effects and Mitigation similar to that for common Birds (Section 7.9) and Accidental Events (Section 7.19).
Herpetile SAR/SOCC		**NONE KNOWN OR SUSPECTED TO OCCUR ON BLACK POINT SITE**																	
Invertebrate SAR/SOCC																			
Odonates • Spot-tailed Glider	No	x	x	x	x					x		x	x				x	x	Effects and Mitigation similar to that for Freshwater Aquatic Species and Habitat (Section 7.10), Wetlands (Section 7.8), Accidental Events (Section 7.19). Decommissioning / reclamation may create habitat.
Freshwater Fauna SAR/SOCC		**NONE KNOWN OR SUSPECTED TO OCCUR ON BLACK POINT SITE**																	
Marine Fish SAR/SOCC																			
• Atlantic Sturgeon, • American Eel, • Atlantic Cod-Southern population, • American Plaice- Maritimes population, • Atlantic Halibut, • Porbeagle, • Winter Skate, • Pollock, • Atlantic Salmon, • Spiny Dogfish, • Albacore, • Yellowfin Tuna, • Bigeye Tuna, • Atlantic Bluefin Tuna, and • White Hake-Atlantic and Northern Gulf of St. Lawrence population	No				x	x			x	x		x				x	x		Effects and Mitigation similar to that for, common Marine Species (7.11) and Accidental Events (Section 7.19).
Marine Mammal SAR/SOCC																			
• Harbour Porpoise	No	X-ship collisions				X			X-boat traffic							X-ship discharges	X		Effects and Mitigation similar to that for common Marine Species (7.11) and Accidental Events (Section 7.19).

Priority Species in Project Area Potentially Affected by Project	Critical Habitat Present in Project Footprint	Potential Effects															Specific Comments
		Direct Mortality	Loss of Habitat	Habitat Alteration	Disturbance/ Displacement	Increased Noise	Increased Dust	Blasting Effects	Increased Human Presence	Sedimentation / Erosion	Decreased Air Quality	Decreased water Quality/Quantity	Alterations to Hydrology	Establishment of invasive Species	Increased Site Lighting	Exposure to Contaminant	Accidents and Malfunctions	Creation of Suitable Habitat	
Marine Reptile SAR/SOCC																			
• Atlantic Leatherback	No				X-boat traffic	X			X-boat traffic							x-ship discharges	X		Effects and Mitigation similar to that for), common Marine Species (7.11) and Accidental Events (Section 7.19).
Operations Phase																			
Terrestrial Flora SAR/SOCC																			
Vascular Plants • Northern Commandra, • Southern Twayblade	No									X		X	X	X		X- road salt	X		Effects and Mitigation similar to that for common Vascular Plants (Section 7.7)
Lichens • Angel Hair Ramalina, • Black-footed Reindeer Lichen, • Coastal Bushy Beard Lichen, and • Naked Kidney Lichen																			Effects and Mitigation similar to that for common Vascular Plants (Section 7.7) and Lichens (Section 7.7).
Terrestrial Mammals SAR/SOCC																			
• Eastern Moose- Mainland NS population	No	X	X	X	X	X			X										Effects and Mitigation also similar to that for common Terrestrial Mammals (Section 7.9) and Accidental Events (Section 7.19).
Bird SAR/SOCC																			
Landbirds (including Passerines, Raptors & Owls): • Rusty Blackbird • Bay-breasted Warbler, • Black-backed Woodpecker, • Blackpoll Warbler, • Boreal Chickadee, • Golden-crowned Kinglet, • Gray Jay, • Ruby-crowned Kinglet, ; and • Yellow-bellied Flycatcher	No								X							X			Effects and Mitigation similar to that for common Birds (Section 7.9) and Accidental Events (Section 7.19

Priority Species in Project Area Potentially Affected by Project	Critical Habitat Present in Project Footprint	Potential Effects																	Specific Comments
		Direct Mortality	Loss of Habitat	Habitat Alteration	Disturbance/ Displacement	Increased Noise	Increased Dust	Blasting Effects	Increased Human Presence	Sedimentation / Erosion	Decreased Air Quality	Decreased water Quality/Quantity	Alterations to Hydrology	Establishment of invasive Species	Increased Site Lighting	Exposure to Contaminant	Accidents and Malfunctions	Creation of Suitable Habitat	
• **Seabirds and Waterfowl**: • Common Loon, • Great Cormorant, • Harlequin Duck, • Common Tern, • Arctic Tern; and • Roseate Tern.	No		X						X							X	X		Effects and Mitigation similar to that for common Birds (Section 7.9) and Accidental Events (Section 7.19
• **Shorebirds:** • Semipalmated Sandpiper, • Spotted Sandpiper, and • Greater Yellowlegs	No		X						X							X	X		Effects and Mitigation similar to that for common Birds (Section 7.9) and Accidental Events (Section 7.19
Herpetile SAR/SOCC		**NONE KNOWN OR SUSPECTED TO OCCUR ON BLACK POINT SITE**																	
INVERTEBRATE SAR/SOCC																			
Odonates • Spot-tailed Glider	No	X								X		X				X-pesticides	X		Effects and Mitigation similar to that for common Birds (Section 7.9) , wetlands, (Section 7.8), Terrestrial ecosystems (Section 7.7) , and Accidental Events (Section 7.19
Freshwater Fauna SAR/SOCC		**NONE KNOWN OR SUSPECTED TO OCCUR ON BLACK POINT SITE**																	
Marine Fish SAR/SOCC																			
• Atlantic Sturgeon, • American Eel, • Atlantic Cod-Southern population, • American Plaice- Maritimes population, • Atlantic Halibut, • Porbeagle, • Winter Skate, • Pollock, • Atlantic Salmon, • Spiny Dogfish, • Albacore, • Yellowfin Tuna, • Bigeye Tuna, • Atlantic Bluefin Tuna, and • White Hake-Atlantic and Northern Gulf of St. Lawrence population	No			X-propeller wash				X-ship traffic					X-ballast water		X-ship discharges				Effects and Mitigation similar to that for Marine species and habitats (7.11) and Accidental Events (Section 7.19)

Priority Species in Project Area Potentially Affected by Project	Critical Habitat Present in Project Footprint	Potential Effects																Specific Comments
		Direct Mortality	Loss of Habitat	Habitat Alteration	Disturbance/ Displacement	Increased Noise	Increased Dust	Blasting Effects	Increased Human Presence	Sedimentation / Erosion	Decreased Air Quality	Decreased water Quality/Quantity	Alterations to Hydrology	Establishment of invasive Species	Increased Site Lighting	Exposure to Contaminant	Accidents and Malfunctions	Creation of Suitable Habitat	
Marine Mammal SAR/SOCC																		
• Harbour Porpoise	No	X-ship collisions				X			X-ship traffic							X-ship discharges	X		Effects and Mitigation similar to that for Marine species and habitats (7.11) and Accidental Events (Section 7.19)
Marine Reptile SAR/SOCC																		
• Atlantic Leatherback						X			X -boat traffic							X-ship discharges	X		Effects and Mitigation similar to that for Marine species and habitats (7.11) and Accidental Events (Section 7.19)

Note:
No terrestrial Amphibian or Reptile (collectively herpetile) SAR are known or suspected to occur on the site or nearby and therefore are not discussed in this table.

Lichens

Four lichen SOCC are known to occur on the Project site. These are Black-footed Reindeer Lichen (*Cladonia stygia*), Naked Kidney Lichen (*Nephroma bellum*), Coastal Bushy Beard Lichen (*Usnea flammea*), and Angel Hair Ramalina (*Ramalina thrausta*). All of these are listed as 3 (Sensitive) on the GSWSC list for NS.

Black-footed Reindeer Lichen occurs in several locations on the Project site, with 19 occurrences detected. Naked Kidney Lichen and Coastal Bushy Beard Lichen both occur in two locations, with one report of each from the northern and southern portions of the property, respectively. Angel Hair Ramalina is known to occur at one location near the centre of the site. The endangered Boreal Felt Lichen is not known to occur in the general area and was not found on site. Polygons of potential Boreal Felt Lichen habitat, as mapped by NSE (2009), are considered to be too far away from the Project site to be affected by Project activities, such as dust emissions.

It is likely that most of these four species occurring on the Project site will experience some direct mortality from Project activities. Overall, potential effects on lichen SAR and SOCC are expected to be similar to those outlined for lichen species as a whole, in Section 7.1. Potential effects of the Project phases on lichen SAR/SOCC are summarized in Table 7.12-1.

7.12.4 Effects on Terrestrial Fauna SAR/SOCC

For most terrestrial fauna SAR/SOCC (including the one mammal, fourteen bird, and one odonate), potential effects are predicted to be similar to those for terrestrial fauna as a whole (Section 7.7). Potential effects of the Project phases on all terrestrial fauna SAR/SOCC are summarized in Table 7.12-1.

The following subsections focus on terrestrial fauna SAR/ species which are known to occur on the Project site.

7.12.4.1 *Mammals*

Moose

The mainland Nova Scotia population of Eastern moose, which is listed as Endangered under the *NSESA*, could potentially be affected by the proposed Project in a variety of ways. Potential impacts to Mainland Moose are summarized in Table 7.12-1. They include:

- Loss of habitat (foraging, wintering, calving);
- Habitat fragmentation;
- Disruption of migratory routes;
- Mortality due to vehicle collisions;
- Increased poaching levels in area due to increased traffic;
- Noise disturbance; and
- Exposure to runoff from hazardous materials/contaminated soils.

Habitat loss will occur on the site due to site development and clearing activities for the main Project site and the access road. Important habitats for Moose tend to be wintering and calving areas. Preferred wintering habitat for Moose in Nova Scotia typically consists of mature conifer or mixed conifer stands, where snow accumulation is decreased and browse is available, reducing winter energy demands (Parker 2003). Approximately 213 ha of coniferous forest and wetland occurring on the Project site will be removed during site development. This parcel of habitat is not part of a core Moose habitat polygon which encompasses much of Guysborough and Antigonish counties (Parker 2003), and so should not be considered significant. The development of the Project is not expected to significantly affect Moose wintering based on current knowledge. However Moose winter track and spring pellet surveys are planned in the area during the winter of 2015 and will provide site specific data related to site utilization of Moose during the winter.

Moose tend to utilize areas associated with aquatic/wetland areas for calving, but will also use islands in beaver ponds and wetland areas with standing water (Parker 2003). There is little of this habitat on site, and standing water areas occur mostly along the shore, where the exposure likely limits the utility of these locations as calving areas. The low density of Moose in the area, combined with the abundance of similar and much larger wetlands throughout the region results in the proposed Project having very little potential to adversely affect calving.

Land clearing on the Project site (213 ha) and the creation of the access road (800 m in length) will contribute to habitat fragmentation in the region. Land clearing for siviculture has also occurred to the east in the vicinity of Fox Island Main. The region is crisscrossed by many small logging and ATV roads and the effects of the Project are predicted to be insignificant within the region.

The increased visitation of and/or residency in the region during the construction and operations phases could also lead to impacts on Moose due to increased poaching activity. Mainland Moose are endangered and hunting them is not permitted; however, poaching continues to be a concern. The presence of the Project on the site, combined with strict reporting policies for any suspected Moose hunting activities in the area, will help to mitigate this potential effect.

It is possible that Moose could be affected by an accident within the Project site resulting in an off-site forest fire, although this is not considered likely. For a discussion of accidental events, possible consequences and preventative measures refer to Section 7.19.

Increased road traffic in the area due to the Project could potentially lead to increased risk of collisions with Moose, potentially leading to mortality. Vehicle use on-site could also result in accidental mortality of Moose. As very few Moose are present in the area, it is unlikely that encounters will occur; however, it is important to recognize the importance of each individual Moose within the small Guysborough population.

The development of the Project site could potentially hinder some small-scale seasonal movements of Moose. Fencing around the site will prevent Moose from accessing the site, forcing them to travel around the site boundaries if they desire. However, the low density of Moose in the area, combined with the relatively small distance such a detour would require, in relation to a Moose's home typical territory, results in this effect being insignificant.

Noise associated with construction and/or decommissioning and reclamation activities may disrupt Moose within several hundred metres of the active area; however, similar habitat is available throughout the adjacent area and impacts at the population level are not expected.

Effects of the decommissioning phase on Moose are considered to be similar to the construction phase, with the addition of the possible recreation of suitable habitats. Decommissioning activities and site reclamation could possibly have slight temporary negative effects on Moose; however, the effect of the resulting reclamation on Moose is expected to be positive, with rehabilitation of suitable terrestrial habitats and possibly wetlands.

Mitigation measures for these potential effects are outlined in Section 7.9. Potential effects and mitigation for malfunctions and accidents, such as spills, are discussed in Section 7.19.

7.12.4.2 *Birds*

To date, a total of fourteen bird SOCC have been reported from the Project site. Of these, a single species, the Rusty Blackbird, is actually a SAR, as it was listed as Endangered under the *NSESA* in 2013. Mitigation for potential impacts to this species is outlined in the following subsection.

Rusty Blackbird

Rusty Blackbird, which is listed as Endangered under the *NSESA*, could potentially be affected by the proposed Project in a variety of ways. Potential impacts to Rusty Blackbird are summarized in Table 7.12-1. They include:

- Loss of habitat (foraging, nesting);
- Habitat fragmentation;
- Disturbance from construction noise (including blasting); and
- Exposure to runoff from hazardous materials/contaminated soils.

Habitat loss will occur as a result of the Project due to site development and clearing activities for the main Project site and access road. Rusty Blackbirds tend to prefer cool habitats in forest openings, including spruce bogs, swamps, and damp alder swales. They construct their nests from 0.5 to 6 metres above the ground or water. They do not overwinter in Nova Scotia.

Approximately 213 hectares of coniferous forest, shrub barrens, coastal barrens, mixed forest, and wetland occur on the site and will be removed by the Project over time. Not all of this is suitable habitat for Rusty Blackbirds. This will not occur at once, but over several decades. Progressive reclamation of the pit will ensure that new terrestrial and possibly wetland habitat is created prior to the closure of the quarry.

Land clearing on the Project site (213 ha) and the creation of the access road (800 m in length) will contribute to habitat fragmentation in the region. The region is crisscrossed by many small logging and ATV roads and the effects of the Project are predicted to be insignificant within the region.

The increased visitation of and/or residency in the region during the construction and operations phases could also lead to impacts on Rusty Blackbird breeding due to increased disturbance. Flushing of birds from their nests can have significant impacts on both adult birds and nestlings

due to stress and increased predation (see Section 7.9 for a more detailed discussion). Noise associated with construction and/or decommissioning and reclamation activities may disrupt Rusty Blackbirds within a few hundred metres of the active area; however, similar habitat is available throughout the adjacent area and impacts at the population level are not expected.

It is possible that Rusty Blackbirds could be affected by an accident within the Project site resulting in an off-site forest fire, although this is not considered likely. For a discussion of accidental events, possible consequences and preventative measures refer to Section 7.19.

Effects of the decommissioning phase on Rusty Blackbird are considered to be similar to the construction phase, with the addition of the possible recreation of suitable habitats as revegetation progresses. Decommissioning activities and site reclamation could possibly have slight temporary negative effects on Rusty Blackbird; however, the effect of the resulting reclamation on RBB is expected to be positive, with rehabilitation of suitable terrestrial habitats and possibly wetlands.

Mitigation measures for these potential effects are outlined in Sections 7.9 and Section 7.19.

7.12.4.3 *Herpetiles*

No terrestrial herpetile SAR or SOCC are known or suspected to occur on the Black Point site. Therefore, potential impacts to terrestrial herpetile SAR and SOCC are not discussed in this section.

7.12.4.4 *Invertebrates*

A single invertebrate SOCC species, a dragonfly known as the Spot-winged Glider was detected on the site in 2010. Mitigation for potential impacts to invertebrate SAR and SOCC is covered by the mitigation for terrestrial fauna, freshwater fauna, and wetlands, which are discussed in detail in Section 7.8, Section 7.9, and Section 7.10.

7.12.5 Effects on Freshwater Flora and Fauna SAR/SOCC

No freshwater flora or fauna SAR or SOCC are known or suspected to occur on the Black Point site. Therefore, potential impacts to freshwater SAR and SOCC are not discussed in this section.

7.12.6 Effects on Marine Fauna SAR/SOCC

Several marine fish, mammal, and reptile SAR and/or SOCC have the potential to occur within the marine footprint and immediate vicinity of the Black Point Project site. Potential effects on marine fauna SAR and SOCC are predicted to be similar to those for marine fauna as a whole, which are discussed in detail in Section 7.11. The potential effects of each of the Project phases on marine fish, mammal, and reptile SAR and SOCC are summarized in Table 7.12-1.

7.12.7 Mitigation & Monitoring

Mitigation for potential effects on SAR and SOCC are similar to recommendations for terrestrial or marine fauna as a whole (Section 7.11).

7.12.7.1 *Terrestrial SAR/ SOCC*

Vascular Plant SAR/SOCC

Standard mitigation measures such as minimization of Project footprint, dust control, emissions control, and monitoring of air quality targets as detailed in Sections 7.7 and 7.1 will be sufficient to protect vascular plant SOCC. No vascular plant SAR are known to occur on the Project site.

As part of the EMP compliance monitoring, a program of identification and removal of noxious or exotic invasive weeds can be established. This program would include consideration for seasonality and risk associated with species known to occur in NS.

Lichen SAR

Standard mitigation measures such as dust control, emissions control, monitoring of air quality targets and minimization of Project footprint as detailed in Sections 7.7 and 7.1 will protect lichen SOCC.

No lichen SAR is known to occur on the Project site.

7.12.7.2 *Terrestrial Fauna SAR/SOCC*

Mitigation for potential effects to terrestrial habitats, wetlands, and terrestrial fauna is discussed in detail in Section 7.7, Section 7.8, and 7.9. These mitigation measures should be sufficient to minimize potential impacts to bird, mammal, reptile, odonate and lepidopteran SAR/SOCC potentially occurring in the Project area. Specific mitigation for SAR species known to occur on Project site are discussed for the various terrestrial fauna groups in the following subsections.

Mammals

Standard mitigation measures for wildlife, as detailed in Sections 7.9 will protect mammal SAR and SOCC. A single mammal SAR is known to occur on the Project site, and specific mitigation for this species is outlined in the following subsection.

Moose

Mitigation for potential effects to terrestrial habitats, wetlands and terrestrial fauna, is discussed in detail in Section 7.7, Section 7.8, and Section 7.9. Mitigation measures for mammals should be adequate to mitigate potential effects on mainland Moose in the area.

Standard handling and storage procedures for hazardous material, as well as procedures for handling and disposal of contaminated soils (outlined in Section 7.18), will adequately mitigate the potential for exposure of Moose to any hazardous materials or contaminated soils.

Strict reporting policies for any suspected hunting activities in the area will help to minimize any potential Moose poaching in the Project area.

Imposing a 50 km/hr speed limit will reduce the potential for vehicle-moose collisions on-site year-round. It will also decrease encounters between humans and Moose.

As the Project will be causing some loss of Mainland Moose habitat, the Proponent will consider contributing to efforts on conservation of mainland Moose, via support for the Mainland Moose Recovery Team and/or the Assembly of Nova Scotia Chiefs program for Moose recovery being administered by the Unama'ki Institute of Natural Resources. Details of the Proponent's participation in, or contribution to, these programs can be negotiated and finalized upon environmental assessment approval and in consultation with DNR. A Moose Management Plan may also be implemented to provide information and assist in the recovery of Moose in the Project area.

Birds

Standard mitigation measures for terrestrial habitats, wetlands, and terrestrial fauna, as discussed in detail in Section 7.7, Section 7.8, and Section 7.9 will protect bird SAR and SOCC. A single bird SAR is known to occur on the Project site, and a second has been identified as having potential to occur and has been included as a precaution; specific mitigation for these species is outlined in the following subsection.

Rusty Blackbird

Mitigation for potential effects to terrestrial habitats, wetlands, and terrestrial fauna, is discussed in detail in Section 7.7, Section 78, and Section 7.9. Mitigation measures for birds should be adequate to mitigate potential effects on Rusty Blackbird in the area.

Standard handling and storage procedures for hazardous material, as well as procedures for handling and disposal of contaminated soils (outlined in Section 7.18), will adequately mitigate the potential for exposure of Rusty Blackbird to any hazardous materials or contaminated soils.

Common Nighthawk

Common Nighthawk (*Chordeiles minor*) is a migratory SAR which has the potential to occur on the Property, and which EC-CWS has requested is addressed in this assessment. Nighthawks are often not detected during standard breeding bird point count surveys due to their nocturnal nature. Evening surveys to determine the presence of this crepuscular/nocturnal species were not conducted on the Project site. A precautionary measure, the Proponent is preparing this EIS report under the assumption that this species may be seasonally present.

Mitigation for potential effects to terrestrial habitats, wetlands, and terrestrial fauna is discussed in detail in Sections 7.7 - 7.9. Standard mitigation measures for birds should be adequate to mitigate potential effects on Common Nighthawk in the area, with the additional measure of ensuring that any exposed soils and soil stockpiles are adequately covered or vegetated to deter Common Nighthawks from nesting on them.

Should Common Nighthawks initiate breeding activities on stockpiles or exposed areas on site despite efforts to deter them, the Proponent will establish a 20 m buffer around the location once identified, and contact CWS for further advice. Periodic monitoring of the nest(s) will be undertaken until the chicks have fledged and left the area.

Herpetiles

No mitigation for herpetile SAR and/or SOCC is necessary, as none are known or suspected to occur on the Project site.

Invertebrates

Mitigation for potential effects to terrestrial habitats, wetlands, and terrestrial fauna, is discussed in detail in Section 7.7, Section 7.8, and Section 7. 9. These measures should be sufficient to any mitigate potential effects on Spot-winged Glider, the single SOCC reported from the Project site.

7.12.7.3 *Freshwater SAR/SOCC*

As no freshwater SAR or SOCC are known or suspected to occur on the Black Point Project site, mitigation for such is not necessary. Mitigation for potential effects to freshwater fauna and habitats is discussed in detail in Section 7.10.

7.12.7.4 *Marine SAR/SOCC*

Mitigation of potential effects on marine fauna (fish, mammals, and reptiles) is discussed in detail in Section 7.11. This is applicable to marine fish, mammal, and reptile SAR and SOCC which are considered to have potential to occur within the Project spatial boundaries. While no marine fauna SAR or SOCC have been reported from the marine portion of the Project site, their potential presence cannot be discounted, as marine surveys were beyond the scope of this report. A Marine Habitat Offset Plan is also being developed to mitigate the loss of a small amount of marine habitat within the Project footprint.

7.12.8 Summary and Residual Effects

Table 7.12-2 provides the results of the effects assessment for all flora and fauna SAR/SOCC for the 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 7.12-2 also provides a summary of recommended mitigation measures and residual environmental effects after successful implementation of the mitigation measures described above. With respect to both the Flora and Fauna SAR/SOCC, Project activities are not likely to result in significant adverse residual effects on SAR or SOCC with proper implementation of recommended mitigation measures.

Table 7.12-2:
Residual Environmental Effects for Species at Risk (SAR)

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=Non reversible)	Ecological/Social-cultural and Economic Context	Residual Effect	Significance
Construction/ Decommissioning and Operations									
Terrestrial Flora SAR/SOCC (Vascular Plants, Lichens)									
Direct and indirect plant mortality due to displacement or loss of biota.	A	• Survey for SOCC plants prior to construction to maximize avoidance. • Complete works during periods of least biological activity/sensitivity.	Low	Locations of SOCC species	Permanent during lifetime of the Project.	NR during lifetime of the Project.	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	Plant mortality	Not Signif.
Indirect plant mortality due to potential runoff and erosion, siltation and turbidity.	A	• Use of suitable backfill materials. • Restrictions on the removal of riparian vegetation. • Establish a buffer zone of 20 m around freshwater habitat. • Management of stormwater quantity and quality to relevant provincial standards. • Establish and implement EPP/EMP including erosion and sediment control plan.	Low	Project site	Construction Phase; Decommissioning phase.	R	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.

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=Non reversible)	Ecological/Social-cultural and Economic Context	Residual Effect	Significance
Indirect plant mortality due to alteration of drainage patterns and infiltration/runoff volumes.	A	• Management of stormwater quantity and quality to relevant provincial standards. • Stormwater will be collected and treated in a stormwater facility prior to discharge as per a site-specific Stormwater Management Plan.	Low	Project site	Permanent during lifetime of the Project.	NR during lifetime of the Project.	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.
Indirect plant mortality as a result of fugitive dust emissions from activities such as site preparation, grading and vehicle traffic. Wind erosion of displaced soil may also generate fugitive dust emissions prior to revegetation.	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	Vicinity of footprint.	Construction Phase	R	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.
Indirect plant mortality due to increase in levels of toxic and deleterious substances due to infrastructure maintenance (salt).	A	• Vegetation growth should generally be regulated by physical cutting. • Implement measures outlined in an EPP/ EMP.	Low	Local; depends on size of affected area.	Operation Phase; Short term/ infrequent.	R	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.
Terrestrial Fauna SAR/SOCC (Mammals, Birds, Herpetiles, and Invertebrates)									
Clearing and grubbing will lead to habitat loss or degradation for fauna.	A	• Support Mainland Moose Recovery efforts. • Minimize disturbed area. • Rehabilitate all	Medium	Project site and access road (213 ha).	Permanent during the lifetime of the Project.	NR during lifetime of the Project.	• Area affected by human activity; pristine areas not known. No critical habitat	Habitat loss	Not Signif.

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects					Residual Effect	Significance
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Non reversible)	Ecological/Social-cultural and Economic Context		
		temporarily used sites.					on-site.		
Clearing of land and road will increase habitat fragmentation for fauna.	A	• Minimize Project footprint. • Minimize lay-down areas. • Modify EMP/EPP in response to new species information (if applicable). • Conduct EEM, if required.	Low	Project site and access road (213 ha).	Permanent during lifetime of the Project.	NR during lifetime of the Project.	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	Minimal habitat fragmentation	Not Signif.
Project will lead to increased vehicle traffic in area and may result in direct fauna mortality.	A	• Speed limit of 50 km/hr on site. • Fencing on-site.	Low	General area	All phases	R	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.
Indirect fauna mortality as a result of exposure to contaminants via disturbed contaminated soils or spills.	A	• Proper handling and storage of hazardous materials. • Proper handling of contaminated soils • Adherence to site-specific EPP.	Low	Project site and access road (213 ha).	All phases	NR	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	None anticipated	Not Signif.
Change in fauna behaviour as a result of noise and light disturbances (including blasting).	A	• Minimize duration of noise disturbance. • Conduct blasting outside of sensitive periods. • Implement mitigation measures regarding noise and light effects on fauna in Section 7.9. -- and Table 1.-.	Low	Project site and adjacent lands.	All phases	R	• Area affected by human activity; pristine areas not known. No critical habitat on-site.	Displacement	Not Signif.

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=Non reversible)	Ecological/Social-cultural and Economic Context	Residual Effect	Significance
Freshwater Aquatic SAR/SOCC (Fish and Freshwater Molluscs)			***NONE KNOWN OR SUSPECTED TO OCCUR ON BLACK POINT SITE***						
Marine SAR/SOCC (Fish, Mammals, and Reptiles									
Loss of fish habitat due to construction of marine terminal	A	• Development and implementation of marine fisheries offset plan.	Low	Marine terminal footprint and immediately adjacent.	Construction phase through to decommissioning.	NR during lifetime of the Project.	• Affected area represents approximately 0.38% of lobster habitat within Stormont Bay.	None anticipated following Offset Program	Not Signif.
Habitat degradation due to sedimentation and turbidity from vessels.	A	• Use of tugs for large vessels.	Low	Marine terminal footprint and immediately adjacent.	Construction phase through to decommissioning.	R	• Marine SAR/SOCC.	None anticipated	Not Signif.
Disturbance and potential change in behaviour due to noise from ship traffic.	A	• Ships will be well maintained and best available technologies for exhaust and pollution control will be used.	Low	Marine terminal approaches.	Construction phase through to decommissioning.	R	• Marine fish and mammal SAR/SOCC.	Temporary displacement	Not Signif.
Disturbance and potential change in behaviour due to noise from pile driving, shore blasting, and other construction activities.	A	• Work during low tide. • Work outside of sensitive periods. • Use of ramped warning signals. • Use of bubble curtains.	Low	Depending on noise level could extend throughout Chedabucto	Construction phase.	R	• Marine fish and mammal SAR/SOCC.	Temporary displacement	Not Signif.
Degradation in fish habitat due to the release of bilge and ballast water to Chedabucto Bay.	A	• Adherence to federal legislation.	Low	Chedabucto Bay	Operation phase.	R	• Potential fish habitat.	None anticipated	Not Signif.

Project-Environment Interaction	Potential Positive (P) or Adverse (A) Effect	Mitigation	Significance Criteria for Residual Environmental Effects					Residual Effect	Significance
			Magnitude	Geographic Extent	Duration/Frequency	Reversibility (R=reversible NR=Non reversible)	Ecological/Social-cultural and Economic Context		
Mortality as a result of collisions with ships.	A	• Tugs will be used to bring in ships. They will be going slowly and observers will monitor for marine mammals and turtles.	Low	Marine terminal and Approaches.	All phases.	NR	• Potential marine mammal and turtle SAR/SOCC.	None anticipated	Not Signif.

7.13 LOCAL ECONOMY, LAND AND RESOURCE USE

7.13.1 Overview

Positive economic effects of the Project will benefit local residents, local businesses in the service sector and government at the municipal and provincial levels. Direct financial benefits to government include corporate taxes and taxes on goods and services. Indirect benefits include increased personal income taxes from local residents that are either involved as employees or contractors with the Project. Improvements in the regional economy can positively affect the population size and demographics as workers move to the area, purchase real estate, goods and services, and raise families. Real estate values can also be positively affected by a vibrant regional economy.

The Project will require a temporary labour force during construction and a smaller but significant labour force over the long term operation of the Project. In addition to direct hires, the Project will generate employment and economic activity through contracting for goods and services.

A major development such as the proposed Project can affect existing as well as planned land uses. Current on-site land uses (trapping, local tourism) will be replaced by quarrying and associated activities. Existing and planned land uses on adjacent properties or within the Affected Area may be impacted through changes to the visual or acoustic environments. In additional, a vessel collision or fuel spill in the marine environment may affect the local economy and alter existing land and resource use patterns.

7.13.2 Boundaries

7.13.2.1 *Temporal Boundaries*

The temporal boundaries for the assessment of impacts upon Local Economy, Land and Resource Use begin with the construction phase of the Project and continue through the operational phase and decommissioning phases. Construction time is estimated at two to three years and closure and decommissioning is expected to require two years. Quarry operations are expected to continue for at least 50 years.

7.13.2.2 *Spatial Boundaries*

The spatial boundaries for the assessment of the Local Economy do not include the Project Area (i.e., within the Project property boundaries) since no opportunities for the purchase of goods and services, beyond those purchases associated with the Project, will be available on site. The spatial boundaries extend to the Affected Area, which includes adjacent lands up to and including Gaulman Point, Fox Island Main and the portion of Highway 16 between these areas. Economic impacts within the Study Area include the limits of the MODG but are generally confined to the area between Guysborough and Canso where communities are expected to be most affected by employment and service opportunities.

With respect to Land and Resource Use, spatial boundaries include all three zones: the Project Area, the Affected Area, and to a lesser extent, the Study Area defined as the MODG.

7.13.2.3 *Administrative Boundaries*

Land use is regulated by the Province and through municipal zoning and land use bylaws. The Municipality of the District of Guysborough Municipal Planning Strategy (MPS 2013) describes the municipality's intentions for future development. The MPS outlines criteria for Council and planning staff to consider when evaluating development proposals and issuing development permits. Together with the Land Use Bylaw and Subdivision Bylaw, the MPS controls future land use and development in the Municipality.

The sea bed Crown lease needed to build the marine terminal is administered by the Province of Nova Scotia, Department of Natural Resources. An application for this lease has been submitted to NSDNR.

7.13.2.4 *Technical Boundaries*

Although a variety of economic models may be employed to predict the economic effects of a project, the analysis below uses a simpler approach to assessing economic benefit. The assessment is based on comparing the relative scale of predicted Project-related employment levels (both in terms of person-hours and in terms of wages paid) with existing employment opportunities within the MODG, especially the area between Guysborough and Canso. This is a qualitative assessment and does not include a description of the multiplier effects that may be expressed using Input-Output modelling. Nevertheless, the analysis is sufficiently robust to demonstrate whether the Project is likely to produce positive or negative economic effects in the region.

7.13.3 Threshold for Determination of Significance

A significant adverse Project effect on the Local Economy is defined as one that results in a long term decrease in economic activity or employment opportunities within the Study Area. A significant positive effect is one that results in a long term employment gains and/or sustained economic activity within the Study Area.

A significant adverse effect on Land and Resource Use is defined as a pervasive change in land use patterns within the Study Area that adversely affects a community's use of that land and/or is inconsistent with a designated land use established through a municipal planning process. A positive effect is one that enhances the land's cultural or economic value to the community in a manner that is consistent with the regulatory planning process.

7.13.4 Effects on Local Economy, Land and Resource Use

Local Economy

The positive economic impacts are principally related to long term employment opportunities which typically result in amplified demand for goods and services, as well as improved tax revenues for municipal, provincial and federal governments. As existing employers expand or new employment is created, new employees spend their earnings and the local economy expands to meet these increased demands. An expanding economy can create a feedback loop where businesses that must expand to meet rising demand in turn increase their purchases at other local business which must expand in turn.

Fundamentally, regional economic impacts associated with individual projects are dependent on the size and duration of expenditures, and upon the ability of the local economy to accommodate these expenditures. It is important that housing, groceries, gasoline, hardware, recreational opportunities and a host of other goods and services are readily available in the local area, in order to prevent consumers from seeking these goods and services elsewhere.

Project construction and operation will create direct employment of those engaged to construct and operate the quarry (50-60 people), as well as indirect employment through the demand for goods and services including contractors to support the Project. Ultimately, this local economic activity will be reflected in regional and provincial economies. These economic effects are considered as positive Project-related impacts that do not required mitigation or monitoring.

It is difficult to determine the effect the quarry may have, if any, on property values. The Proponent notes that in their experience, property values may increase as quarry workers seek homes near to their work location. Alternatively, property values may decrease due to perceived quarry impacts (e.g., noise) and/or other, non-quarry related reasons (i.e., continued out-migration).

At this time, there is a local labour pool to support this Project. Conversations with local residents suggest that many young skilled and unskilled workers are currently seeking employment outside of Nova Scotia and would be happy to return to well paying jobs in Guysborough Co. There is a total work force of approximately 13,600 in the Strait Region (Statistics Canada 1996). Of these, 1,500 are experienced in primary industries, 1,800 in manufacturing, 1,000 in construction and 900 in transportation. Additional experienced labour is present in Cape Breton and northern mainland Nova Scotia. Given the current labour availability relative to the demand, no negative effects on the labour supply are anticipated.

The Proponent estimates that up to 120 to 150 people will be directly and indirectly employed over the 36 month construction period beginning in 2017. The primary job types required for the construction work include truck drivers, concrete trades, equipment operators, piping trade, industrial welders, and general labourers. The Proponent has expressed a public commitment to source labour from with the Province of Nova Scotia to the extent that these people are available and interested in the work.

Total construction expenditures are estimated at $80 to $110 million over 36 months, or $27 to $37 million on an annualized basis. This will have an estimated direct and indirect GDP impact to the Province of Nova Scotia of $39 to $53 million per year, and $6.5 to $8.8 million per year total GDP for the MODG (based on 1999 Nova Scotia input-output multipliers for oil and gas engineering construction). Provincial taxes for the 3-year construction period will be in the range of $2.0 to $2.6 million, with federal taxes at $2.4 to $3.2 million. The Proponent has engaged in preliminary discussions regarding labour and training requirements with local labour unions and educational institutions. The Proponent intends to continue this dialogue to ensure that the local force is informed with respect to skills needed.

The following estimates of operational economic impacts were calculated using both low and high production scenarios of 2 and 5 million tonnes, respectively. During the operation of the facility, employment is estimated to be between 50 to 60 full time positions, with 95% of these jobs sourced from the MODG and nearby areas. The employment income to these workers will be from $2.9 to $3.4 million per year. Annual GDP is expected to range from $9.7 to $24 million for the Province, with the MODG collecting 40% of this revenue; $3.9 to $9.8 million. Total GDP

contribution over the 50-year period is expected to range from $485 million to $1.2 billion for the Province and from $195 to $490 million for the MODG. Annual provincial taxes will be in the range of $0.9 to $2.2 million, with federal taxes marginally higher at $1.0 to $2.6 million.

A vessel collision or other accident resulting in a fuel spill in the marine environment would have negative effects on Land and Resource Use (see below) as well as on Tourism and Recreation (Section 7.14) and Commercial Fisheries (Section 7.15). These effects would have direct and indirect negative economic consequences as described in the sections cited. In contrast, monies disbursed for cleanup and restoration of a marine fuel spill may partially offset these negative consequences through direct employment of vessels, workers, equipment and related services.

Project related economic effects to commercial fishing are described in Section 7.15.

Land and Resource Use

A diverse assortment of land uses are commonly used to accommodate the various municipal planning objectives in a given area. These objectives include different types of residential and commercial development, parks and recreational spaces, and industrial development. In order to foster long term land use planning and integrate these land use changes into the existing municipal fabric over time, municipalities rely on municipal planning strategies (MPS). The MODG MPS outlines the municipality's vision for land use within its jurisdiction over the coming 20 years or so.

The land designated for the Black Point Quarry Project was assembled by the municipality through a land exchange with the province, combined with the expropriation of two privately owned parcels within the current Property boundaries. Within the long term MPS, this land has been zoned Industrial Heavy I-2. Permitted uses for this zoning includes, among other activities, "rock quarry operation or open-pit mines from which rocks or minerals are extracted" (MODG 2013). One of the primary effects of the Project on the Land and Resource Use VC is to change the use of the Property from an undeveloped piece of land used occasionally for trapping and recreational activities (ATV passage and fishing in the nearshore), to a quarry that will be operated on a continuous basis for roughly 50 years, and where these current activities will eventually be limited or no longer practical. Despite these land use changes, the current zoning reflects a long term municipal vision to promote economic development and so is compatible with the goals and objectives of the community.

With respect to accidental events, a vessel fuel spill in the marine environment would likely result in changes to land and resource use in the vicinity of spill over the short and medium term (estimated at 5-15 years). Depending on where the spill occurred and the volume of fuel released, people may refrain from boating in the area and visiting favourite beaches and headlands.

7.13.5 Mitigation and Monitoring

7.13.5.1 *Mitigation*

For safety reasons, occasional recreational activities that are currently practiced within the Project's terrestrial boundaries (ATV passage and trapping) will be restricted during construction and operation. Recreational users will be notified of restricted access by signage at the entrance

to the construction site. Restriction of the informal recreational use of the Property may be an inconvenience, but is not likely to be significant. Similarly, marine recreational fishing that currently occurs on an occasional basis in the vicinity of the Project may no longer be practiced. Since many other recreational fishing opportunities nearby, this effect is not considered significant.

All of the mitigation measures presented elsewhere in the EIS are applied to reduce actual and perceived project impacts, which in turn may directly or indirectly affect property values.

Vessels will not be refuelled at the marine terminal and fuel used at the quarry will be kept in double hulled reservoirs or will be placed within secondary confinement and protected against collision. This helps to minimize the risk of accidents at the terminal. In the event of a spill on land, site drainage is directed south to the settling ponds rather than north to Chedabucto Bay. This in turn helps to contain any spills and allow them to be cleaned up. Navigational safety mitigation measures and emergency response planning measures are presented in Section 7.18.3.

7.13.5.2 *Monitoring*

No follow-up monitoring will be implemented with respect to the effects of the Project on Land and Resource Use. Similarly, no follow-up monitoring will be undertaken with respect to the effect of the Project on the Local Economy.

7.13.6 Residual Effects and Significance

There are no significant adverse environmental effects on the Local Economy. In contrast, positive impacts can be anticipated in the form of direct and indirect employment resulting in regional economic development. Land use changes are consistent with the community desire for this property, as expressed in the Municipal Planning Strategy. No significant residual effects are anticipated with respect to the predicted change in Land and Resource Use.

Table 7.13-1:
Residual Environmental Effects for Local Economy, Land and Resource Use

Project Environment Interaction	Potential Residual Environmental Effects (A = Adverse; P = Positive)	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance
Construction									
Preparation of the processing plant and quarry; construction of the processing plant: Exclusion of current trapping and ATV passage	A	• Compliance with zoning requirements • Use of signage and fencing to warn/restrict access • Use local workers and procure local goods services locally to the extent possible • Explain training requirements to local residents, high schools and community colleges	1	2	3/6	I	Pristine	Limitations to public access	Not Signif.
Impacts on labour, income and economic activity	P	• Ongoing communication with labour unions and labour suppliers	1	3	3/6	R	Pristine	None anticpated	Not Signif.
Operation and Maintenance									
Ongoing terrestrial and marine operations: Exclusion of current trapping and ATV passage	A	• Compliance with zoning requirements • Use of signage and fencing to warn/restrict access	1	3	5/6	I	Pristine	Limitations to public access	Not Signif
Marine Spill	A	• Implementation of navigational safety measures; Use of an Emergency Spill Response Plan						None anticipated	

Impacts on labour, income and economic activity	P	•	none	Low (1)	3	5/6	R	Pristine	Not Signif

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

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

Reversibility:
R = Reversible
I = Irreversible

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

7.14 TOURISM AND RECREATION

7.14.1 Overview

Residents and tourists alike utilize the local terrestrial and marine landscapes for outdoor activities such as camping, hiking, fishing, boating, off-road motoring, and hunting. These activities are popular and to a certain degree, available, due to the largely undeveloped nature of Guysborough County. Tourism and recreational activities, as well as the infrastructure associated with these activities, such as accommodation, marinas, recreation centres and parks, make up the Tourism and Recreation VC. The presence of a quarry may influence perceptions regarding noise and changes in the visual character of the coastal landscape, resulting in changes to resource use patterns. The Project may result in restrictions to currently accessible beaches and headlands. A fuel spill in the marine environment that attains local beaches and headlands would likely reduce the appeal of the affected area and other parts of the county to tourists and recreational users.

Details of existing tourism and recreational activities are presented in Section 6.8.

7.14.2 Boundaries

7.14.2.1 *Temporal Boundaries*

The temporal boundaries for the assessment of impacts upon tourism and recreation begin with the construction phase of the Project and continue through the operational phase and decommissioning phases. Construction time is estimated at two to three years and closure and decommissioning is expected to require two years. Quarry and shipping operations are expected to continue for at least 50 years.

7.14.2.2 *Spatial Boundaries*

The spatial boundaries for the assessment of impact on Tourism and Recreation are within the Project Area (i.e., within the Project property boundaries) and extending to the Affected Area, which includes adjacent lands up to and including Gaulman Point, Fox Island Main and the portion of Highway 16 between these areas. In the event of a marine spill to the environment, the Affected Area would include coastal regions affected by the fuel.

7.14.2.3 *Administrative Boundaries*

For safety, it is expected that recreational and commercial boating traffic will be excluded from areas immediately surrounding the marine terminal. Navigability of water courses and coastal waters is regulated by federal legislation under the *Navigation Protection Act*.

7.14.2.4 *Technical Boundaries*

While a certain amount of data regarding tourism in Nova Scotia is available for review, no statistical data was found to describe expenditures on tourism and recreational activities within the MODG.

7.14.3 Threshold for Determination of Significance

A significant adverse effect on Tourism and Recreation is defined as a permanent and widespread change in tourism or recreational activities such that people are no longer able to undertake these activities within the municipality and/or that result in a significant loss of tourism related revenue to local businesses. A significant positive effect is one that

enhances tourism or recreational activities or brings additional revenue through these activities to local businesses.

7.14.4 Project Effects on Tourism and Recreation

The quarry development has the potential to affect the tourism and recreation in the following ways:

1. A decrease in wilderness/nature oriented recreation and tourism within the Project Area and vicinity (i.e., Affected Areas) due to marine vessel traffic and actual or perceived noise, dust and light from the quarry construction and operations. Visually, the quarry may deter boaters and kayaks from visiting this portion of the coastline. This in turn may negatively affect revenue at local campgrounds, rental accommodations and other service providers. A fuel spill in the marine environment would likely deter tourists and recreational users from visiting affected areas, possibly including nearby coastal areas.

2. An increase in expenditures on tourism services. Large development projects may hire staff from outside the immediate region and present employment opportunities to local residents who are currently seeking work. These people may choose to live relatively close to the quarry to minimize commuting distances. Increased populations in nearby communities including Fox Island Main, Upper Fox Island, Half Island Cove, Phillips Harbour and Canso would likely result in secondary economic benefits to these communities as new residents increasing frequent local tourism and recreational infrastructure and services. The magnitude of increased expenditures is difficult to estimate, but is generally related to:

    - The number of staff hired for the Project;
    - Recreational opportunities and services available in the immediate area; and
    - The duration of the Project.

In relation to other districts in Nova Scotia, the Eastern Shore of Nova Scotia accounted for only 7% of the visitors to Nova Scotia (2010 Nova Scotia Visitor Exit Survey). Of the 7% of tourists who visited the Eastern Shore, only 9% visited Guysborough and 18% visited Canso. This demonstrates that tourism is not a major source of revenue for these communities, although it no doubt plays a critical economic role to some local businesses. Similarly, demand on existing tourism and recreational services are relatively low. The main tourist locations are beaches, trails and parks. Recreational fishing in the Bay, especially for Bluefin Tuna, is also a popular tourist and recreational activity. Unfortunately, no similar data exist that describe the level of economic activity generated by local tourists; that is, by people visiting this area from Halifax, Cape Breton and other parts of Nova Scotia.

Currently, the coastal regions of the Project Area are occasionally visited by local residents who enjoy the beaches and undeveloped vistas (H. Krause, pers. comm. 2014). These areas are also used occasionally for recreational fishing. Because access to the terrestrial portions of the Project Area has historically been difficult, the Property is not consistently used for recreational purposes. An overgrown access trail connects Fox Island Main to Black Point, and ATV trails reportedly connect Upper Fox Island with residents on Half Island Cove Road (O. Rhynold, pers comm. 2014). Beaches, recreational fishing opportunities and hiking/ATV opportunities are relatively common within the municipality and so the loss of these opportunities within the Project Area itself is not considered a significant adverse effect.

The closest tourism and recreational facilities in the Affected Area are Lower Half Island Cove Beach, 1.70 km west, Eagle Valley and Hayden Lake Cottages, 880 m 980 m south, respectively, and Seabreeze Campground 3.3 km east. The potential environmental effects of dust, noise, and light trespass on these receptors are presented in Sections 7.1, 7.2, 7.3 respectively. In all cases, no significant adverse effects are predicted although noise and light may be perceptible from viewpoints to the east and west. With respect to Seabreeze Campground located over 3 km from the Project site, it is likely that Project related noise will be perceived as a component of ambient of background noise. This is not expected to affect attendance rates at the campground.

At peak operations there will be approximately 90 ships a year transporting material from the quarry; adding to the almost 600 large vessels (and an unrecorded number of fishing and recreational vessels) that are already present on an annual basis. Given that ships are a common sight in Chedabucto Bay, the presence of these additional vessels is not expected to cause a noticeable change to tourism and recreational use patterns in the Affected Area.

As noted in Section 7.13 (Local Economy, Land and Resource Use), a vessel fuel spill in the marine environment would likely result in changes to land use in the vicinity of spill over the short and medium term (estimated at 5-15 years). Depending on where the spill occurred and the volume of fuel released, people may refrain from boating in the area and visiting favourite beaches and headlands. This is in turn would have negative economic consequences within Guysborough County.

As noted, the Project will employ 50-60 people full time at peak production. The majority of people employed will likely come from local communities and therefore no significant increase in population is expected. Nevertheless, these 50-60 new employees will likely spent a portion of their disposable income on recreational or tourism-type activities, equipment and services. While this expenditure may be noticeable to local businesses and so would be considered a positive Project effect, the increased expenditure is not considered to be a *significant* positive effect.

7.14.5 Mitigation & Monitoring

Since the effects from the Project under normal operating conditions on tourism and recreational activities are expected to be minimal, no specific mitigation or monitoring is proposed. The site entrance from Marine Drive will be equipped with a sign announcing the company and operations, while precautionary signs will be posted at appropriate locations along the property boundary and coastline warning recreational users of potential site and operational dangers.

With respect to a spill in the marine environment, navigational safety mitigation measures aimed at preventing vessel collisions and emergency response planning measures are presented in Section 7.18.3. Vessels will not be refuelled at the marine terminal; this helps to minimize the risk of fuel spills at the terminal. Vehicle fuel used at the quarry will be kept in double hulled reservoirs protected against collision. In the event of a spill on land, site drainage is directed south to the settling ponds rather than north to Chedabucto Bay. This in turn helps to contain any spills and allow them to be cleaned up.

7.14.6 Residual Effects & Significance

The significant residual impacts of the development are considered in the Table 7.14-1. No significant adverse effects to this VC.

Table 7.14-1:
Residual Environmental Effects for Tourism and Recreation

			Significance Criteria for Residual Environmental Effects						
Project-Environment Interaction	**Potential Positive (P) or Adverse (A) Effect**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility (R=reversible NR=Non reversible)**	**Ecological/Social-cultural and Economic Context**	**Residual Effect**	**Significance**
Construction									
Decrease in tourism on within the property boundary and Affected Areas	A	None	Low (1)	2 (1-10 km^2)	3/6 (2 years/continuous)	R	Area is affected by past human activity.	Minimal within County	Not Significant
Increase in tourism related expenditure	P	None	Low (1)	3 (11-100 km^2)	3/6 (2 years/continuous)	R	Area is affected by past human activity.	Positive	Not Significant
Operation / Decommissioning									
Decrease in tourism on within the property boundary and Affected Areas	A	None	Low (1)	2 (1-10 km^2)	5/6 (>6 years/continuous)	R	Area is affected by past human activity.	Minimal within County	Not Significant
Marine Fuel Spill	A	Implementation of navigational safety measures; Use of an Emergency Response and Spill Contingency Plan	Medium (2)	2 (1-10 km^2)	5/1 (>6 years/one time)	R	Area is affected by past human activity.	None anticipated	Not Significant

Increase in tourism related expenditure	P	None	Low (1)	3 (11-100 km^2)	56 (>6 years/continuous)	R	Area is affected by past human activity.	Postive	Not Significant

Legend

Magnitude:
U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown.
0 = Nil - No environmental effect.
1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation)
2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability)
3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)

Geographic Extent:
1 = < 1 km^2
2 = 1 – 10 km^2
3 = 11 – 100 km^2
4 = 101 – 1,000 km^2
5 = 1,001 – 10,000 km^2

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

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

Reversibility:
R = Reversible
I = Irreversible

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

7.15 COMMERCIAL FISHERIES

7.15.1 Overview

Marine commercial fisheries represent an important, sustainable resource of historical, cultural, social and economic value to local communities and Mi'kmaq As noted, there are no *freshwater* commercial or recreational fisheries on the Property. At the same time, aquaculture is not currently practiced along the south shore of Chedabucto Bay. Freshwater fisheries and aquaculture are not discussed further in this section.

The primary species harvested on a commercial basis in Chedabucto Bay south of the established shipping lanes are:

- Lobster;
- Shrimp;
- Herring, Mackerel and Squid
- Snow Crab;
- Tuna; and
- Scallop

Sea urchin, rock crab, marine plants and eels are reportedly not fished on a commercial basis at this time, although local fishermen do have licenses that permit the harvest of these species. Mackerel is the primary salt-water recreational species in the area, but catch and release recreational bluefin tuna fishing is also popular.

The fisheries considered for this assessment include the commercially harvested finfish and shellfish listed above. For the purposes of this section, the term "fish" and "fishing" generally refers to all species mentioned above unless the context suggests otherwise.

7.15.2 Boundaries

7.15.2.1 *Temporal Boundaries*

Impacts to commercial fishing are expected while the marine terminal is being constructed (24 months) and operated (45 years). Decommissioning activities will be short-lived (12 months although this may be extended if needed) but may also interfere with commercial fishing.

The temporal boundaries also consider the different fishing seasons since these are the times when commercial fishing occurs within the spatial boundaries defined for the EIS.

7.15.2.2 *Spatial Boundaries*

The spatial boundaries for Commercial Fisheries are similar to those identified for Marine Species and Habitat. Assessment boundaries divided into the Project Area, the Affected Area and the Study Area.

For the Commercial Fisheries VC, the Project Area is defined as the limits of the proposed seabed Crown lease that will be needed to construct the marine terminal (Section 1.0 and Figure 4.0-1). The Crown lease boundaries will entirely contain the marine terminal.

The Affected Area is the nearby zone that could potentially be affected by Project activities. For this VC, the Affected Area is a zone around the marine terminal where lobster fishing will be restricted for safety considerations as ships access and berth at the terminal.

The Study Area is the larger zone in Chedabucto Bay where other types of Project-environment interactions may occur. In this case, the Study Area is defined to include the proposed ship travel routes between the marine terminal and the established shipping lanes in Chedabucto Bay, as shown on Figure 3.29. This zone is chosen since it defines an area within which Project-related shipping may interfere with commercial fishing activities.

7.15.2.3 *Administrative Boundaries*

Commercial fish harvesting is managed and regulated by Fisheries and Oceans Canada, a federal agency, under the *Fisheries Act* and its enabling regulations. From the provincial perspective, the *Fisheries and Coastal Resources Act* regulates recreational fishing, sea plant harvesting, licensing of fish buyers and processors, and aquaculture.

Administrative boundaries applicable to commercial fisheries include the fishing area boundaries and districts, as well as fishing seasons imposed by regulation on commercial fishermen. These boundaries are described in Section 6.10.

7.15.2.4 *Technical Boundaries*

To protect the confidentiality and economic livelihood of fishermen, species landing data reported by individual fishermen is “aggregated” into larger datasets that tend to conceal exactly where fish and other species are caught, and how much of each species is landed. According to DFO, each unit of data released consists of a minimum of five license holders, vessels and buyers. This means that only generalized fishing trends are available as a basis for descriptions of Project impacts.

7.15.3 Threshold for Determination of Significance

A Project-related significant adverse effect on commercial fisheries is one that causes:

1. an uncompensated loss of habitat of those fish species that are used for, or support commercial, recreational and/or Aboriginal fisheries; or

2. a sustained decrease in earnings from a fishery due to lower catch quantity and/or quality, or increased fishing costs (i.e., due to longer travel times, loss of gear, additional license fees, etc.).

7.15.4 Effects of the Project on Commercial Fisheries

The presence and use of the marine terminal will result in limitations to lobster harvesting in the immediate area and, as a result, displacement into other areas of those who currently fish in the nearshore at the Black Point site. This limitation will occur for two reasons: (1) the construction of the marine terminal will remove approximately 1.0 ha of lobster habitat that is currently available for commercial exploitation, and (2) fishermen will likely steer clear of the active marine terminal for safety and out of concern for gear losses. The marine terminal itself is not expected to significantly interfere with marine navigation.

Potential sediment-laden water runoff from terrestrial construction activities and consequent negative effects to water quality may displace fish from the immediate near shore but is unlikely to result in their death.

The transit of empty and loaded aggregate transport vessels has the potential to interfere with other commercial fishing activities that occur in deeper water between the established shipping lanes and the south shore of Chedabucto Bay. Once construction is complete, Project-related ship traffic will begin at a relatively modest rate of about 30 ships per year (less than 3 ships per month), increasing to about 90 ships per year once full capacity is reached after approximately 10 years (provided market conditions support this rate). This is equivalent to about one ship every four days or so. In addition to interference with on-going fishing, noise associated with this increased traffic may displace fish from the immediate area.

The added ship traffic (consisting of aggregate transports, tugs and pilot vessels) may require fishermen who frequent deeper water to avoid preferred fishing grounds to accommodate Project-related ship traffic. The deep water shrimp fishery concentrated along the edge of the established shipping lane is reportedly vulnerable to displacement since fishermen are currently exploiting all the available shrimp grounds.

Accidental fuel spill or other discharges to the aquatic environment can alter water quality and physical habitat, which in turn can negatively affect life-cycle stages of commercially important species and their food supply. Accidental aggregate spills will not likely affect the commercial fishery since this material has already been washed to remove fine-grained sediment. Granite itself is chemically inert and is common in Chedabucto Bay.

Effects of decommissioning the marine terminal will similar to those expected during construction, except that it is likely the marine terminal will be left in place rather than removed. Surface structures such as the access road and slewing arm may be removed for safety and security but work associated with this removal will be of temporary duration.

No impact is expected to the fixed berth mackerel, herring and squid trap fisheries since these berths are considerably removed from the Project site (Section 6.10). A possible exception to this are the two mackerel traps located in Indian Cove approximately 4.0 km east of the marine terminal. Concerns have been raised by local fishermen that the marine terminal will divert mackerel from their normal coastal-hugging route that brings them into Indian Cove where the traps are located. Instead, the terminal may encourage the fish to remain offshore and travel directly from Black Point to Fox Island, rather than entering Indian Cove.

Consideration is also made for the Mi'kmaq First Nations which have recognized rights to the commercial or livelihood fishery. It is understood that any impacts that could result in an uncompensated loss in habitat, or in loss of sustained earnings in the livelihood fishery must be addressed with respect to the impact on Mi'kmaq rights.

Mi'kmaq livelihood fishing is managed in accordance with the regulatory procedures used by DFO for the non-aboriginal commercial fishery: the existing baseline conditions for the commercial fishery are shared with the Mi'kmaq livelihood fishery (seasonality, license conditions, quotas etc.). As a result, the current baseline conditions for the livelihood fishery are the same as those of the commercial fishery.

Although the Mi'kmaq Band Fisheries Departments have reported that there is currently no livelihood lobster fishery activity, or food, social and ceremonial lobster fishing activity in the waters near the Project site at this time, effects on the commercial fishery in the area may have an impact on the right to access the fishery. Therefore it is important to maintain ongoing communication with Mi'kmaq First Nations throughout the Project and during decommissioning. This communication will be through direct dialogue.

It has been noted that the principle livelihood fishery in the area is the commercial shrimp trap fishery. Concerns have been raised by non-aboriginal fishermen that ship movements may interrupt or temporarily displace shrimp trap fishing operations. This spatial conflict has been resolved through dialogue between the Proponent and local area shrimp fishermen, with the result that vessel activity near the marine terminal will avoid preferred shrimping grounds to the extent this is possible, practical and safe.

Mi'kmaq fishing, hunting and gathering activities can be impacted by the cumulative effects of multiple projects (Section 9.0). However, it is likely that the cumulative effects of the identified projects in the area will have little impact on the Mi'kmaq fishery and wildlife harvesting in the Project area. It is possible that there could be a positive cumulative impact on social condition of Mi'kmaq harvesters as multiple projects are undertaken that might provide useful and necessary employment for Mi'kmaq marine and environmental skills at several ongoing project sites.

7.15.5 Mitigation & Monitoring

7.15.5.1 *Mitigation*

The scale of marine terminal construction impacts to commercial fisheries will depend in part on the seasonal timing of in-water work. Impacts will be greater if marine terminal construction occurs during lobster season, which runs from April 29 to June 30. The area occupied by the marine terminal is reportedly fished by only two or possibly three fishermen since appropriate lobster habitat is limited to relatively shallow depths in the immediate nearshore. Off the Black Point property, the water deepens rapidly and the bottom changes from rocky to muddy substrate, which is less preferred by lobster.

The primary mitigation measure is to minimize impacts during construction through the use of standard best management practices for terrestrial and in-water construction. Standard construction best management practices and mitigation measures to control onshore sediment release to the marine environment will be implemented. These measures are described in Section 7.6 and Section 7.11.

The effects of increased ship traffic will be mitigated by ensuring fishermen and the local traffic authority is aware of Project-related vessel traffic with sufficient advance notice to redeploy gear elsewhere as needed. At the same time, regular and on-going communication from fishermen who routinely fish in areas that will likely be transited by Project vessels would be helpful to limit unnecessary changes to fishing habits and accidental interactions between Project vessels and fishing gear. Communication regarding ongoing fishing practices can be used by pilots and ship masters to avoid particular fishing areas at all times, during certain times of the fishing season, or for certain weeks of a specified month. To aid this two way communication, local fishermen will be encourage to call the quarry site office, which will be manned 24 hours per day, in order to receive updates regarding vessel arrivals and departures.

Vessels regularly transit Chedabucto Bay safely and effectively with the help of pilots who understand the navigational hazards of the Bay, using communication with shore based traffic oversight facilities, and through the use of established shipping lanes and navigation protocols. Should Project-related vessel traffic or construction result in fishing gear damage or loss, this loss can be reported to the quarry site office.

Construction and regular use of the marine terminal will likely require a safety exclusion zone around the terminal. The loss of fishing access will no doubt mean that lobster can no longer be harvested from this nearshore area. However, this area is quite small (1.1 ha not

including the estimated safety zone) and preliminary discussions with lobster fishermen have indicated that considerable opportunity to create lobster habitat in the nearshore exists immediately adjacent to (both east and west of) the Project site.

The marine terminal will be equipped with lights and fog horns as required for safety by Transport Canada. These aids will effectively mitigate any navigation concerns.

Mitigation for loss of fish habitat is detailed in Section 7.11. A Fisheries Offset Program will describe the work that will be undertaken to create new lobster habitat along the south shore of Chedabucto Bay. Mitigation measures must also ensure that impacts on Mi'kmaq rights to food, social and ceremonial and livelihood fish harvesting are addressed. As part of the above, the Project will maintain formal and routine communication with Mi'kmaq First Nation representatives to determine the effectiveness of mitigation measures on the specific impacts on Mi'kmaq food, social, ceremonial and livelihood harvesting that may be identified during Project activities. Routine communication protocols will be established under the terms of the Collaborative Benefits Agreements.

Furthermore, potential impacts on livelihood fishing activity will be a focus of discussion in the Community Liaison Committee to which Mi'kmaq representatives have been invited as committee members.

Summary

During the construction phase, efforts to reduce or mitigate effects to commercial fishermen will include (a) on-going communications between the Proponent and representatives of the local fishing community; (b) completing the marine terminal construction outside of lobster fishing season (i.e., for the late summer, fall, winter and early spring) to the extent possible; (c) complying with well-established navigation safety procedures; and (d) addressing claims regarding gear damage and loss and when appropriate, providing compensation. With the implementation of these measures, significant adverse effects on commercial fisheries due to construction of the marine terminal are therefore not anticipated.

Exclusion from fishing grounds due to incoming or outgoing vessels will be mitigated through ongoing communication between fishermen and the vessels. Provided communication is regular, on-going and two-way, impacts associated with commercial fisheries other than lobster are expected to be not significant. The potential effect on overall catch harvest and the cost of fishing is from vessel interference is anticipated to be insignificant, but will be addressed through consultation with the marine fisheries authorities and the local fishing community. The Proponent will inform local fishermen and other vessel captains of the location and scheduling of activities and other potential hazards through issuance of *Notices to Mariners,* as required by applicable regulation. Provided these mitigation measures are implemented on an on-going basis, no significant adverse impacts to commercial fisheries are predicted.

7.15.5.2 *Monitoring*

Monitoring of the effectiveness of the marine Fisheries Offset Program will be undertaken for a minimum of three years during and after marine terminal construction until it can be demonstrated that the program objectives have been met. Terminal operations and fishing access will be monitored in response to concerns expressed by the local fishing community, as needed. In future consultation with the GCIFA, the Proponent will consider participating in the comprehensive and extensive fisheries data collection programs currently undertaken by the GCIFA.

7.15.6 Residual Effects & Significance

Provided the recommended mitigation measures are implemented and claims for compensation due to gear damage or loss are addressed in a timely and effective manner, no significant adverse residual environmental effects on commercial fisheries are likely to occur. Table 7.15-1 provides a summary of the residual environmental effects and recommended measures for the Commercial Fisheries VC.

Table 7.15-1:
Residual Environmental Effects for Commercial Fisheries

Project Environment Interaction	Potential Residual Environmental Effects A = Adverse P = Positive	Mitigation	Magnitude	Geographic Extent	Duration / Frequency	Reversibility	Ecological / Socio-Economic Context	Residual Effect	Significance of Residual Impacts
Construction									
Marine terminal construction: noise and suspended sediments causing fish avoidance;	A	• See Mitigation above	1 (low)	2 (1-10km²)	3/1	R	1	Temporary avoidance	Not Significant
Loss of access to fishing grounds; displacement								Temporary pending Offset Program	
Vessel traffic to support construction: loss of access to fishing grounds; displacement	A	• See Mitigation above	1 (low)	2 (1-10km²)	3/1	R	1	Temporary displacement	Not Significant
Loss or damage to fishing gear								None anticipated	
Operation and Maintenance									
Presence of the marine terminal: loss of access to fishing grounds; displacement	A	• See Mitigation above.	1 (low)	2 (1-10km²)	5/6	I	1	None anticipated following Offset Program	Not Significant
Accidental fuel spill or other discharges to the aquatic environment can alter water quality and physical habitat, which in turn can negatively affect life-cycle stages of commercially								None anticipated	

important species and their food supply. Interruption of mackerel movements due to the projecting marine terminal resulting in reduced catches in Indian Cove										None anticipated	
Project-related Vessel traffic: loss of access to fishing grounds; displacement Loss or damage to fishing gear	A	•	See above.	Mitigation	1 (low)	2 (1-10km^2)	5/6	R	2	None anticipated	Not Significant
Decommissioning											
Project-related vessel traffic:	A	•	See above.	Mitigation	1 (low)	2 (1-10km^2)	3/3	R	2	None anticipated	Not Significant

Legend	Geographic Extent:	Frequency:	Ecological / Socio-Economic Context:
Magnitude: U= Unknown - An environmental effect affecting an unknown portion of a population or group or where the changes in a specific parameter are unknown. 0 = Nil - No environmental effect. 1 = Low (e.g., specific group, habitat, or ecosystem localized 1 generation or less, within natural variation) 2 = Medium (e.g., portion of a population or habitat, or ecosystem 1 or 2 generations, rapid and unpredictable change, temporarily outside the range of natural availability) 3 = High (e.g., affecting entire stock, population, habitat or ecosystem, outside the range of natural variation)	1 = < 1 km^2 2 = 1 – 10 km^2 3 = 11 – 100 km^2 4 = 101 – 1,000 km^2 5 = 1,001 – 10,000 km^2 Duration: 1 = < 1 month 2 = 1 – 12 months 3 = 13 – 36 months 4 = 37 – 72 months 5 = > 72 months	1 = < 11 events/year 2 = 11 – 50 events/year 3 = 51 – 100 events/year 4 = 101 – 200 events/year 5 = > 200 events/year 6 = continuous Reversibility: R = Reversible I = Irreversible	1 = Relatively pristine area or area not adversely affected by human activity. 2 = Evidence of adverse environmental effects. N/A = Not applicable A = Adverse P = Positive

7.16 ARCHAEOLOGICAL AND HERITAGE RESOURCES

As defined by the Nova Scotia Department of Communities, Culture and Heritage, an archaeological resource is:

> *"a work of past human activity, or zoological, botanical, geological or other natural materials found in association with such activity that:*
>
> > *(i) is primarily of value for its prehistoric, historic, cultural or scientific significance; and,*
> >
> > *(ii) lay on, or was buried or partially buried in land in the province, including land covered by water."*

Archaeological and Heritage Resources were identified in the EIS Guidelines as a potential VC as concerns have been raised regarding the possible existence of these resources during the public outreach phase of the environmental assessment.

A 2011 Archaeological Resource Assessment survey did not identify any archaeological or heritage resources, but potential post-European contact resources were identified on the Property near the coast during the 2014 Archaeological Resource Assessment (Section 6.12 and **Appendix L**). Although 30 m buffer zones will be left undisturbed along the coastline, (thereby protecting some of these finds), much of the coastal zone inside this buffer will be built upon, thus potentially disturbing, destroying or covering over some of these resources.

Details of archaeological and heritage resources existing conditions on the Project site are presented in Section 6.12.

7.16.1 Boundaries

7.16.1.1 *Temporal Boundaries*

The temporal boundaries for the assessment of impacts upon archeological and heritage resources are limited to the construction phase of the development. Construction is estimated to take two to three years. An adverse effect on an archeological or heritage resource would be permanent.

7.16.1.2 *Spatial Boundaries*

The spatial boundaries for the assessment of impact on archeological and heritage resources are limited to the terrestrial portion of the Project Area, particularly the coastal areas. The inhospitable nature of the barrens suggests that little cultural activity, whether Pre-contact or historic, would have occurred in the central portion of the Project Area.

7.16.1.3 *Technical Boundaries*

No technical boundaries were identified for the Archeological and Heritage Resources VC.

7.16.1.4 *Administrative Boundaries*

Nova Scotia's *Special Places Protection Act* governs archaeological surveys in Nova Scotia. In order to conduct any archaeological work a Heritage Research Permit issued by the Minister of the Department of Communities, Culture and Heritage must be obtained.

7.16.2 Threshold for Determination of Significance

Based on the existing information for the area, the Project may interact with some areas considered to hold a high potential for documented and/or undocumented archaeological resources. If archaeological resources are identified within the Project Area, a significant adverse effect is defined as an uncontrolled disturbance to, or destruction of, any such resource considered by the Mi'kmaq, provincial regulators or local residents to be of major importance.

7.16.3 Effects Archaeological and Heritage Resources

7.16.3.1 *Construction*

There is potential for the loss of archaeological resources in preparation of the site for construction, during the clearing, grubbing and grading phase of the Project. Artefacts may be encountered on the lower coastal platform as described in Section 6.12.

7.16.3.2 *Operation*

There is no potential for the disturbance of archaeological or heritage resources during the operational phase of the Project.

7.16.3.3 *Decommissioning*

There is no potential for the disturbance of archaeological or heritage resources during the decommissioning phase of the Project.

7.16.4 Mitigation and Monitoring

7.16.4.1 *Mitigation*

Exploratory excavation will likely be required in those areas that may be disturbed during Project construction. This excavation work will be undertaken under the direction of experienced archeologists before construction begins. At the same time, potential heritage resources identified during the 2014 study that will not be disturbed by construction will be flagged to ensure they are not accidentally affected by construction activities.

Prior to beginning construction, the Proponent will implement a Cultural Resource Management Plan to guide site personnel in the event that archaeological and heritage resources are identified during construction. An example of this plan is provided in **Appendix L** as an attachment to the 2014 Archaeological Resource Assessment.

The Cultural Resource Management Plan specifies a notification procedure if remains are found, and will describe resource specific preservation measures as needed. This may include archaeological excavation or avoidance of the site. These mitigation measures would be

approved by the Minister of the Department of Communities, Culture and Heritage before site construction could begin. This Plan is considered a standard mitigation measure applied at construction site with cultural heritage or archaeological potential

7.16.4.2 *Monitoring*

The Project archaeologist will be informed with respect to construction starting dates and progress. During initial construction phases, the archaeologist will be on “standby” and may visit the site from time to time as needed.

7.16.5 Residual Effects and Significance

The results of the effects assessment for the archaeological resource VC is provided in Table 7.16-1.

With application of resource specific mitigation measures outlined in the Cultural Resource Management Plan, no significant adverse effects to these resources are likely.

Table 7.16-1:
Residual Environmental Effects for Archaeological and Heritage Resources

			Significance Criteria for Residual Environmental Effects						
Project-Environment Interaction	**Potential Positive (P) or Adverse (A) Effect**	**Mitigation**	**Magnitude**	**Geographic Extent**	**Duration/Frequency**	**Reversibility (R=reversible NR=Non reversible)**	**Ecological/Social-cultural and Economic Context**	**Residual Effect**	**Significance**
Construction									
Damage to or destruction of cultural resources.	A	• Undertake exploratory excavation to document and conserve resources prior to construction • Flag and buffer heritage resources so that will not be disturbed during construction • Implement a Cultural Resources Management Plan in the event that other heritage resources are revealed during constructions	Low	Limited to the lower coastal platform of the Project footprint (about 30 ha).	Permanent / one time but avoidable with mitigation	NR	Area is affected by past human activity.	None Anticipated	Not Significant
Operation / Decommissioning									
None expected									

7.17 ABORIGINAL LAND AND RESOURCE USE

The MEKS prepared for this environmental assessment (**Appendix K**) highlights the Mi'kmaq Nation's long-standing relationship with, and attachment to, the region in and around the Project site. The region holds historical significance to the Mi'kmaq nation and to the development of relationships between European settlers and the Mi'kmaq. While the Project area is not home to present day Mi'kmaq communities, it was in this region that Mi'kmaq demonstrated local hunting, trapping and gathering practices to newcomers, thus fostering a lasting relationship of peace and friendship with the French, and eventually other European inhabitants of the *Eskikewa'kik* area. This intimate relationship between the Mi'kmaq and the region is demonstrated with the extensive awareness of flora and fauna resources in the Project area despite the interruption in use of the area due to development and national Aboriginal policies. The existence of numerous species of plants, fish, and game in the Project area that are known to be culturally significant to Mi'kmaq is evidence that the site was likely used by the ancestors of today's local Mi'kmaq communities.

Based on the findings of community wellbeing studies conducted by Aboriginal Affairs and Northern Development Canada, the well-being index score for Mi'kmaq communities is well below average index values for local non-aboriginal communities (O'Sullivan 2011). The average Nova Scotia Mi'kmaq income index is 41/100, education is 41, housing is 72, and labour force activity is 66 with an overall community wellbeing index value of 55, which is well below the Atlantic region wellbeing average of 73. Since employment and income levels are below average, many families augment food supplies through hunting and fishing.

This is consistent with traditional and historical practice since Nova Scotian Mi'kmaq communities have always been highly dependent on natural resources. Fisheries and hunting played an important role in in the annual community cycle, with communities migrating between their summer and winter encampments and the associated area harvests being divided between food, ceremonial, and commercial purposes (Stiegman 2006). This dependence was the foundation for the cultural relationship with the environment referred to as Netukulimk, a Mi'kmaq concept that relates to making a livelihood from the land through resource harvesting which does not jeopardize the integrity, diversity, or productivity of the environment (Doyle-Bedwell and Cohen 2001). There was an easy transition into a livelihoods fishery after colonization, as fishing was historically among the essential seasonal activities of the Mi'kmaq (Notzke 1994)

Traditionally, Mi'kmaq rights relating to decision-making over natural resources were not vested in a hierarchical leadership but rather were made through a consensus of all members of the community (Milley and Charles, 2001). This approach to management was eroded over time as a result of government policy and practices. Furthermore, passive exclusion of First Nations from mainstream economic activity resulted from governmental limitations on access to the fishery (as well as forestry and other resources) which resulted in little, if any, economic benefit (Wiber and Milley 2007).

This has resulted in the below average economic condition (as noted above), and while First Nations are provided with various social services and programs (including housing, education and health), program deliver has not kept pace with demand and these communities and many First Nation communities remain well below Canada's accepted national standards.

However, improvements to resource access have come about over the past two decades through the avenue of aboriginal rights, as a result of decisions of the Supreme Court of Canada. In particular, the Marshall decision has led to significantly increased involvement of Mi'kmaq First Nations in commercial fishing activities, through the issuance of communal commercial licenses. Being communal in nature, a community can manage these commercial licenses not only in the interests of those who are fishing, but also to provide benefits across the community.

As noted in section 6.10.4, several Mi'kmaq communities are currently fishing marine species for livelihood purposes along the eastern shore. Of these, only the Waycobah shrimp trap fishery is operating in proximity to the Project where Project-related impacts may be anticipated. The Waycobah band holds the only Mi'kmaq shrimp trap license in the south side of Chedabucto Bay however this license is currently being fished by non-aboriginal license holders on behalf of the Band where the allocated traps are divided among several local non-Mi'kmaq fishermen (G. Boudreau, pers. comm. 2015). In addition, no Mi'kmaq fishermen currently deploy lobster traps in the Project vicinity (G. Boudreau, pers. comm. 2015) although they, like other LFA 31 license holders, have the right to fish anywhere within LFA 31.

Shrimp and other fisheries are managed under the Department of Fisheries and Oceans through communal commercial licenses, some of which are issued for the large fishery management areas along the Nova Scotia eastern shore. Given this, there is no defined "Mi'kmaq fishery" as such.

As noted in section 6.10.4, there is currently no direct Mi'kmaq use of the Project site for subsistence harvesting of food or furbearing in animals. However, as noted in the MEKS (**Appendix K**), based on archival research and interviews with key knowledge holders there is:

1. potential for the disturbance of hitherto unidentified archaeological resources during the construction of the infrastructure (access road, processing facility, shipping terminal) associated with the Project, as well as the quarry operation itself.

2. likely permanent loss of wildlife and plant resources which have been traditionally harvested within the immediate project footprint. This loss is likely the result of the physical removal or displacement of specimens during construction and operation of the quarry, or restriction of access to the location as a potential harvesting area.

3. potential harm or dispersing of local wildlife due to noise disturbance resulting from increased human presence, vehicular traffic, blasting, and general mining activities.

4. potential disturbance or contamination of vegetation, wetlands and water bodies within the corridor along the access road, and within the area of the quarry pit as well as the shipping terminal as a result of settlement of dust and other airborne pollutants created during the mining, crushing and transport of the product. This can depreciate the quality of local food and medicinal plants for human consumption as well as the quality of animal browse and water/wetland habitat.

5. potential degradation of the local marine and shoreline habitats surrounding the shipping terminal due to dust contamination, the potential for accidental aggregate spillage during loading, and possible contamination resulting from accidental spills of petroleum products associated with cargo vessels.

The nature of Mi'kmaq cultural connection with traditional resource harvesting activities suggests that environmental effects on fish, plants and wildlife can create associated socio-cultural and/or socio-economic effects. These can lead to disconnection with traditional food sources thus increased dependence on non-traditional foods and general community frustration and anger due to cultural erosion/assimilation.

7.17.1 Boundaries

The boundaries of the potential environmental effects vary from ecosystem and socio-economic perspectives. The Affected Area includes all lands and waters that are *potentially* used by the Mi'kmaq for traditional harvesting purposes, and which could be affected by the Project via light, noise, dust or other emissions. In this respect, the Project boundaries for the Aboriginal Land and Resource Use VC are identical as those described for each biophysical component in the previous sections. Generally speaking however, the environmental effects (1 to 5 above) are bounded within the Project site, or in close proximity to the project Site since there is currently no active traditional harvesting on the Project site or in the immediate vicinity.

The boundaries for the social, health, cultural, and socio economic effects are wider in geographical scope. These effects include the Mi'kmaq families who have been involved with resource harvesting in the region, and their communities. The boundaries include the Mi'kmaq communities discussed in section 6.9.3.

7.17.2 Threshold for Determination of Significance

The threshold for determination of significance of the social, cultural and economic effects is determined through ongoing discourse with Mi'kmaq representatives. Since Project effects can be considered as a matter of Rights to harvest food, social and ceremonial resources, and Treaty Rights to harvest natural resources, including plants, fish and wildlife for a moderate livelihood the threshold for determination of significance is a matter of consideration by the Crown and Mi'kmaq representatives (Assembly of Nova Scotia Chiefs and the Governments of Canada and Nova Scotia).

Project effects resulting in the loss of employment and income for Mi'kmaq fishers that could not be replaced within a reasonable time, loss of food resources upon which Mi'kmaq families depend that could not be found in reasonable proximity to communities, or permanent loss of cultural relationship caused with the lands, flora and fauna directly by the Project would be significant. Non-permanent or geographically limited (i.e., small scale) changes in harvest areas caused by displacement due to Project activities are not considered to be significant.

7.17.3 Effects on Aboriginal Land and Resource Use

In addition to the environmental considerations discussed below, Mi'kmaq culture is valued greatly in NS. Many Mi'kmaq continue to pursue elements of a traditional lifestyle, spending time in the country harvesting fish, game, berries, and firewood. Mi'kmaq land/resource use and culture could be affected by the Project development through such effects as the loss or alteration of harvesting areas and reduced access to traditionally used lands. Aboriginal land claims can affect the establishment of clear title for land designated for industrial development and exclusive use. Both Federal and Provincial Governments have responsibilities with respect to Aboriginal peoples and the settlement of outstanding land claims. Consideration of Aboriginal interests is legislated by federal and provincial laws.

While presently there is limited involvement of Mi'kmaq individuals in the Project site, it was clearly evident that the region had been used in the past (within living memory) for food gathering and recreation. The decision to continue to use this area has been affected by a number of historical factors (most significantly centralization policies to move Mi'kmaq families to reserves) and demographic factors. A rapidly growing youth population that is pursuing education and alternative training has resulted in a slight de-emphasis on hunting within the rapidly growing communities (it is possible that firearms regulations and hunter training requirements may be a contributing factor in the decline in hunting amongst Mi'kmaq youth).

It is also clear from the research that, traditionally, decisions related to food, social and ceremonial fishing and hunting has been based on opportunistic access to food resources that are most abundant in close proximity to reserve communities and urban residential areas. As a result, there may be future interest in fishing, hunting and possibly gathering in the Project area as land-use changes, and increased urbanization and other developments impact areas currently used by Mi'kmaq hunters and fishers. In keeping with traditional decision-making practices, an important attribute of the ecological knowledge system, areas such as the Project site would logically be considered for harvesting activities due to its easy access from Nova Scotia's transportation routes.

It has been noted during the engagement activities that several Mi'kmaq communities have access to the waters adjacent to the project site for livelihood fishing. While these licenses fall under the management plans and regulatory control of the Department of Fisheries and Oceans, access to the commercial fishery by Mi'kmaq harvesters is founded in the Treaty Rights held by the Mi'kmaq nation. Mi'kmaq which has been involved in the local groundfish, lobster, snow crab, tuna, swordfish, and mackerel fisheries include: Acadia, Potolotek, Eskasoni, Sipekne'katik, Membertou, Millbrook, Wagmatcook, Waycobah, Pictou Landing and Paqtnkek.

Potential Project-related effects on the natural environment and land resources with potential significance for Mi'kmaq interests are listed in Table 7.17-1 The table includes mitigation measures aimed to minimize the overall ecological effects of the Project on the site and adjacent lands. The Proponent is committed to addressing Mi'kmaq interests, minimizing possible adverse Project effects, and maximizing Project benefits in a collaborative approach to Project planning and development (see Section 11). This is expected to include all phases of the Project.

While there is currently no Mikmaw harvesting on the site or in waters immediately adjacent, it is intended that the Project site and adjacent waters will be accessible to Mi'kmaq for safe harvesting for flora and fauna for food, social and ceremonial purposes, in accordance with provincial and federal regulations. Any future potential Project impacts (environmental, social and economic) on these harvesting activities will be a matter of the formal and regular meetings with the Mi'kmaq community representatives in accordance with the terms set in the Collaborative Benefits Agreements.

Table 7.17-1:
Potential Impacts on Mi'kmaq Interests

Potential Impacts	Assessment of Significance	Mitigation
Construction		
Disturbance of archaeological Resources.	• Archaeological resources are irreplaceable and of extreme importance. Being the only source of information on Mi'kmaq pre-contact history, land use, occupancy and culture, archaeological information from the site should be preserved and protected.	While there has not been a confirmed Mi'kmaq archaeological significance of the Project site, observations will be maintained during all construction activity and should evidence be uncovered all activity will cease in the area until Mi'kmaq archaeological experts have had an opportunity to examine the site and determine appropriate action.
Permanent loss of wildlife and plant resources within the immediate Project footprint.	• The species of significance to Mi'kmaq communities identified within the Project areas, in particular medicinal plants, are also present within the surrounding areas. The permanent loss of some of (or access to) these specimens within the Project area is not expected to significantly limit Mi'kmaq use of these resources.	Efforts will be made to minimize the potential impact by containing all activity to within the Project footprint. Transferring significant flora and fauna to suitable nearby habitat will be implemented if warranted and feasible as determined through ongoing dialogue with Mi'kmaq communities
Construction, Operation and Decommissioning		
Noise disturbance will adversely impacts local wildlife resources.	• Increased sound levels resulting from construction activities can interfere with hunters in areas of significance to Mi'kmaq. Because of the local nature of these impacts, their significance on local Mi'kmaq harvesting activities is limited.	Noise mitigation will include measures noted in Section 7.2.
Contamination of surrounding vegetation, wetlands and water bodies through dust and other airborne pollutants.	• The level of depreciation of local food and medicinal plants for human consumption is determined to be not significant, as are the impacts of a deteriorating quality of animal browse and water/wetland habitats on local fish and wildlife. Even though the radius of these impacts will undoubtedly extend beyond the boundaries of the Project area, their effects on individual Mi'kmaq resource activities is expected to be limited.	Predicted ground level dust concentrations outside the Property will remain well within applicable air quality standards (**Appendix O**). Appropriate mitigation measures have been defined in Section 7.1.

Potential Impacts	Assessment of Significance	Mitigation
Contamination of marine and shoreline habitats surrounding the shipping terminal through possible fuel, oil or waste discharge associated with Project related vessel traffic or particulate run off from the project site.	• Potential impacts of such may be wider-ranging depending on factors such as the nature of the accident/spill, season and marine currents. The significance of such potential impacts on the Mi'kmaq fishery is undetermined, however, based on the apparent current lack of use of the area for food, social and ceremonial fisheries harvesting, it is assumed that any effects will have negligible effect on current Mi'kmaq FSC fish harvesting. • Impacts of particulate run off have been considered and are expected to be negligible since runoff will be directed to sedimentation ponds for treatment prior to discharge.	Considerations for avoidance and reducing the risk for accidents and malfunctions have been an integral part of the work on design, construction and operation of the Project. This is outlined in Section 7.18, where appropriate mitigation measures are described.

7.17.4 Residual Effects and Significance

The residual effects of the Project on Mi'kmaq land and resource use activities are considered to be of minor significance. However, as noted in Table 7.17-2 below, some residual effects may have greater significance which can be mitigated through monitoring and communication.

Table 7.17-2:
Residual Effects and Significance

Residual Effect	Significance
Permanent loss of wildlife and plant resources which have been reportedly traditionally harvested within the immediate Project footprint; loss of future opportunities to harvest these resources.	Minor significance. The effects are localized only to the Project site and will not likely have widespread impact on regional resource abundance and distribution.
Harm to, or dispersion of local wildlife due to noise disturbance	Minor significance, The effects of noise on fauna can modify local behaviour (often a temporary effect as many species will acclimatize to anthropogenic noise). As above, noise effects will not likely have widespread impact on regional resource abundance and distribution.
Potential depreciation of the quality of local food and medicinal plants for human consumption due to disturbance, or contamination of vegetation, wetlands and water bodies within the Project site	Medium significance. The effects of contamination may result in permanent loss of harvest areas which will not likely have widespread impact on abundance, but could potentially create health risk for people using, or consuming food resources that occupy the Project site. Ongoing monitoring and communication with Mi'kmaq harvesters through representative organization can mitigate this risk.
Potential degradation of the local marine and shoreline habitats surrounding the shipping terminal related to dust contamination, the potential for accidental aggregate spillage during loading, and possible contamination resulting from petroleum products associated with cargo vessels	Medium significance. As above, environmental contamination of local fish and shellfish harvesting areas traditionally used by Mi'kmaq can pose a health risk. Ongoing monitoring and communication with Mi'kmaq representative organizations can mitigate this risk. Since Mi'kmaq exercise their rights to livelihood fisheries in accordance with the DFO Regulatory procedures for commercial fisheries, widespread effects on the Mi'kmaq coastal commercial fisheries will be the same as non-aboriginal commercial fisheries. This is determined as being of minor significance as the area is not considered to be critical habitat for commercially important species.

7.18 CHANGES TO COMPONENTS WITHIN FEDERAL JURISDICTION

7.18.1 Environmental Effects Within Federal Jurisdiction

As stipulated in the EIS Guidelines, this section summarizes those changes to the environment that may be caused by the Project on environmental components listed in paragraph 5(1)(a) of CEAA, 2012, namely fish and fish habitat as defined in the *Fisheries Act*, aquatic species (marine plants) as defined in the *Species at Risk Act* and migratory birds as defined in the *Migratory Birds Convention Act, 1994*. The material presented here is summarized from the sections above.

Freshwater Species and Habitat

There is no freshwater fish habitat present on the Black Point property. For the purposes of the EIS, Reynolds Brook located 1.0 km south of the Property is assumed to support freshwater fish and fish habitat. Full quarry development will reduce Reynolds Brook inflows by approximately 18%. This change to the environment may impair fish survival during dry periods and/or improve habitat quality by reducing inflows of low pH surface water to the Brook. This in turn may positively or negatively change the risk of fish mortality in Reynolds Brook, and/or result in changes to habitat quality and use. The effects and Accidents and Malfunctions will not be felt in Reynolds Brook since these effects would be contained within the quarry pit, which ultimately discharges north through the sedimentation ponds rather than south to Reynolds Brook.

With the implementation of the mitigation measures described in Section 7.10.5.2, including the creation of a 30 ha lake following cessation of quarrying activities, the residual impacts to freshwater fish and fish habitat are predicted to be not significant.

Marine Species and Habitat

The potential Project-related effects associated with this VC are presented in section 7.11.4 and include:

- Reduced habitat quality and habitat function due to altered water and sediment quality from sediments introduced to the marine environment during construction and operation.
- Reduced habitat for fish that are part of or support commercial, recreational or Aboriginal fisheries resulting from construction of marine terminal.
- Fish mortality due to the use of explosives within the pit; behavioural changes to fish, crustaceans and other marine species due to noise and vibrations associated with explosives use.
- Mortality (marine plants, benthic and pelagic organisms, etc.) and/or the loss of benthic habitat due to aggregate spills when the ships are loaded.
- Increased disturbance to marine flora and fauna and reduced habitat quality and function for marine species due to noise and vessel movement from increased ship traffic.
- Invasive species that may be introduced through the illegal discharge of ballast water.

In summary, these Project effects, as well as those resulting from an accidental fuel spill in the marine environment, may result in changes to the risk of mortality or injury to fish, marine mammals and/or marine plants and changes to habitat quality and use.

To address these potential effects a series of mitigation measures are proposed in Section 7.11.5 for implementation during construction and operations. Following the application of these measures, including the replacement of lobster habitat in the immediate vicinity of the Project and the implementation of spill response plans, the residual adverse effects to Marine Species and Habitats are predicted to be not significant.

Migratory Birds

Changes to ambient noise (Section 7.2) and light (Section 7.3) may affect migratory birds through driving them out of the area and/or other effects on their behaviour. These effects in turn may affect change the risk of bird mortality or injury and result in changes to habitat quality and use.

Mortality of a single individual of a migratory or non-migratory Species at Risk or a large number of migratory birds could be considered a significant adverse environmental effect. Effects on critical habitat of a migratory bird SAR which cause breeding failure or abandonment of nesting may also be considered significant, even if the effects are temporary. This would include abandonment or nesting failure of a migratory bird SAR or at a seabird/waterbird colony due to an accidental event or the response to an accidental event associated with the Project.

A variety of generic and site mitigation and environmental protection measures are described to minimize or eliminate Project-related effects to migratory birds; please see Sections 7.2, 7.3, 7.9.4 and 7.12. Following the implementation of these mitigation measures over the course of the Project, residual adverse effects are predicted to be not significant.

7.18.2 Power and Duty by Federal Authority

Should the Black Point Quarry Project require a federal authority to exercise a power or perform a duty (e.g., grant a permit) CEAA, 2012 requires that the Proponent take into account:

(*a*) a change that may be caused to the environment (other than those described in the previous section) and that is directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function; and

(*b*) an effect, other than those already described regarding aboriginal peoples, of any change referred to in paragraph (*a*) on

(i) health and socio-economic conditions,

(ii) physical and cultural heritage, or

(iii) any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

The marine terminal component of the Project is expected to result in "serious harm to fish" (i.e., the death of fish or permanent alteration to, or destruction of, fish habitat) for species that are

part of or support a commercial, recreational or Aboriginal fishery. Under these circumstances, the *Fisheries Act* authorisation will be required to undertake the Project. Changes to fish and fish habitat and proposed mitigation measures are described in the preceding Section. As noted, with the implementation of these mitigation measures no significant residual environmental effects are expected.

The potential effects on Aboriginal peoples as required by section 5(2)(b) of CEAA, 2012 are summarized in Section 7.18.4 below.

7.18.3 Changes Expected on Federal or Transboundary Lands

The marine components of the Project, especially aggregate shipping, have the potential to result in changes to the environment on federal submerged lands and federal waters. Shipping routes will enter Canada's territorial sea and internal waters (Chedabucto Bay), both of which constitute federal lands as defined under section 2(1) of CEAA, 2012. Changes to Marine Species and Habitat VC will occur on federal submerged lands and in federal waters; these changes are described in Section 7.11 above. Apart from these changes, the Project may also result in changes to Commercial Fisheries and Aboriginal Land and Resource Use (Mi'kmaq fisheries). These changes are presented in more detail in Sections 7.15 (Commercial Fisheries) and 7.17 (Aboriginal Land and Resource Use).

The primary potential effect to the Commercial Fishery on submerged federal lands/federal waters is a potential change in availability of fisheries resources. This change would occur primarily at the marine terminal but may on occasion extend into Chedabucto Bay if Project-related shipping affects shrimp fishing activities in deeper waters. Although the shipping route has been selected to avoid preferred shrimping grounds, it is conceivable that shrimp fishers may occasionally be displaced from portions of these grounds should weather conditions or pilot advices necessitate an alternative shipping route. Given the small extent of the potentially affected area and the temporary nature of such events, the potential for significant adverse residual environmental effects is low.

In the case of an accidental event leading to a fuel spill in the marine environment, a potential significant adverse effect may experience by the Commercial Fisheries VC. However, the application of spill response efforts, an Emergency Response Plan (which includes spill dispersion modelling), and emergency preparedness training on ship and at the Project site, significant residual effects on Commercial Fisheries are not likely to occur.

As noted in Section 7.17 (Mi'kmaq Land and Resource Use) limited Mi'kmaq communal commercial fisheries are present at and near the Black Point Project site. A single shrimp license is fished in the southern portion of Chedabucto Bay; the Mi'kmaq-allocated traps are distributed among several non-Mi'kmaq fishermen. Given the presence of communal commercial fisheries in the area, there is a potential for a change to Aboriginal Land and Resource Use. The same mitigation measures described for Commercial Fisheries are applicable to this VC. Given the implementation of the mitigation measures described above for Commercial Fisheries, the residual effects on this VC, including in the event of an accidental fuel spill in the marine environment, are expected to be not significant.

7.18.4 Effects of Changes to the Environment

This section summarizes the effects of changes to the environment that may be caused to those components listed in section 5(1)(c) and 5(2)(b) of CEAA, 2012. The information presented in this section is summarized from the environment effects assessment presented throughout Section 7.0 of the EIS and include:

1. Effects of changes to the environment on Aboriginal people (CEAA section 5(1)(c); and
2. Effects of changes to the environment that are directly linked or necessarily incidental to federal decisions (CEAA section 5(2)(b).

Effects on Aboriginal People

As stipulated in section 5(1)(c) of CEAA, 2012, this section summarizes the effects of changes to the environment on Aboriginal people caused by the Project, namely:

- health and socio-economic conditions,
- physical and cultural heritage,
- the current use of lands and resources for traditional purposes, or
- any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

Given the distance from the Project site to the nearest Mi'kmaq community (Paqtnkek First Nation located 66 km away from the site), potential Project-related effects such as changes to air quality and ambient noise are not likely to affect the health of Aboriginal people. An accidental fuel spill in the marine environment may negatively affect communal commercial or CRA fisheries however such impacted species would not be consumed and thus no health effects would be expected.

An MEKS was undertaken to characterise past and current traditional use of the Project site including the nearshore areas of Chedabucto Bay where the marine terminal will be constructed (Appendix K). To supplement this work, Mi'kmaw representatives from the neighboring Mi'Kmaq communities were contacted to discuss ongoing fishing activity in the Project area. As noted in the MEKS (**Appendix K**), the site is not currently visited for resource harvesting and there are currently no FSC fisheries at the Project site. This is not to conclude that the Project site will not be visited in the future for FSC purposes. Under these circumstances, however, changes to the environment caused by the Project are not likely to affect physical and cultural heritage or the current use of lands and resources for traditional purposes.

Archeological investigations conducted during the course of this EIS concluded there is low potential for presence of Mi'kmaq artifacts or remains on the site. Given this, Project activities are not anticipated to result in any changes to the environment that would have an effect on Aboriginal physical and cultural heritage areas, sites, structures or other resources.

Effects Linked or Incidental to Federal Decisions

As stipulated in section 5(2) (b) of CEAA, 2012, this section summarizes the effects of changes to the environment "directly linked or necessarily incidental to a federal authority's exercise of a power or performance of a duty or function" required to allow the Project to proceed, if any of the following are affected:

- health and socio-economic conditions,
- physical and cultural heritage, or
- any structure, site or thing that is of historical, archaeological, paleontological or architectural significance.

An Authorisation for serious harm to fish under section 35(2)(b) of the Fisheries Act will likely be required to permit the construction and operation of the marine terminal. A Navigation Act Approval will be required for marine terminal construction and may be required for watercourse crossings. The anticipated "change" or environmental effect is a potential change in habitat quality and use of the Marine Species and Habitat VC. The marine terminal is not expected to result in adverse effects to heath, physical and cultural heritage, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. In contrast, effects on socio-economic conditions may result from the terminal's effect on the commercial fisheries through:

- Change in risk of fish injury or death; and
- Change in fish or other habitat quality and use;

Given that these potential changes to the environment are expected to be temporary and confined to the area around the marine terminal and to the designated shipping routes between the terminal and the main shipping lanes in Chedabucto Bay, the effects of these potential changes are not expected to alter the socio-economic conditions for commercial fishermen. Following implementation of the mitigation measures described in Sections 7.15 and 7.17 (including fisheries offset projects), residual environmental effects on Marine Species and Habitats and related residual environmental effects on socio-economic conditions related to Commercial Fisheries, are predicted to be not significant.

Table 7.18-1:
Summary of Environmental Mitigation

Subject Category	Change or Effect	Mitigation	Follow Up Programs and Commitments
Changes to components within federal jurisdiction	<u>Freshwater Fish Habitat</u> Change to flow and water quality in Reynolds Brook, assumed to support fish	• Creation of a 30 ha lake following Project cessation • Erosion and Sediment Control Plan • Stormwater Management Plan • Emergency Response and Spill Contingency Plan	• Habitat assessment and determination of fish presence/absence in Reynolds Brook. • Flow and water quality monitoring in Reynolds Brook prior to and once the pit begins to affect flow to Reynolds Brook.
	<u>Marine Fish, Fish Habitat and Aquatic Species</u> Reduced habitat quality and habitat function due to altered water and sediment quality. Reduced habitat for fish that are part of or support commercial, recreational or Aboriginal fisheries resulting from construction of marine terminal. Fish mortality due to the use of explosives within the pit; behavioural changes to fish, crustaceans and other marine species due to noise and vibrations associated with explosives use. Mortality (marine plants, benthic and pelagic organisms, etc.) and/or the loss of benthic habitat due to the presence of the terminal and aggregate spills when the ships are loaded. Increased disturbance to marine flora and fauna and reduced habitat quality and function for marine species due to noise and vessel movement from increased ship traffic. Invasive species that may be introduced through the illegal discharge of ballast water.	• Environmental Management Plan • Application of appropriate timing windows for all in-water work. • Implementation of terrestrial erosion and sediment control measures. • Surface water monitoring to ensure that quality meets all regulatory standards prior to discharge • Install stockpiles, fuel and chemicals > 30 m from the coast. • Emergency Response and Spill Contingency Plan. • Control ballast water release via "*Ballast Water Control and Management Regulations*" and the requirements as per the International Convention for the control and Management of Ship's Ballast Water and Sediments.	• Fisheries Offset Program and associated effectiveness monitoring. • Surface water monitoring program
	<u>Migratory Birds</u> Changes to ambient noise and ambient light conditions may affect migratory birds through driving them out of the area and/or other effects	• Noise: please see mitigation measures described in Section 7.2 (Noise and Vibration) and Table 10-1 (Proposed Mitigation and	• Routine site monitoring as described in the Environmental Management Plan will include maintaining records of bird mortality so developing issues

	on their behaviour. These effects in turn may affect change the risk of bird mortality or injury and result in changes to habitat quality and use.	Monitoring by VC). • Light: please see mitigation measures described in Section 7.3 (Ambient Light) and Table 10-1 (Proposed Mitigation and Monitoring by VC). • Please see additional mitigation measures in Section 7.9 (Terrestrial Wildlife) and Section 7.12 (SAR and SOCC), which are also summarized in Table 10-1 (Proposed Mitigation and Monitoring by VC). .	related to lighting can be identified. • The Environmental Management Plan will include instructions on implementing the protocol "*Best practices for stranded birds encountered offshore Atlantic Canada*" (EC 2014e) for responding to avian strandings related to activities in the marine environment. • Nightly site inspections will reveal opportunities for light reduction
Changes to the environment on federal or transboundary lands	Changes to federal submerged lands and in federal waters in the form of changes to Commercial Fisheries including Mi'kmaq Fisheries), Marine Species and Habitat and Marine Surface Waters. These changes may occur through construction and operation of the marine terminal, aggregate shipping, and/or accidental spills in the marine environment.	• Environmental Management Plan • Application of appropriate timing windows for in-water work. • Erosion and Sediment Control Plan • Surface water monitoring to ensure that quality meets all regulatory standards prior to discharge. • Install stockpiles, fuel and chemical storage facilities > 30 m from the coast • Emergency Response and Spill Contingency Plan. • Control ballast water release via "*Ballast Water Control and Management Regulations*" and the requirements as per the International Convention for the control and Management of Ship's Ballast Water and Sediments. • The quarry site office will be manned 24 hrs/day so that fishermen can telephone to receive information regarding vessel arrival and departures. • The phone number can also be used to report loss or damage to gear caused by Project-related vessel traffic.	• Fisheries Offset Program and associated monitoring for effectiveness. • Concussion and ground vibration monitoring during each blast to ensure limits established by DFO for the marine environment are respected. • Mi'kmaq resource harvesting activities will be reviewed with Mi'kmaq representatives at the Community Liaison Committee meetings.

		• Routine communication with potentially affected Mi'kmaq will occur through the CLC. • Any future potential Project impacts (environmental, social and economic) on these harvesting activities will be a matter of the formal and regular meetings with the Mi'kmaq community representatives.	
Changes that are linked or incidental to federal decisions	An Authorisation for serious harm to fish under section 35(2)(b) of the Fisheries Act will likely be required to permit the construction and operation of the marine terminal. A Navigation Act Approval will be required for marine terminal construction and may be required for watercourse crossings. The Project is not expected to result in adverse effects to heath, physical and cultural heritage, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. In contrast, potential effects on socio-economic conditions may result from temporary and localized: • Change in risk of fish injury or death; • Change in fish or other habitat quality and use; and • Change in commercial and Aboriginal fisheries.	• Environmental Management Plan • Application of appropriate timing windows for all in-water work. • Implementation of terrestrial erosion and sediment control measures. • Surface water monitoring to ensure that quality meets all regulatory standards prior to discharge • Install stockpiles, fuel and chemicals > 30 m from the coast. • Emergency Response and Spill Contingency Plan. • Control ballast water release via "*Ballast Water Control and Management Regulations*" and the requirements as per the International Convention for the control and Management of Ship's Ballast Water and Sediments. Routine communication with potentially affected Mi'kmaq will occur through the CLC. • Any future potential Project impacts (environmental, social and economic) on these harvesting activities will be a matter of the formal and regular meetings with the Mi'kmaq community representatives.	• Fisheries Offset Program and associated effectiveness monitoring. • Surface water monitoring program • Concussion and ground vibration monitoring during each blast to ensure limits established by DFO for the marine environment are respected. • Mi'kmaq resource harvesting activities will be reviewed with Mi'kmaq representatives at the Community Liaison Committee meetings.

Effects of changes on Aboriginal peoples	The site is not currently visited for resource harvesting and there are currently no FSC fisheries at the Project site. Changes to the environment caused by the Project and their effects are not likely to affect physical and cultural heritage or the current use of lands and resources for traditional purposes.	• Any future potential Project impacts (environmental, social and economic) on these harvesting activities will be a matter of the formal and regular meetings with the Mi'kmaq community representatives. • Routine communication with potentially affected Mi'kmaq will occur through the CLC.	• Mi'kmaq resource harvesting activities will be reviewed with Mi'kmaq representatives at the Community Liaison Committee meetings. • The Proponent commits to allowing future access to non-active portions of the site to the extent this does not compromise the safety of the Mi'kmaq visitors or quarry workers. • The Proponent will continue to make Project status presentations and offer site visits to interested Mi'kmaq representatives
Effects of changes that are linked or incidental to federal decisions	An Authorisation for serious harm to fish under section 35(2)(b) of the Fisheries Act will likely be required to permit the construction and operation of the marine terminal. A Navigation Act Approval will be required for marine terminal construction and may be required for watercourse crossings. The anticipated effect of changes caused by these decisions (i.e., marine terminal construction) is not expected to result in adverse effects to heath, physical and cultural heritage, or any structure, site or thing that is of historical, archaeological, paleontological or architectural significance. In contrast, effects on socio-economic conditions may result from: • Change in risk of fish injury or death; • Change in fish or other habitat quality and use; and • Change in commercial and Aboriginal fisheries. Given that these potential changes to the environment will temporary and confined to the area around the marine terminal and to the designated shipping routes between the terminal and the main shipping lanes in Chedabucto Bay, the effects of these changes are not expected to alter the socio-economic conditions for commercial or Aboriginal fishermen.	• The non-hazardous portions of the Project site and adjacent waters will be accessible to Mi'kmaq for harvesting purposes, to the extent this is not precluded by safety considerations • Any future potential Project impacts (environmental, social and economic) on harvesting will be a matter of the formal and regular meetings with the Mi'kmaq community representatives. • The impact of construction in the marine environment during and after lobster fishing season will be minimized to the extent possible. • The quarry site office will be manned 24 hrs/day so that fishermen can telephone to receive information regarding vessel arrival and departures. • The phone number can also be used to report loss or damage to gear caused by Project-related vessel traffic. • Routine communication with potentially affected Mi'kmaq will occur through the CLC.	• Monitoring of progress and implementation of MOU and any other agreements reached with other First Nation communities. • Mi'kmaq resource harvesting activities will be reviewed with Mi'kmaq representatives at the Community Liaison Committee meetings. • Monitoring terminal operations and fishing access in response to concerns expressed by local fishing community, as needed; • Fisheries Offset Program; monitoring of the effectiveness of the marine Fisheries Offset Program for a minimum of three years during and after marine terminal construction until it can be demonstrated that the program objectives have been met.

7.19 ACCIDENT AND MALFUNCTION SCENARIOS

The assessment of potential environmental effects resulting from accidents and malfunctions differs from the assessments completed for individual VCs. This assessment employs risk based approach that involves two steps:

1. Identification of hazards associated with the Project infrastructure and activities to be undertaken on-site or off-site. These potential hazards are identified based on past experience with quarries similar to the Black Point Project and with similar types of works and activities in general.
2. Identification of potential environmental effects or the anticipated consequences of the identified hazards by completing a qualitative risk assessment aimed and providing some perspective on the hazards and their consequences by rating the likelihood of the adverse environmental effects. This rating represents the overall assessment of significance for the potential adverse environmental effects of accidents and malfunctions.

Only those accidents and malfunctions that are considered to have both a measureable environmental effect and a high probability of occurring during the life of the Project are considered in this assessment. For these “credible” accidents and malfunctions, the environmental effects identified represent a reasonable worst case outcome. Highly unlikely or hypothetical events (i.e., failure of multiple design features, contingencies and back-up systems) are not assessed.

The key accidents and malfunctions that could potentially occur during site preparation, construction, operation and closure phase of the Project are described in the following sections. Mitigation measures and planning to prevent the occurrence of such events, and response procedures to be implemented in the event they do occur, will be developed as part of the Industrial Approval application process and operational protocols.

It is anticipated that additional potential hazards, design and operational safeguards, and the need for further contingencies and emergency response measures may be identified during the review of the draft EIS report as well as through the ongoing public and Mi’kmaq engagement activities.

Malfunctions and accidental events will be prevented and mitigated through a systematic approach to worker health and safety and environmental protection. Health and safety polices and plans will be required from contractors while onsite workers will receive appropriate training to prevent and mitigate workplace accidents and environmental incidents.

7.19.1 Hazard Identification

Virtually all of the Project works and activities described in Section 3.0 have some potential for accidents and malfunctions. Those hazards with the greatest potential to result in environmental effects are:

- **Structural Failures:** These include quarry pit slope failure, aggregate stockpile slope failure, processing plant/marine terminal infrastructure failure and sediment pond failure;

- **Accidents:** These include an explosives accident, marine spills, transportation accidents (including vehicle and marine collisions), hydrocarbon spills on land or in the water; and,

- **Other Malfunctions:** These include unspecified health and safety incidents, wildlife encounters and forest fires.

Table 7.19-1 summarizes these hazards in terms of the Project phases during which they are most likely to occur. A solid dot indicates that there is higher potential for environmental effects to occur, while a hollow dot indicates a lesser potential.

Table 7.19-1:
Summary of Accidents and Malfunctions by Project Phase

Risk Category	Project Works or Activities	Project Phases During which Accidents and Malfunctions Could Occur				
		Site Preparation	Construction	Operations	Closure	Post-Closure
Structural Failure	Quarry Pit Slope Failure	–	–	●	○	○
	Stockpile Slope Failure	–	○	●	○	–
	Processing Plant/Marine Terminal Failure	○	○	●	○	–
	Sediment Pond Failure	○	○	●	○	○
Accident	Terrestrial Spill	○	○	●	○	–
	Explosives	–	○	●	–	–
	Marine Spill	–	–	●	–	–
	Transportation Accidents	○	○	●	○	–
Other	Forest/Site Fires	●	●	○	○	–

Legend : ● Greatest potential for adverse environmental effects.
○ Lesser potential for adverse environmental effects.

7.19.2 Structural Failures

Quarry Pit Slope Failure

Two primary open pit slope failures are possible:

1. Failure of the bedrock faces caused by improper mine design and operational procedures (including groundwater controls); and
2. Failure of overburden slopes.

The open pit will be excavated through into bedrock to an ultimate depth of approximately 130 m below ground surface (30 m below sea level). The side slopes follow well understood and accepted engineering practices of benched surfaces to provide for slope stability and space for quarry truck access ramps and roads. The final as-built design of the open pit will be engineered and approved at the regulatory stage prior to construction.

As noted in Section 3.0 the quarry benches will generally be 15 meters in height. Safety benches will be established every two benches and will have a width of approximately 7.5 meters. The final slopes for the quarry will have face angles of 85 degrees with a maximum pit slope of 65 degrees. Working benches will have face angles of 70 to 75 degrees.

As described in Section 6.1.9, the granite rock to be quarried has a “high” excavation difficulty, a “high” resistance to weathering and provides a “good” foundation support. The rock is dense (150-200 pcf) and has a very high compressive strength (up to 19,000 psi) (Koloski *et al.* 1989). Therefore, any potential pit instabilities are likely to be structurally controlled (along major joints/discontinuities).

With respect to the overburden, overburden thickness in the vicinity of the pit is typically less than 3 m thick and does not pose a significant risk of failure.

Significance Assessment

A significance environment effect of rock face failure is one that results in worker injury or death.

Potential Environmental Effects

Improperly designed and operated open pits can pose a safety hazard to workers during construction and operation. Apart from the safety hazard, no apparent environmental effects, outside of or in addition to those that would eventually occur through pit development, are evident.

The maximum effects due to pit slope failure are likely to occur during the pit closure period (i.e., just after quarrying is completed and the pit is allowed to start filling). This is because groundwater inflow will continue to occur while day to day observation of the pit slope will be less frequent, since the quarry crew will no longer be operating in the pit.

Mitigation and Emergency Response

During the quarrying process, the open pit slopes will be continually inspected by company staff and monitored by qualified mining engineers who will observe conditions on a daily basis and can adjust the design of the pit wall to avoid unstable conditions.

Bedrock pit slope angles were established using standard of practice approaches and methodologies combined with the Proponents past experience quarrying granite for aggregate.

Specific emergency response procedures describing how to respond to a pit slope failure will be incorporated into the Emergency Response Plan.

Stockpile Slope Failure

Overburden and topsoil stockpiles will be formed into a screening berm along the southern property boundary as discussed in Section 3.0. The screening berm will have a maximum height of about 3 m and will be designed with slope angles that promote stability through the establishment of a vegetation cover.

Aggregate stockpile failure will be contained entirely within the coastal platform near the processing plant, since this entire area will be sloped to south during initial site preparation to help accumulate stormwater runoff needed for the aggregate washing.

Significance Assessment

A significance environment effect of overburden or aggregate slope failure is one that results in worker injury or death.

Potential Environmental Effects

Given the low maximum height and the rapid stabilization expected once the screening berm is colonized by vegetation, the risk of berm failure is minimal. The berm will be placed within the 30 m undeveloped buffer along the southern property boundary. In the event that slumping occurs, soil will be confined within the property boundary and no significant environmental effects will occur.

Given the confining effect that will result by sloping the coastal platform to south, aggregate stockpile failure will not result in any environmental impacts. However, aggregate stockpile failure may result in worker injury or death, as well as damage to conveyors and processing equipment.

Mitigation and Emergency Response

Aggregate stockpiles will be located greater than 30 m from the coast on sloped platform designed to contain stormwater drainage. Overburden stockpiles will be placed at the southern property boundary no nearer than 20 m from the nearest watercourse and will be compacted using loaders and dump trucks. If needed, the screening berm can be artificially vegetated to prevent erosion but this is not considered necessary at this time. As needed, perimeter ditches will be installed to manage water from the screening berm.

If stockpile failure were to occur, the first response will be to cease all work in the area and ensure worker safety. When the failure area is secured, and depending on the scale of the failure, stockpile slope would be re-contoured in place. Slumped material would be excavated and returned to the stockpile, and if required drainage ditches would be repaired. An investigation into the causes of the failure would be undertaken so that the conditions leading to failure could be avoided or mitigation in the future.

Sedimentation Pond Failure

Sedimentation Pond Failure is defined as the failure of the retention pond embankment resulting in the release of stored water used for aggregate washing. As noted, the laydown area containing stockpiled materials will be designed to contain and direct runoff to the settling ponds. Failure of the engineered ponds to contain runoff is highly unlikely since these low, large volume ponds will be excavated into the rock and bermed with crushed stone several tens of meters thick.

Significance Assessment

A significance environment effect of a sedimentation pond failure is one that results in an uncontrolled discharge on sediment laden water to the environment.

Potential Environmental Effects

Due to the sloping and configuration of the coastal platform, sedimentation pond failure would not result in the release of sediment laden runoff to the environment. The ponds and nearby platform and stockpile areas would simply flood, which would halt quarrying activities until the water could be pumped into the pit sump. This also applies to “failure” of the pit sumps: the sumps may overflow but all water would remain fully contained within the pit. The settling ponds and pit sump are designed to allow water transfer between them; each can act as emergency storage for the other. In the case of excessive water, both the ponds and the pit sump can overflow without discharge to the ocean.

Mitigation and Emergency Response

The sedimentation ponds have been engineered to accommodate the anticipated stormwater runoff expected at the Project. These ponds and erosion and sediment control measures installed elsewhere in the Project area will be regularly inspected and monitored, particularly during and after extreme precipitation events. Erosion and sediment control structures found to be damaged will be repaired immediately and any other remedial action will be taken as necessary. Fines storage will be confined to areas within the quarry pit so any control failures would not result in an off-site release of material.

In a pit flooding event, pit water would pumped to the sedimentation ponds for clarification prior to discharge. If the sedimentation ponds were already full, the site manager would wait until the water clarified within the sump, sample the clarified water and if found to meet discharge requirements, pump the water to Chedabucto Bay. This would not interfere with quarrying activities, which could continue elsewhere in the quarry.

Retention pond-specific emergency response procedure will likely not be developed specifically for this component; however, inspection and emergency response procedures in reaction to erosion and sediment control failure will be described in the EMP.

Processing Plant/Marine Terminal Infrastructure Failure

Structural failure of processing plant components (crushers, screening, conveyors, supporting structures, etc.) or the shiploader at the marine terminal may occur over time as joints loosen or metal becomes worn, weakened or corroded.

Significance Assessment

A significance environment effect of a structural failure is one that results in worker injury or death. There is no risk of negative environmental effects associated with such failure. Even if failure of the shiploader arm were to lead to an aggregate spill in the marine environment, the crushed granite is already washed of its fine materials, chemically inert, and would be easily colonized by marine biota.

Potential Environmental Effects

There are no potential environmental effects, apart from worker health and safety considerations, associated with structural failure.

Mitigation and Emergency Response

Equipment wear and tear is expected over the life of the quarry, particularly in a coastal environment subject to salt spray and consequent corrosion. Given this, a regular inspection and maintenance program will be initiated as a matter of course so that worn or inefficient equipment can be replaced on a regularly scheduled maintenance rotation.

Emergency response procedures will primarily be those responses applicable to accidents and worker injury. These procedures will be contained within the Workplace Health and Safety Emergency Response Plan.

7.19.3 Accidents

Terrestrial Spills

Spills onto the land may occur during any phase of the Project. During site preparation and construction spills will be limited to those materials available onsite, which will include:

- Petroleum products consisting of gasoline and diesel fuel; and
- Oils and lubricants

The operations phase will include those materials listed above as well as limited volumes of waste oil, used glycol, spent parts washer fluids and other materials generated during equipment maintenance.

During decommissioning, the reservoirs used to store these materials will be dismantled so that only limited amounts of raw and waste liquids will be stored on site.

Releases may occur during fuelling or through breaks or leaks in hydraulic lines, and/or storage container failure. The amount of any potential spill is limited to the size of fuel tanks, storage tanks and equipment tanks.

Significance Assessment

A significance environment effect of a terrestrial spill is one that results in loss of any quantity fuel, oil or lubricant, or any other Project-related raw materials to the environment such that a measureable impairment of the terrestrial, freshwater or marine environment results. Such impairment may be defined by:

Groundwater: when groundwater discharge to surface water bodies no longer meets Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 1999 as updated).

Surface Freshwater and Marine Waters: if water quality no longer meets criteria listed in the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, freshwater and marine (CCME 1999 as updated) and/or NSE's Table 3 Tier 1 Environmental Quality Standards for Surface Water. Table 3 provides criteria for a variety of potential contaminants in both fresh and marine surface waters. All criteria are for the protection of aquatic life.

Potential Environmental Effects

Small spills will have negligible environmental effects. In the event of a large spill or leak, soil, groundwater and surface water contamination may occur, although it is unlikely that a spill will adversely affect the quality of wildlife habitats since the working areas of this industrial site where a spill might occur will be largely devoid of vegetation. Fuel storage and equipment maintenance will occur in a dedicated area near the access road entrance to the coastal platform. This area located more than 60 m from the nearest surface watercourse and more than 100 m from the ocean.

A fire is also possible if precautions are not taken to prevent exposure to an ignition source near the spilled flammable material. A transient negative effect on air quality would also be possible due to the volatilization of the spilled material.

Mitigation and Emergency Response

Fuelling of land based equipment will need to be conducted onsite on a regular basis. Fuel will be stored in above ground storage containers as indicated in Section 3. All storage tanks will be either double walled self-contained tanks or single walled tanks with secondary containment. All petroleum storage containers 55 gallons (208 L) or larger will be stored within a contained area capable of holding 110% of the volume of the largest reservoir placed within it. The fuelling area will be erected on a reinforced concrete slab or lined containment area enclosed within side curbs and with a sloping floor to contain any spills and/or leaks that may occur during fuelling. These materials will be stored and handled in accordance with all relevant regulations. All staff will have a minimum level of awareness training related to the handling and storage of fuels, chemicals and wastes. In addition there will be strict re-fuelling protocols for heavy equipment that will minimize the risk of accidental spillage.

All Project equipment and vehicles will be maintained to ensure they meet safety standards and are in good operating condition. Regular pre-shift inspections and maintenance programs will ensure the continued reliability and integrity of such equipment.

All fuel, chemicals and wastes will be handled in a manner that minimizes or eliminates spillage and accidents. In the event of a spill or leak during fuelling activities, maintenance, or general equipment operation, immediate action will be taken to stop and contain the spilled material. In addition, a complete Spill Contingency Plan will be developed and approved by regulatory agencies prior to construction. Staff will receive extensive training in responding to spill events and Spill Contingency Plans will be posted for viewing by all staff. There will also be spill training drills to ensure that operations personnel are trained and able to handle unforeseen events.

Hazardous materials will be handled and stored in accordance with provincial hazardous materials regulations and regulations enacted under the Canadian Environmental Protection Act, as applicable. Hazardous materials will be transported for off-site disposal using a licensed hazardous waste transport company. Employees will be trained on proper handling and management practices for these materials.

Terrestrial spills would be localized and easily cleaned up using standard equipment such as absorbent pads and spill responses procedures. All contaminated material will be collected and stored in an appropriate manner so as to not result in a re-release to the environment until such a time as it will be transported to an approved treatment / disposal facility.

All spills will be reported to the 24-hour environmental emergencies reporting system (1-800-565-1633) in accordance with the Emergency Spill Regulations under the Nova Scotia Environment Act.

Vessel Accidents / Collisions

During construction and operation of the marine terminal, considerable vessel activity by multiple ships and boats may occur for limited periods of time around the site. Given this, there is potential for Project related vessel collisions, primarily between aggregate transport ships and either tugs, pilot vessels or nearby recreational or fishing vessels. Other accident types may include collisions with the terminal during bad weather or due to pilot error and grounding of the vessel on submerged rocks. Navigational error, malfunctioning of navigation equipment, engine malfunction and poor weather conditions may all contribute to these accidents.

Significance Assessment

A significance environment effect of a vessel accident or collision is one that results in worker injury or death or loss of any quantity fuel, oil or lubricant to the marine environment such that water quality no longer meets criteria listed in the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, marine (CCME 1999 as updated) and/or NSE's Table 3 Tier 1 Environmental Quality Standards for Surface Water (marine).

Potential Environmental Effects

In the event of a vessel tank rupture following an accident at sea, up to 2500 to 3000 metric tonnes of marine diesel oil fuel could be discharged to the marine environment. Fuel containment would be achieved using booms, absorbents and dispersants deployed from stock

on board and/or maintained at the quarry site near the marine terminal. In warm weather, the fuel can be expected to degrade and evaporate over a relatively short time, but this process would be slowed in the winter until the following summer.

Mitigation and Emergency Response

The management of marine traffic in Chedabucto Bay is under the responsibility of the Canadian Coast Guard. It is mandatory that all large vessel traffic report to the Canadian Coast Guard at specified points and that vessels approaching or leaving the marine terminal allow the boarding of a trained and experienced pilot.

Aggregate transport vessels will employ double hulled fuel reservoirs to reduce the risk that a collision will pierce the tank and release fuel. The potential for collisions will be minimized through controlling vessel speed; scheduling and coordinating activities with other marine users, Transport Canada and the Canadian Coast Guard; and posting Notices to mariners as needed. The marine terminal will contain navigational aids and anti-collision radar will provide early warning of a potential collision hazard. In addition, a Mooring Plan that identifies and establishes operating limits for all marine terminal activities (berthing, mooring, and aggregate loading, etc.) under severe atmospheric and/or oceanographic conditions will be employed to minimize collision risks. Emergency response in the event of a vessel collision is coordinated by the Canadian Coast Guard with support from local land based emergency responders as needed. The Coast Guard will be naturally aware of the timing and type of activity associated with the marine terminal operation and will be informed of the construction schedule before work begins. The Proponent's Emergency Response Plan will contain a section regarding response to incidents at sea, however the ship's Master is ultimately responsible for the safe operation and emergency response in case of accident.

Explosives Accident

An explosives accident would be limited to the construction and operational phases of the Project. No explosives will be stored or manufactured on site. The Proponent will contract the explosives component of this project to a licensed blasting contractor. Accidents may include premature blasts or accidental detonation of blasting components. A review of accident data indicates that "flyrock" and lack of blast area security were the primary causes of blasting related injuries in surface mining. Fatal injuries due to lack of blast area security were attributed to: failure to clear blast area; failure to follow instructions; inadequate guarding; inadequate blasting shelter; and unsafe location (Bajpayee et al, 1999).

Significance Assessment

A significance environment effect of an explosives accident is one that results in worker injury or death or environmental impairment. Such impairment is defined as

Groundwater: when groundwater discharge to surface waterbodies no longer meets Canadian Water Quality Guidelines for the Protection of Freshwater Aquatic Life (CCME 1999 as updated).

Surface Freshwater and Marine Waters: if water quality no longer meets criteria listed in the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, freshwater and marine (CCME 1999 as updated) and/or NSE's Table 3 Tier 1 Environmental Quality Standards

for Surface Water. Table 3 provides criteria for a variety of potential contaminants in both fresh and marine surface waters. All criteria are for the protection of aquatic life.

Potential Environmental Effects

A spill of fuel oil and/or ammonium nitrate (the ANFO explosives mixture), or the emulsion itself has the potential to contaminate local ground and surface water. Given the use of explosives exclusively within the pit area, any release would likely be to water collected in the pit sump. This provides the opportunity to treat and test the water prior to discharge, minimizing the risk of environmental effects. A spill from a truck in transit to the pit (i.e., on the access road) has a greater possibility of reaching soil and surface watercourses.

Mitigation and Emergency Response Procedures

Preventive measures aimed at reducing the effects of blast accidents include: ensuring that all personnel have evacuated the blast area during shot firing; using adequate blasting shelters for employees whose presence is required in the blast area; controlling and monitoring all entrances to the blast area; ensuring that the blast is properly designed, drilled, and loaded; and emphasizing education and training to enhance skill levels for implementation of engineering control techniques.

Other measures that will be taken to minimize the risk of an incident involving explosives include:

- No explosive material will be stored onsite;
- All blasting activities will be conducted an experienced and trained, licensed contractor;
- The blasting operator will be responsible for blast designs and methods in accordance with the Blasting Safety Regulations made pursuant to the Nova Scotia Occupational Health and Safety Act, the Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters (Wright and Hopky 1998), and in accordance with the Nova Scotia Pit and Quarry Guidelines (NSEL 1999).
- The blast area will be properly secured and notifications issued to workers.
- The Proponent's staff will receive spill response training and will be familiar with the provisions of the site-specific Emergency Response Plan. This plan will address spill response on the quarry property.
- The licensed blasting contractor will maintain his own emergency response plan and staff training records. The Proponent will have the opportunity to review this plan and integrate any explosives-specific measures into the Black Point Emergency Response Plan.

Should an explosive component spill occur, the spill will be managed as per instructions within the Emergency Response Plan and under the direction of the blasting contractor. A spill from a truck on the access road or elsewhere within the property would be managed by the Proponent's staff as any other fuel spill.

Marine Spills

A spill of hydrocarbons in the marine environment could occur during the construction, operation and decommissioning phases of the marine terminal. The potential sources of a fuel spill at or near the marine terminal include vessel collisions with the terminal or with other vessels. No fuel

will be stored at the terminal and no vessel refuelling will occur at the Black Point Quarry. No vessel maintenance will occur at the terminal.

Significance Assessment

A significance environment effect of a marine spill is one that results in contamination such that marine water quality no longer meets criteria listed in the CCME Canadian Water Quality Guidelines for the Protection of Aquatic Life, marine (CCME 1999 as updated) and/or NSE's Table 3 Tier 1 Environmental Quality Standards for Surface Water (marine).

Potential Environmental Effects

As noted above under vessel collisions, release of hydrocarbons to the marine environment has the potential to impact aquatic life (fish, marine mammals and birds), and their respective habitats. A significant spill would also affect commercial fishing interests.

The impacts of such an event may include diesel fuel deposited onto the shoreline and an oil slick expanding to cover an area beyond the immediate spill location. Over the short term (i.e., from the spill to approximately 10 days) impact of such a spill might include fish kills, coating of the fur and feathers of marine mammals and birds, and loss of lobster and other marine species in the immediate area of the spill as well as in areas where the slick migrates before being contained. Over the longer term (i.e., one month and beyond) residual impacts following cleanup of the spill might include impairment of fisheries productivity. Certain mobile species could relocate to other areas; impacts to breeding areas could create lead to decreases in fisheries productivity over time.

Mitigation and Emergency Response Procedures

As noted, vessels will not be refuelled at the marine terminal. All shipping and associated activities (refuelling, waste management, etc.) will be contracted by the Proponent to a third party. This allows the Proponent to select reputable shipping firms with a demonstrated history of safety and operational integrity. The use of experienced, well trained and trustworthy shipping crews, tubs and pilots helps to minimize the potential for collisions leading to spills, and illegal ballast water discharge.

The Project will mitigate marine spill risk by ensuring that ship docking at the terminal is tug and pilot assisted as needed and required by law, the terminal and mooring structures are properly constructed and well lit, and also by having a written agreement with a certified spill response contractor to provide response services in the event of a spill. Other mitigating factors include continual redesign of vessels to make them less susceptible to collision damage. This will reduce this risk over the life of the Project. Finally, an Emergency Spill Response Plan that contains predictive oil spill modelling will be prepared and emergency response training will be employed at the site. Advance planning including mock simulations of spill events and maintenance of spill response equipment at the site to ensure rapid deployment will reduce the response time required to contain the spill which is a key part of reducing the damage to the environment.

Transportation Accident

Vehicular collisions may occur during any phase of the Project. Mobile equipment at the quarry will include excavators, loaders, off-road trucks, bulldozers, water trucks, cranes, drill rigs and service vehicles. Most vehicle traffic is confined to the pit where rock is loaded and transported to the primary crusher. Once the quarried rock has been deposited in the primary crusher, subsequent aggregate transport occurs largely via conveyor.

Significance Assessment

A significance environment effect of a terrestrial vehicular accident is one that results in worker injury or death.

Potential Environmental Effects

A vehicle collision or accident has very little potential to lead to significant environmental damage. Fuel spills from vehicle accidents within the pit will be confined to the pit. Spills from accidents on the access road may attain roadside ditches but the volume of fuel spilled is expected to be minimal. The most significant risk is that posed to worker health and safety.

Mitigation and Emergency Response Procedures

The Proponent has considerable experience in managing the many vehicles that operate within an active quarry. Accident mitigation begins with adequate worker training, and by employing experienced workers to the extent possible. Other controls include ensure access and haul roads are sufficiently wide to allow safe passage of two vehicles side by side, clearing vegetation to ensure adequate line-of-sight around corners and at road junctions, posting and enforcing speed limits within the quarry, the use of in-vehicle radios linked to a central dispatch, and regular maintenance of brakes, tires and other vehicle components.

Emergency response in the event of a vehicle collision or accident would follow procedures outlined in the site-specific Emergency Response Plan.

Ballast Discharge

Under the *Ballast Water Control and Management Regulations*, all ships entering Canadian waters must exchange ballast water outside of the Exclusive Economic Zone (200 nautical miles from shore), treat their ballast water, discharge their ballast water to a reception facility, or retain their ballast water on board ship. This reduces the risk of introducing invasive species to Canadian waters and prevents unauthorised discharge of bilge water and non-compliant ballast water. Ships that fail to do this and discharge untreated ballast water within the Exclusive Economic Zone are committing a criminal act.

Significance Assessment

A significance environment effect of an illegal ballast water discharge is one that results in the release and establishment of a non-native species to Canadian waters.

Potential Environmental Effects

As described in Section 6.11, ballast water taken aboard ships in foreign ports may contain organisms that are not native to Nova Scotia, and which could cause harm to local ecosystems. In Nova Scotia these organisms include green crab, several species of sea squirts (tunicates), Dead Man's Fingers (*Codium fragile*) and *Membranipora menbranacea*.

Mitigation and Emergency Response Procedures

In addition the provisions of the *Ballast Water Control and Management Regulations* described above, an international convention regarding ballast water has been adopted by the International Maritime Organization (IMO); ratification is expected in 2015. Under IMO's International Convention for the Control and Management of Ships' Ballast Water and Sediments, all vessels will be required to report and treat ballast water using an IMO approved method. This convention will further limit the opportunities for illegal ballast dumping.

7.19.4 Other

Forest Fire

A lightning strike or human carelessness may cause a forest fire at or near the site, requiring emergency response from site staff. An accidental fire at the Project site may also occur but this is considered unlikely due to the lack of flammable materials within the quarry and processing plant. Vehicle fires, while uncommon, may also occur. Due to the lack of vegetation, it is unlikely that a vehicle or other on-site fire could cause a forest fire that might spread elsewhere.

Significance Assessment

A significance environment effect of a forest fire at the Project site is one that results in worker injury or death or a fuel spill, which in turn results in the effects listed above.

Potential Environmental Effects

The immediate concern with respect to a forest or vehicular fire is for human health and safety; additional concerns include habitat loss, direct mortality to wildlife, and loss or damage of property. The emissions from a fire would likely consist mainly of smoke (particulate matter) and CO2, but could also include CO, NOx, SO2, and other products of incomplete combustion. A large fire could create air contaminant levels greater than the ambient air quality standard over distances of several kilometres; however, the likelihood of such cases is considered low and the event would be of short duration.

Mitigation by Design and Operational Safeguards

Fire detection systems will be provided at appropriate locations such as the administrative office and fuel dispensing/maintenance shop. All buildings will meet National Building Code of Canada construction standards and will be equipped with appropriate fire suppression systems such fire extinguishers or sprinklers as needed.

The fuel storage facilities will be designed to meet the National Fire Code of Canada requirements and will meet the provincial storage regulations for these facilities.

All Worker Health and Safety requirements regarding fire preparedness will be met, including ensuring that a suitable number of workers are trained in firefighting and tested for proficiency at least once per year. All plant personnel will be trained on:

- Fire hazards;
- Fire prevention; and
- Firefighting roles, responsibilities and requirements for their respective positions.

In addition, all personnel will be provided with orientation and training, including conducting regular fire drills and evacuation.

The site-specific Emergency Response Plan or portions thereof will be distributed to the Queensport and Canso Fire Departments. Representatives of these Departments will be invited to meet with the Black Point Safety Supervisor or equivalent in order to view the site layout and infrastructure, review access and evacuation routes and understand the activities undertaken at the site.

Contingency and Emergency Response Procedures

Emergency response procedures will be developed as part of the Emergency Response Plan. This plan will address how to respond to a fire on the property. Evacuation of personnel from the area will be the highest priority. Meeting places for site workers will be established and headcounts taken to account for all personnel. In the unlikely event of a large fire, local emergency response and firefighting capability will be called to respond to reduce the severity and extent of damage and to protect the safety of workers. The fire department will be notified of the hazardous materials on the site and health concerns related to the chemicals including required personal protective equipment.

7.19.5 Risk Assessment

Each potential accident and malfunction discussed above was assessed according to likelihood of the event and given a risk rating from “negligible” to “high”. Environmental effects are assigned a magnitude rating from “low” to “extreme”. The combination of the likelihood of an event and the magnitude of its environmental effects is determined by plotting these ratings on the matrix shown on **Figure 7.19-1**. As shown in this matrix, increased risk is associated with accidents and malfunctions having a greater *likelihood* of occurrence and greater *magnitude* of effects.

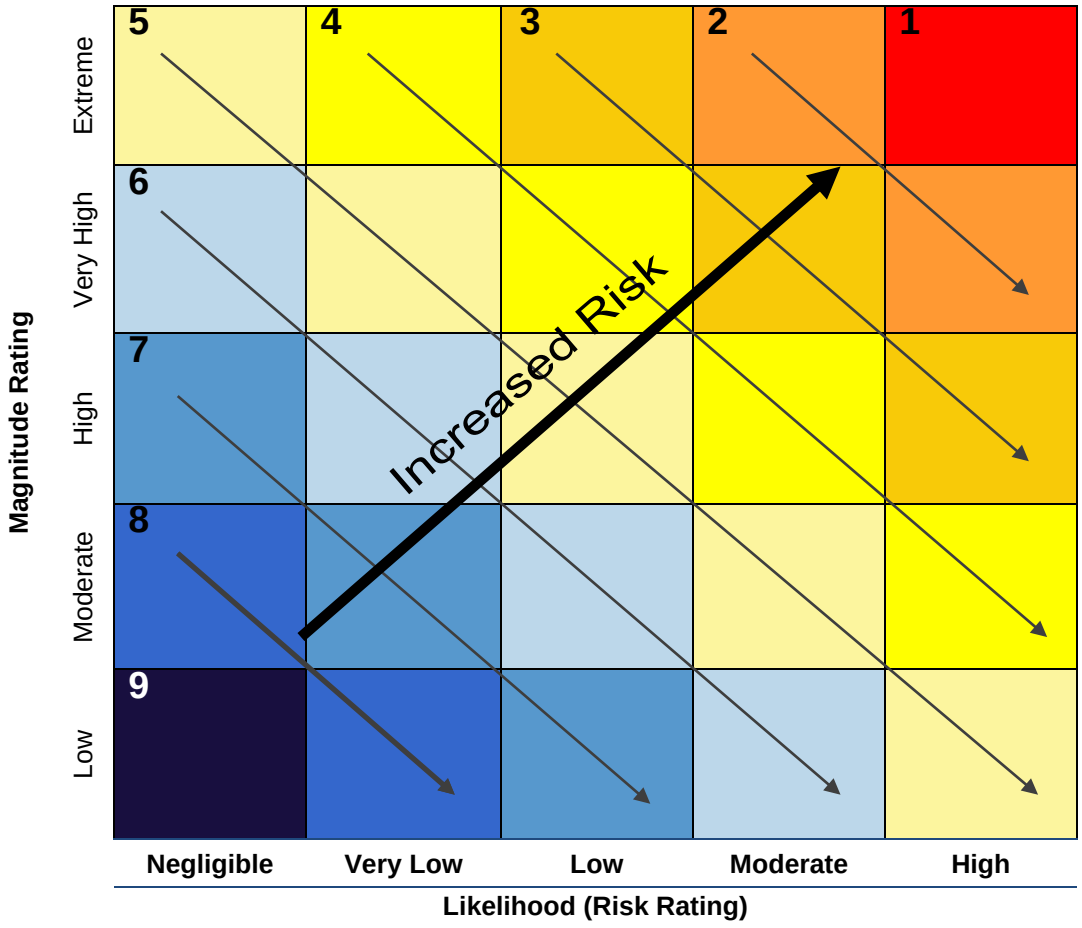


Figure 7.19-1:
Risk Rating Matrix

The magnitude rating not only considers the mitigation, operational safeguards and emergency response available to minimize environmental effects, but also the cost of remediation (as a measure of severity). The magnitude ratings are defined as follows:

- **Low:** No long term effects, readily remediated with a cost in the $10,000's;
- **Moderate:** Limited or no long term effects, remediated for costs in the $100,000's;
- **High:** Moderate long term effects expected, remediated for costs in the $ millions;
- **Very high:** Significant long term effects expected, costly remediation in the $10s millions; and
- **Extreme:** Highly significant long term effects likely, remediation cost in the $100s millions.

The risk ratings (likelihood) are defined as follows:

- **Negligible:** Not likely to occur (less than a 1 in 10,000 probability per year - 1/10,000 events per year);
- **Very Low:** Unlikely to occur (less than a 1 in 1,000 probability per year);

- **Low:** Possibly could happen (less than a 1 in 100 probability per year);
- **Moderate:** May happen (less than a 10% probability per year); and
- **High:** Can happen over the life of the mine (greater than a 10% probability per year).

Accidents and malfunctions with an overall combined rating of greater than or equal to 4 not are considered to be significant events or consequences. An overall combined rating of 3 requires that the accident or malfunction be considered further in during the project's detailed design phase. An overall combined rating of less than or equal to 2 would be considered significant.

Results of this qualitative analysis are provided in 7.18-2. The results indicate that all accidents and malfunctions described above have ratings ranging from 5 to 8. These events and their environmental effects are therefore considered not significant.

Table 7.19-2:
Accidents and Malfunctions affected VECs

Malfunction/Accident	Key VCs Potentially Effected	Risk Rating	Magnitude Rating	Overall Rating 1 = Maximum 9 = Minimum
Quarry Pit Slope Failure	Human Health and Safety	Negligible	High	7
Stockpile Slope Failure	Human Health and Safely Surface Water Resources Terrestrial Habitat and Vegetation	Negligible	Moderate	8
Sedimentation Pond Failure	Marine and Surface Water Resources Terrestrial Habitat and Vegetation Marine Species and Habitat Species at Risk	Very Low	Low	8
Marine Terminal Infrastructure Failure	Marine and Surface Water Resources Marine Species and Habitat Species at Risk	Very Low	Moderate	7
Processing Plant Infrastructure Failure	Marine and Surface Water Resources Marine Species and Habitat Species at Risk	Very Low	Moderate	7
Terrestrial Spill	Human Health and Safely Geology, Soil & Sediment Groundwater Resources Wetlands	Low	Moderate	7
Vessel Accident/Collisions	Human Health and Safely Marine Species and Habitat Species at Risk Local Economy Commercial Fisheries	Very Low	Very High	5
Explosives Accident	Human Health and Safely	Negligible	Moderate	8

Malfunction/Accident	Key VCs Potentially Effected	Risk Rating	Magnitude Rating	Overall Rating 1 = Maximum 9 = Minimum
	Marine and Surface Water Resources Terrestrial Habitat and Vegetation Terrestrial Wildlife Marine Species and Habitat Species at Risk			
Marine Spill	Human Health and Safely Marine and Surface Water Resources Marine Species and Habitat Species at Risk Local Economy Commercial Fisheries	Very Low	Very High	6
Illegal Ballast Discharge	Marine and Surface Water Resources Marine Species and Habitat Species at Risk Local Economy Commercial Fisheries	Low	High	5
Transportation Accident	Human Health and Safely Terrestrial Habitat and Vegetation Terrestrial Wildlife	Low	Moderate	8
Forest / Site Fire	Human Health and Safely Air Quality Terrestrial Habitat and Vegetation Terrestrial Wildlife Tourism and Recreation Aboriginal Land and Resources Use	Negligible	High	7

7.19.6 Conclusion

In the table above, the incidents having greatest likelihood of occurring, combined with the potential of doing the greatest harm, are given the lowest number. Accidents or malfunctions causing spills in the marine environment are ranked as the most risky compared to other incidents that may occur on site. Even so, the risk of a marine spill is not ranked as significant.