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

Environmental Impact Statement

PART 2 Section 6

Vulcan Materials Company

February 2015

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6.0 EXISTING CONDITIONS

6.1 Geophysical Environment

6.1.1 Physiography, Geomorphology and Topography

The Project site falls within the Atlantic Coast Ecoregion (**Figure 6.1-1**), which is located along the southeastern coast of Nova Scotia (Webb and Marshall 1999). There are eight ecoregions in Nova Scotia; all are subdivisions of the Atlantic Maritime Ecozone. Ecoregions are characterized by distinctive large-order landforms or assemblages of regional landforms, small order climates, water, soils, vegetation, and regional human activity uses and patterns (Neily *et al.* 2003).

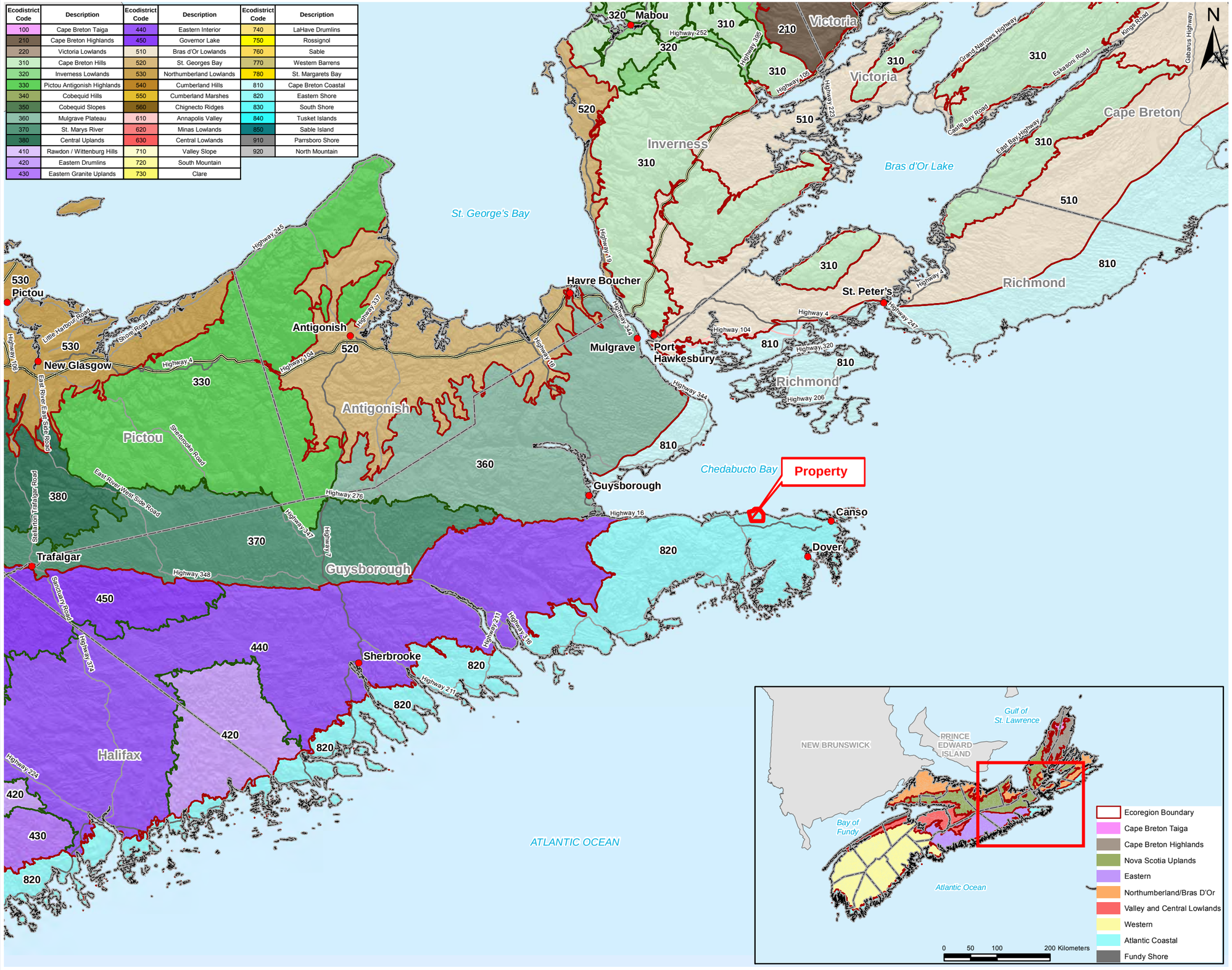
The Atlantic Coast Ecoregion has a highly irregular shoreline. Inactive geological fault lines have had a strong influence on shaping the many deep inlets along the eastern shore of Nova Scotia but these predominantly northwest-trending faults are less common along the south shore of Chedabucto Bay where the coast is less embayed. The south shore of Chedabucto Bay is very linear with an east-west orientation that reflects the presence of the inactive Cobequid-Chedabucto Fault (see 6.1.4). The landforms are underlain predominantly by Paleozoic-age metamorphic and granite bedrock, which is covered by a discontinuous veneer of stony glacial till[1]. Common tree species in this Ecoregion include white spruce (*Picea galuca*), black spruce (*Picea mariana*), and balsam fir (*Abies balsamea*). Other tree species include the hardwoods red maple (*Acer rubrum*) and yellow birch (*Betula alleghaniensis*). Common wetlands in this ecoregion include fens, salt marshes, and raised and flat bogs (Webb and Marshall 1999).

Ecoregions are further divided into ecodistricts, which are characterized by distinctive groups of landforms, relief, bedrock and surficial geological material, soil, vegetation, water bodies, and land uses (Webb and Marshall 1999). The Project site is located within the Eastern Shore Ecodistrict. This Ecodistrict spans a varied landscape of landforms, geology, and soils between the east side of the Halifax peninsula up to and including the Canso peninsula. The influence of the Atlantic Ocean provides a consistent coastal climate which is reflected in the forest types found within the Ecodistrict. The Ecodistrict is bounded by granite barrens at both ends, with metamorphosed dark, clay-rich sandstones (“greywackes”) and slates of the Halifax and Goldenville formations in between (Neily *et al*. 2003).

The Project site is located on a smooth granite hill with a maximum elevation of approximately 97 m above sea level (asl). This is one of the highest elevations in the region and places the Project site at the top of the local watershed. Topography slopes gently in all directions from the peak of the granite hill; to the north an abrupt change in elevation is observed at 60 m asl. The northwest edge of the property (north of Fogherty Lake) forms a cliff, which descends from 60 m asl to sea level over a distance of about 150 m. This cliff is lower in the north-central and northeast portions of the property between Fogherty Head and Black Point, where the topography levels off at approximately 20-30 m asl and gradually grades to the rocky coast (**Figure 6.1-2**).

[1] Glacial till is a heterogeneous mix of clay, sand, gravel and boulders left behind by melting glaciers.

Ecodistrict Code	Description	Ecodistrict Code	Description	Ecodistrict Code	Description
100	Cape Breton Taiga	440	Eastern Interior	740	LaHave Drumlins
210	Cape Breton Highlands	450	Governor Lake	750	Rossignol
220	Victoria Lowlands	510	Bras d'Or Lowlands	760	Sable
310	Cape Breton Hills	520	St. Georges Bay	770	Western Barrens
320	Inverness Lowlands	530	Northumberland Lowlands	780	St. Margarets Bay
330	Pictou Antigonish Highlands	540	Cumberland Hills	810	Cape Breton Coastal
340	Cobequid Hills	550	Cumberland Marshes	820	Eastern Shore
350	Cobequid Slopes	560	Chignecto Ridges	830	South Shore
360	Mulgrave Plateau	610	Annapolis Valley	840	Tusket Islands
370	St. Marys River	620	Minas Lowlands	850	Sable Island
380	Central Uplands	630	Central Lowlands	910	Parrsboro Shore
410	Rawdon / Wittenburg Hills	710	Valley Slope	920	North Mountain
420	Eastern Drumlins	720	South Mountain		
430	Eastern Granite Uplands	730	Clare		



NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

Black Point Quarry Project

ECODISTRICTS OF NOVA SCOTIA

September 18, 2014	Rev 1.0	Figure No. 6.1-1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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LEGEND

- Property Boundary
- Crown Lease Land
- Waterbody
- Watercourse
- LIDAR Contour (2m)
- Utility Line

0 100 200 400 Meters

SCALE: 1:10,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

PROPERTY BOUNDARIES

October 22, 2014	Rev **1.0**	Figure No. **6.1-2**
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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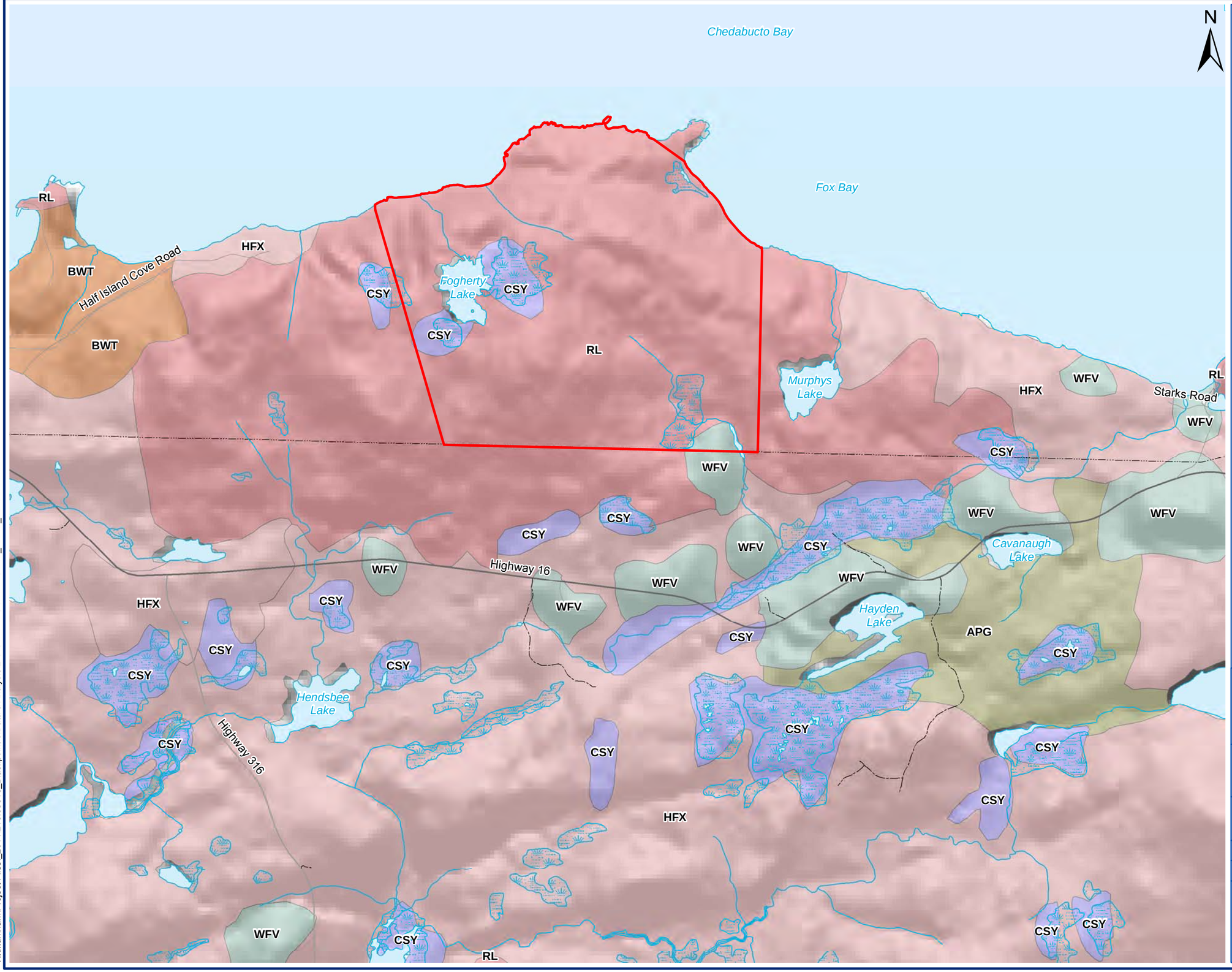
6.1.2 Soils/Sediment

Approximately 94% of the soils in Guysborough County have developed from glacial till, with the remainder being developed on alluvial (river) deposits or glaciofluvial (rivers of glacial origin) deposits. Textures in the soils developed over till range from sandy loam to loam in the upper layers, while the parent till material ranges from gravelly sandy loam to clay loam. Textures in the alluvial and glaciofluvial soils range from gravelly sandy loam to silt loam in the surface layer, while in the subsoil the material ranges from gravel to silt loam (Hilchey *et al.* 1964).

Soils are thin to non-existent on the top of the granite hill that dominates the property. Soils thicken to the east and west at lower elevations where wetlands have developed. The soil map labels the Project site as “Rockland”, defined as soil areas with 50% or more of rock outcrops or boulders (**Figure 6.1-3**). Isolated pockets of peat, defined as brown, poorly decomposed organic material 30 cm or more in depth, are shown adjacent to Fogherty Lake, and form the Castley soil type. A single occurrence of Wolfville Series soil is shown in the extreme southeast corner of the property. This soil consists of “moderately stony, dark brown friable loam over dark grayish brown sandy clay loam”. As noted above, this soil is developed from a parent material made of glacial till, in this case “firm dark reddish brown sandy clay loam glacial till” (SRI 1963).



N

LEGEND

- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

Soil Cover

- APG - Aspotogan
- BWT - Bridgewater
- CSY - Castley
- HFX - Halifax
- RL - Rockland
- WFV - Wolfville

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014;

MORIEN RESOURCES / VULCAN MATERIALS

Black Point Quarry Project

SOIL COVER

September 18, 2014	Rev **1.0**	Figure No. **6.1-3**
Project No. 210.05913.00000		

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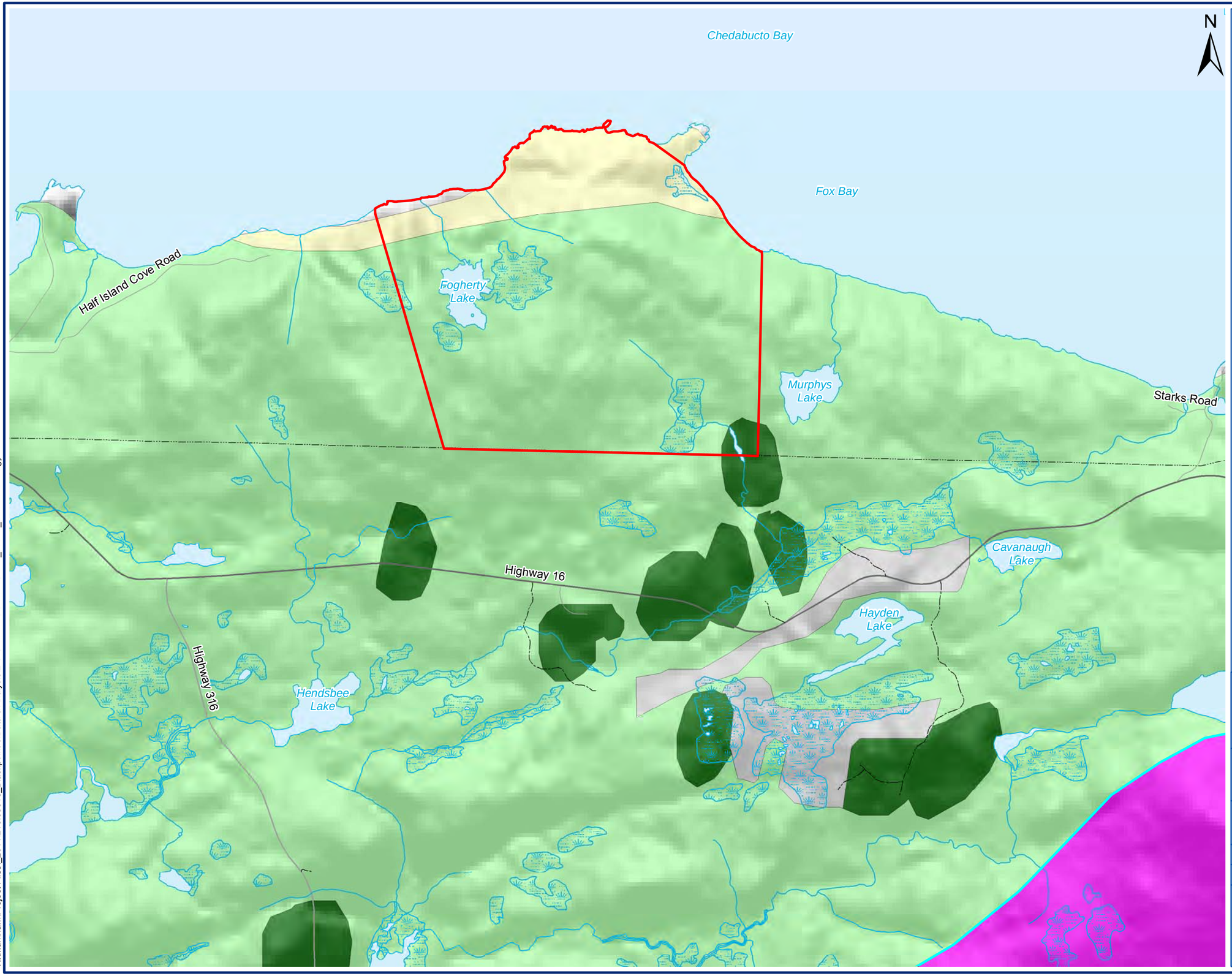
6.1.3 Surficial Geology

Surficial geology in the vicinity of the Project site is described on published geology maps (Stea *et al*. 1992; Stea and Fowler 1979) as predominantly comprising Pleistocene-age granite and quartzite tills derived from local bedrock sources (**Figure 6.1-4**). The stony till shown within the property boundary is yellow-brown in color, loose and sandy. Regionally, it averages 2 m thick but is up to 5 m thick in some areas. The quartzite till is bluish-greenish-grey in color, loose and coarser grained than the stony till; it averages 3 m thick but may be up to 20 m thick in some places. A thin band of red till and/or marine deposits developed on Halifax Formation bedrock is present along the coastal portion of the property.



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LEGEND

- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

Surficial Geological Units

- Organic Deposits
- Marine Deposits
- Stony Till Plain (Ground Moraine)
- Silty Drumlin (Drumlin Facies)
- Bedrock

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; DP ME 36, Version 2, 2006, Digital Version of Nova Scotia Department of Natural Resources Map ME 1992-3, Surficial Geology Map of the Province of Nova Scotia, scale 1:500 000, by R. R. Stea, H. Conley and Y.

VULCAN MATERIALS / MORIEN RESOURCES

Black Point Quarry Project

SURFICIAL GEOLOGY

September 18, 2014	Rev **1.0**	Figure No. **6.1-4**
Project No. 210.05913.00000		

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Observations made on site indicate these tills are essentially absent on the top of the granite hill, but thicken on the slopes of the hill at lower elevations. The tills are well exposed along the coastline at Half Island Cove (Figure 6.1-5) and Fox Island Main. Dug wells, which are used more often than drilled wells in this area to provide potable water, are installed in these loose tills.

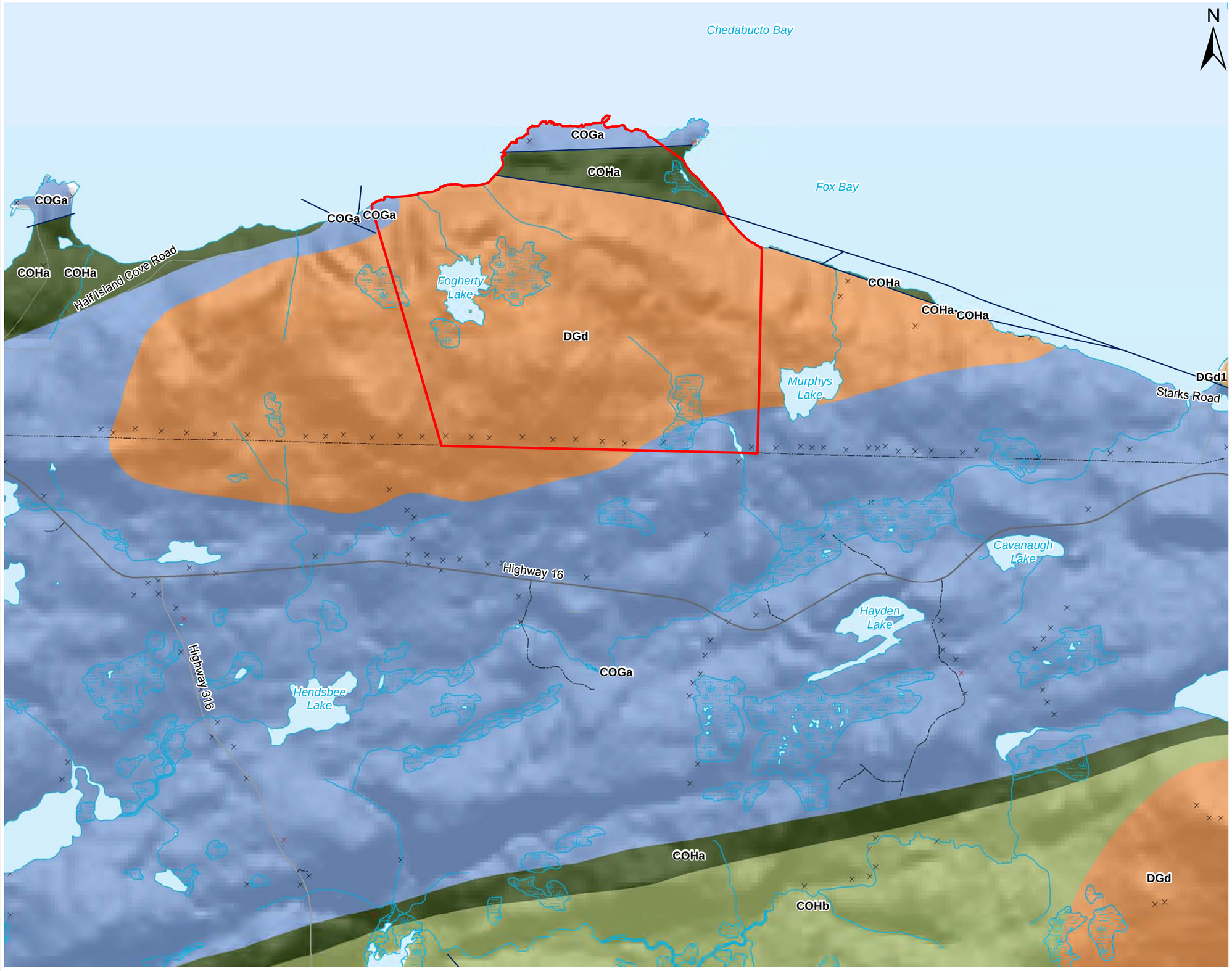
Figure 6.1-5:
View of glacial till east of Gaulman Point

6.1.4 Regional Geology

The Project site is located within the Meguma Terrane, south of the Cobequid-Chedabucto Fault System which separates the Meguma Terrane in the south from the Avalon Terrane in the north. The Meguma Terrane underlies the southern mainland of Nova Scotia, south of a line connecting the Minas Basin with Chedabucto Bay, and also extends seaward. The sedimentary rocks of the Meguma Terrane consist of primarily metamorphosed, fine-grained sandstones and slates with minor amounts of volcanic and carbonate rocks in local areas. The Meguma Terrane was later intruded by younger granitic rocks (NSMNH 1984), including the granite intrusion at Black Point that will provide the aggregate material for the Project.

Granite represents about 20-25% of the bedrock in Nova Scotia and is found throughout mainland Nova Scotia and Cape Breton. The granite intrusions in the Meguma Terrane were generated during the Acadian mountain building event, when the Meguma sedimentary pile was

compressed against, and possibly over, the Avalon Zone (NSMNH 1984). The geology of the site and surrounding area is presented on Figure 6.1-6.



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LEGEND

- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line
- Fault, Approximate
- Fault, Assumed

Outcrops

- ▲ fault breccia, cataclasite
- × observed outcrop
- × porphyroblast occurrence
- ± xenolith concentration

Bedrock Geologic Units

Goldenville Formation

- COGa - Goldenville Formation thickly bedded

Halifax Formation

- COHa - Halifax Formation graphite schist
- COHb - Halifax Formation mica-quartz-garnet phyllite

Upper Devonian

- DGd - Upper Devonian med grained, equigranular to slightly porphyritic granite
- DGd1 - Upper Devonian med grained, equigranular to slightly porphyritic granite <4% biotite

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; DP ME 350, Version 1, 2006, Digital Version of Geological Survey of Canada Bulletin 383, Figure 2. Geology of the Canso Area, Nova Scotia, parts of NTS 11F/02, 11F/03, 11F/06 and 11F/07, scale 1:50 000, by J. D. Hill, 1986

VULCAN MATERIALS / MORIEN RESOURCES

Black Point Quarry Project

BEDROCK GEOLOGY

September 18, 2014	Rev 1.0	Figure No. 6.1-6
Project No. 210.05913.00000		

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6.1.5 Local Geology

The geology of the Project site and surrounding areas consists of Cambro-Ordovician age metamorphosed sedimentary rocks of the Goldenville and Halifax Formations Figure 6.1-6. The Goldenville Formation is the older of the two and is generally found to the south and west of the Project site, although this rock also outcrops on the tip of the Fogherty Head / Black Point headland. The Goldenville Formation consists of a thickly bedded metamorphosed muddy sandstone ("metawacke") with minor metamorphosed siltstone and slate ("metapelite"). Immediately to the south of the faulted boundary with the Goldenville Formation on the Fogherty Head / Black Point headland lies the Halifax Formation, consisting of graphite schist (a metamorphosed crystalline rock) interbedded with thin layers of metawacke (Hill 1991).

The majority of the Project site, including the area to be quarried, is underlain by medium-grained granite (Hill 1991). The granite has been intruded into the sedimentary rocks of the Goldenville and Halifax Formations. The granite's northern boundary with the Halifax Formation is a west-northwest to east-southeast trending fault. Similarly, the boundary between the Halifax and Goldenville Formations between Fogherty Head and Black Point is also a fault. These faults are thought to be part of the Cobequid-Chedabucto Fault Zone that has been inactive for millions of years.

Eleven bore holes have been drilled in the Project site footprint in order to confirm the granite's suitability as a construction aggregate. The drill logs are provided as an attachment to the Hydrogeological Technical Report in **Appendix A**. The logs describe a pinkish to greyish-white granite comprising 50% to 60% feldspar, 35% to 48% quartz and up to 10% biotite and muscovite mica.

The drill cores indicate that the most frequent fracturing and jointing occurs in the upper 40 m as demonstrated by the fracture frequency plot attached to Hydrogeological Technical Report in **Appendix A**. Two fault zones were noted in the core logs of drill holes BP-8 and BP-9 at 93 to 94 m below ground surface (bgs) and 20 m to 25 m bgs, respectively, and are shown on the fracture plots by fracture frequencies of >20 fractures per metre. Detailed topographic and LiDAR data of the site indicate a bifurcating lineament running from the northwest corner of Murphy's Lake to Watercourse 2 located northeast of Fogherty Lake. This northwest-southeast trend is consistent with known faulting in the area. Core holes BP-8 and BP-9 are located close to this lineament and potentially intersect a related fault.

Twenty-two granite core samples from three holes drilled during the 2014 resource assessment program were submitted to the laboratory for major and minor element analysis. In total, 49 parameters were measured, including the naturally occurring radioactive elements thorium and uranium. The analyses demonstrated the granite is chemically stable and is ideally suited for use as aggregate.

The whole rock analyses of these 22 samples demonstrated average thorium concentrations of 7.9 ppm (range 6.7-8.9 ppm) and average uranium concentrations of 7.08 ppm (range 6.18-8.15 ppm). These values are typical for Nova Scotia granites. In the rock classification system presented for the South Mountain granite (the rock that underlies much of southwestern Nova Scotia), the Black Point granite would be classified as a muscovite-biotite bearing 'fine-grained leucomonzogranite' or FGLMG (MacDonald *et al.* 1992). Average geochemical compositions of 105 FGLMG samples revealed average thorium concentrations of 6.3 ppm with a standard deviation of 4.2 and average uranium concentrations of 7.9 ppm U with a standard deviation of 5.5 ppm. Therefore compositions ranging from 2.1 ppm to 10.5 ppm for thorium and 2.4 ppm to

13.4 ppm for uranium are within one standard deviation of the arithmetic mean for this type of rock and can be considered average compositions.

6.1.6 Acid Rock Drainage (ARD) Potential

The granite at the Project site will be quarried to produce crushed-stone aggregate. Analytical testing was conducted in 2014 on the granite taken from three boreholes drilled in the granite resource (BP-7, BP-8 and BP-9) to confirm its suitability as construction aggregate. Testing included analysis of weight % sulphur and acid production potential as indicators of acid rock drainage (ARD) potential, since ARD has both structural and environmental implications. Testing indicated that the concentration of sulphur / sulphide in the granite is well below the threshold indicated in the *Sulphide Bearing Material Disposal Regulations* and is therefore considered non-acid producing (**Appendix B**). This is fully consistent with the chemical composition of aggregate quality granite: even limited ARD potential would render the rock un-useable as aggregate.

Halifax formation slates, which are often sulphide bearing, and Goldenville formation quartzite and greywacke, which is rarely sulphide bearing, are present within the proposed Project area at the northern end of the site. These rocks underlay the area proposed for the processing plant and aggregate stockpiles (Figure 6.1-6). Although they will not be quarried for aggregate, these formations may be disturbed for construction of the laydown area.

In October 2011, Black Point Quarry project geologists collected samples from these formations for ARD analysis. Five of the six surface samples collected have a sulphide content below the 0.4% threshold stipulated in the Regulations (**Appendix B**). 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 laboratory-generated pH of 7.4 (i.e., slightly alkaline). From all indications, the Goldenville Formation rock on site is sulphide free and is proposed to be used in construction of the rubble-fill for the wharf. The Halifax Formation, which likely contains sulphides appears to exist only in a small band across the site (**Appendix B**) and will be avoided to the extent possible. As described in Section 7.4, the Proponent will sample and test these rocks prior to any excavation in accordance with the guidance provided in the provincial Sulphide Bearing Material Disposal Regulations. Should sulphide bearing materials be disturbed, the Proponent will work with NSE and NSDNR to confirm that all regulatory requirements are met before excavation begins.

6.1.7 Seismic Activity

Seismic activity may affect operations of any facility, particularly one close to the ocean where a tsunami can have consequences. Figure 6.1-7 shows the distribution and size of historical earthquakes recorded in eastern Canada, while Figure 6.1-8 shows the relative earthquake hazard across Canada. All of Nova Scotia is located within the next-to-lowest low hazard zone.

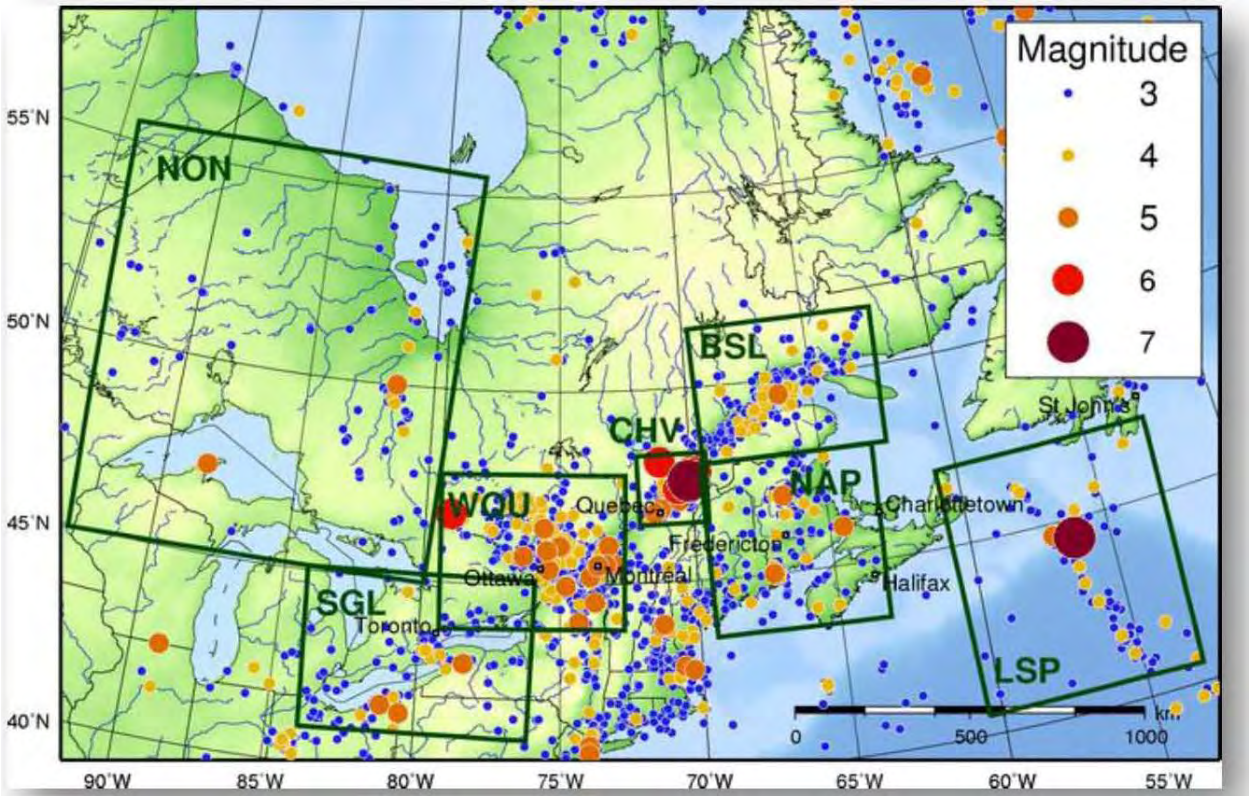

Figure 6.1-7:
Distribution and magnitude of historical earthquakes

Source NRCan 2013a

The rectangles delineate larger scale maps available at Earthquakes Canada. The Laurentian Slope Seismic Zone (LSP) denotes an area off Canada's southeast coast, which includes the Grand Banks of Newfoundland. The Laurentian Slope experienced about nine events 5.0 or greater between 1929 and 1977 (Ruffman 1995). The large red dot within the LSP zone identifies the location of a magnitude 7.2 earthquake that occurred in 1929. Tragically, this earthquake caused a tsunami which killed 28 people on Newfoundland's Burin Peninsula.

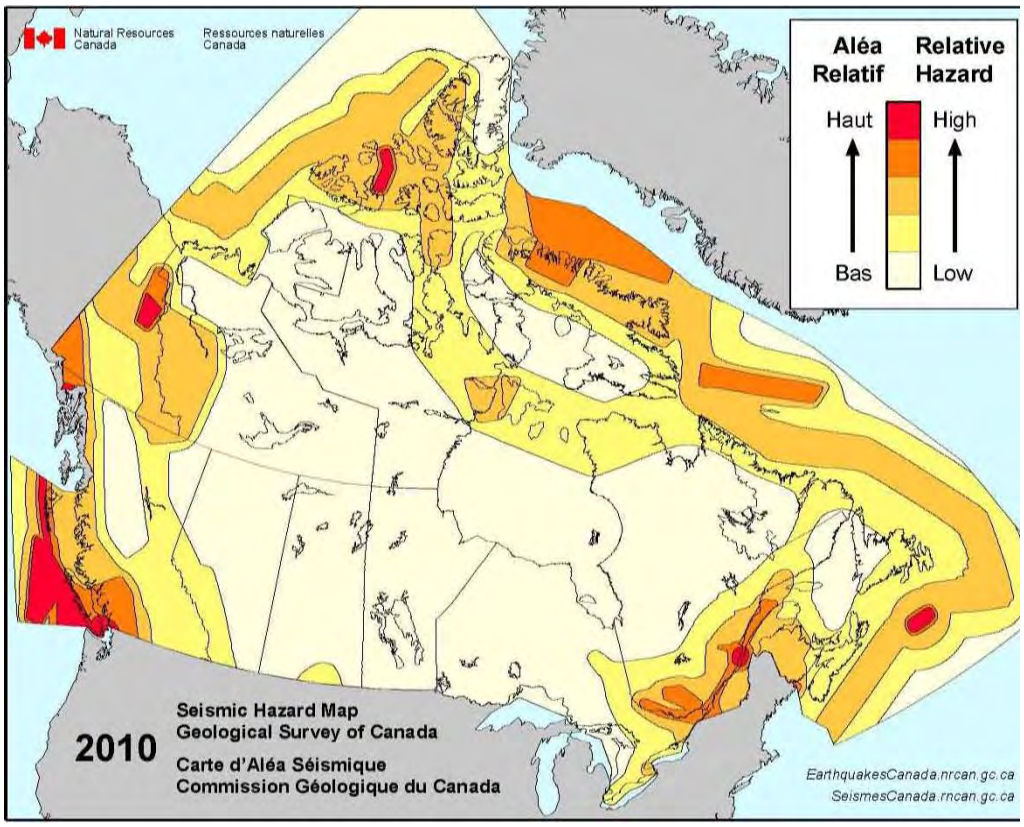

Figure 6.1-8:
Relative Earthquake Hazard

Each year, approximately 450 earthquakes occur in eastern Canada, of which four will exceed magnitude 4, thirty will exceed magnitude 3, and about 25 will be reported as felt (NRCan 2013a). A decade will, on average, include three events greater than magnitude 5, generally taken as the threshold of damage.

Earthquakes on Canada's east coast are not caused by tectonic movement along active plate boundaries, as is commonly the case on the west coast. It is thought that seismic activity in this region is related to the large scale, regional stress fields (NRCan 2013a) and slumping of sediment at the edge of the continental shelf into deeper water below.

Although tsunamis are not common, they have been recorded periodically along the eastern seaboard of North America. Ruffman and Tuttle (2005) have summarized tsunamis reported along the eastern continent (quoted from AMEC 2006).

- A local tsunami was noted on June 27, 1864, at St. Shotts on the southwest extremity of the Avalon Peninsula, Newfoundland;
- On November 17, 1872, tide gauges on the Fox Islands in Penobscot Bay and in North Haven, Maine registered a train of tsunami-like waves for about six hours;
- On August 10, 1884, a magnitude 5.6 earthquake in southern New York State created a tsunami that was observed in Philadelphia, along the coast at Trenton and Highlands, New Jersey, and through to New York Harbour;

- On October 4, 1884, three trans-Atlantic cables south of the Tail of the Banks broke at the same time over a down-slope distance of 10 nautical miles suggesting a slump; a possible tsunami may have resulted, however no tsunami reports are presently known;
- On January 9, 1926, an apparent tsunami was seen at Bernard, in Bass Harbour on Mount Desert Island, and at Corea in Maine;
- On November 18, 1929, the magnitude 7.2 "Grand Banks" earthquake (epicentre of 44.5°N, 56.3°W) triggered a large submarine slump that generated a tsunami and caused the loss of 28 lives. It represents Canada's largest documented loss of life directly related to an earthquake; and
- In 1940, a small tsunami-like event observed on the Island of Saint-Pierre may have been associated with the Laurentian Slope Seismic zone.

The 1929 Grand Banks earthquake is the highest magnitude earthquake recorded on the east coast. No damage from this earthquake or the ensuing tsunami was report in mainland Nova Scotia, although chimneys damaged on Cape Breton Island and minor landslides were reported. The tsunami was reportedly observed as far southwest as Lunenburg as well as in Bermuda. It was recorded on tide gauges as far south as Charleston in the US, in the Azores, and across the Atlantic Ocean in Portugal (NRCan 2013b).

The Black Point Quarry site is located at the edge of the "minor damage" zone for the 1929 tsunami (NRCan 2013b). As indicated in Figure 6.1-7, there are no historical earthquakes reported to originate in or near Cobequid Bay. For reference, reports of the 1929 earthquake were converted to Revised Modified Mercalli Intensities (MMI) and plotted on a map (Figure 6.1-9). Canso records a MMI of 5 out of 10 (shaking: moderate; damage very slight). In summary, the Project site is located in an area of low seismic hazard.

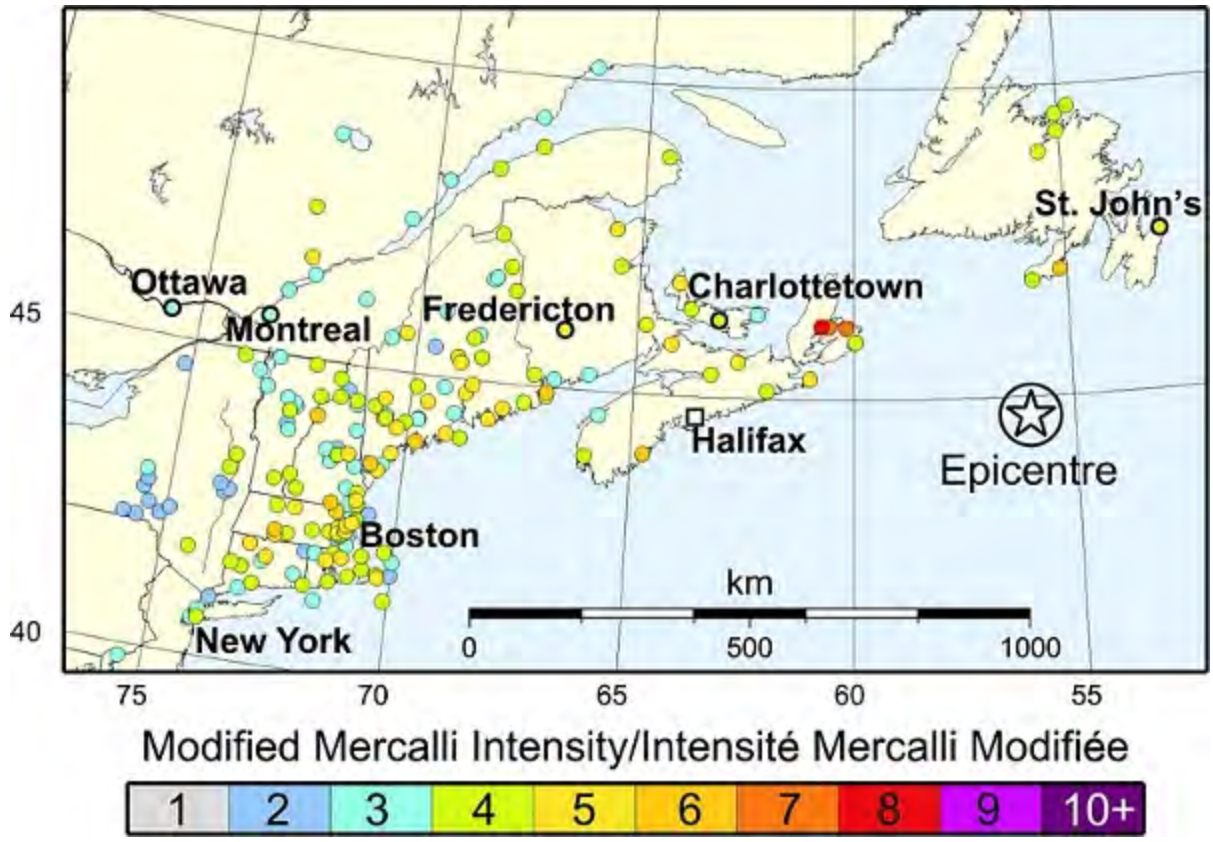

Figure 6.1-9:
Revised Modified Mercalli Intensities for the 1929 Grand Banks Earthquake

Source NRCan 2013c.

6.1.8 Isostatic Uplift and Subsidence

Sea level rise affecting coastal communities and ecosystems results from the combined effect of (a) increased global sea levels and (b) the added effect of regional or "isostatic" subsidence of the Earth's crust. Uplift and subsidence are the crust's secondary response to the removal through melting of the glaciers that covered much of Nova Scotia at the end of the last ice age, approximately 10,000 years ago.

At their peak, glaciers located centered in New Brunswick and Newfoundland reached several thousands of metres in thickness. The immense weight of these massive ice concentrations depressed the crustal rocks beneath them. At the same time as the crust beneath the glaciers was depressed, rocks further away from this centre of mass were flexed upward. The following analogy effectively describes this. The subsidence effect is similar to when a person sits upon a seat cushion: the cushion edge is displaced upward even as the centre of the cushion is pushed downward by the weight of the person. Once the weight of the glaciers was removed, the crust beneath the former glacier began to rise to its pre-glacial position, while the crust located further way began to subside as a secondary effect. This subsidence that followed isostatic rebound continues today. In much of Nova Scotia, crustal subsidence is exacerbating the effects of global sea level rise (Fader 2005; King and Fader 1988; Shaw *et al*. 2006).

6.1.9 Landslip Potential

No geotechnical analysis of the site specific conditions for future slope stability has been undertaken for this site. The granite proposed for use as aggregate is known to be highly resistant to fracture and slumping. The landslip potential is very low. The general lack of surficial deposits on the site limits the potential of these materials to fail (i.e., cause a landslide) during a seismic or heavy precipitation event. In addition, any surficial materials overlying the granite rocks will be stripped away prior to quarrying, and therefore will not be susceptible to slumping. Table 6.1-1: presents the geotechnical properties of the rock types found on the property.

Table 6.1-1:
Geotechnical Properties of Bedrock on the Property

Geologic Material	Density (pcf)	Compressive Strength psi x 1000	Permeability	Seismic Velocity fps x 1000
Igneous Intrusive	150-200	3-300	Low	12-20
Metamorphic High Grade	150-200	3-25	Low	12-20
	Excavation Difficulty	Resistance to Weathering	Foundation Support	Stability in Cuts
Igneous Intrusive	High	High	Good	Good
Metamorphic High Grade	High	High	Good	Good

Source: Koloski *et al*. 1989

As noted in Section 3.0, the crusher fines will be stored within the quarry itself. These materials are extremely stable when stockpiled. To ensure worker safety within the quarry, the stockpiles are designed to maintain their shape under all weather conditions. As described in Section 7.6, even if a waste rock pile were to slump, it would be entirely contained within the quarry.

6.2 Water Resources

6.2.1 Surface Water

Additional details of the baseline surface water environment are presented in the Surface Water Assessment Technical Report (**Appendix C**). A summary of the key findings is presented below.

6.2.1.1 *Watersheds, Water Balance and Peak Flows*

The mean annual runoff for the site has been estimated using a water balance approach, taking account of rainfall and evaporation data (presented in Section 6.3) and an infiltration factor to estimate annual runoff. It is estimated that of the total 1426 mm of annual precipitation, 549 mm evaporates and 351 mm infiltrates into the ground, providing an annual runoff of 526 mm. This equates to 1 865 592 m^3 across the entire 354.5 ha site or an average flow of 59 L/s.

The Project site can be divided into 13 catchments, as shown in **Figure 6.2-1**, which drain to off-site watercourse systems (discussed in more detail in the following section) or directly to the ocean. The estimated mean annual for each catchment is presented in Table 6.2-1.

Table 6.2-1:
Catchment Areas and Mean Annual Runoff

Catchment	Flows To	Baseline Scenario (Pre Development)	
		Area (ha)	Mean Annual Runoff (m^3)
F1	Chedabucto Bay	14.4	75 573
F2	Chedabucto Bay (Through Fogherty Lake)	61.5	323 504
F3	Chedabucto Bay	5.8	30 387
F4	Chedabucto Bay	8.7	45 767
M1	Chedabucto Bay (Through Murphys Lake)	13.2	69 481
N1	Chedabucto Bay	1.0	5 401
N2	Chedabucto Bay	11.0	57 684
N3	Chedabucto Bay	19.9	104 481
N4	Chedabucto Bay	21.5	113 040
N5	Chedabucto Bay	14.4	75 632
N6	Chedabucto Bay	22.4	118 041
S1	Reynolds Brook	31.9	168 101
S2	Reynolds Brook	2.9	15 100
S3	Reynolds Brook	126.1	663 399
Total		354.5	1 865 592

N

Chedabucto Bay

Fox Bay

Fogherty Lake

Murphys Lake

Watercourse 1

Watercourse 2

Watercourse 3

Watercourse 4

Quilt-West Watercourse

N1

N2

N3

N4

N5

N6

F1

F2

F3

F4

S1

S2

S3

M1

BPSTR06

BPSTR08

BPSTR09

BPSTR12

LEGEND

- Stream Sample Location
- Point of Catchment Calculation
- Direction of Surface Flow
- Property Boundary
- Catchment Boundaries
- Waterbody
- Wetland
- Watercourse
- Utility Line
- Contour (4m, LIDAR)

* Catchment Bondaries are based on LiDAR data
Flow through wetlands is difficult to predict without onsite investigation. Catchment boundaries are an estimate only.

0 125 250 500 Meters

SCALE: 1:12,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

WATER FEATURES, SAMPLING LOCATIONS, TOPOGRAPHY AND CATCHMENTS

October 23, 2014	Rev 1.0	Figure No. 6.2-1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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Currently, precipitation falling on 54.7% of the site's surface area (193.8 ha) is directed by topography to the north, and discharges 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. 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. Flow from the remaining 45.4% of the site (160.7 ha) is directed south to wetlands and tributaries of Reynolds Brook.

Peak flows and flood volumes generated by the site during baseline and developed conditions were estimated using the SCS Method as presented in Surface Water Assessment Technical Report (**Appendix C**). As can be observed in the un-mitigated post-development scenario, peak flows will increase 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. Peak flows and flood volumes for the 25- and 100-year storms are given in Table 6.2-2.

Table 6.2-2:
Peak Flow Rates and Flood Volumes

Flood Hydrograph	1:25 years	1:100 years
Peak Flow (m^3/s)	47	62
Flood Volume (m^3)	258 000	341.000

6.2.1.2 *Site Watercourses*

The site hosts numerous wetlands, Fogherty Lake, and three watercourses within the site boundary (**Figure 6.2-2**).

Fogherty Lake is a shallow waterbody surrounded by trees, barrens and exposed rock. The water is clear but darkly tea-coloured, and visibility is nil at approximately one metre depth. The lake substrate is exposed bedrock and large boulders. There is some woody organic debris on the lake bed, which has a strong sulfurous smell. Lake water is very acidic (field pH =2.94) (AMEC 2011 in **Appendix E**).

Three watercourses are identified within the site boundary and are described in full in AMEC's report (Appendix E), a summary of which follows:

- Watercourse 1 – which flows from Fogherty Lake north into Chedabucto Bay. A beaver dam is located near the upstream end of the watercourse. Upstream of the dam, the channel is deep and wide and the substrate largely consists of fines; downstream, the channel is a relatively narrow and shallow run with one area of natural deadwater. The northernmost 150 m of this watercourse was not surveyed, as it flows down a steep slope; however, the dimensions and substrate of the downstream reaches appeared to be similar to the run portions of the channel (AMEC 2011). Flow was measured (2014) and water quality monitored (2011, 2014) approximately 10 m downstream from the discharge of Fogherty Lake at location BPSTR06. The channel varied from approximately 0.50 to 1.0 m wide and had a moderate slope. The stream bed consisted of gravel with varied sized boulders scattered throughout.

- Watercourse 2 – flows within a steep valley from the centre of the site in a north-westerly direction into Chedabucto Bay. There was a great deal of deadfall in the channel valley. The upstream reaches were dry at the time of the 2011 survey, and further downstream the stream was very shallow; this watercourse is probably ephemeral. The stream was dry in July and August, 2014. The last 220 m of this watercourse was inaccessible, as it flows down a steep slope to the ocean, as does Watercourse 1; however, the dimensions and substrate of the downstream reaches appeared to be similar to the rest of the channel (AMEC 2011).

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LEGEND

- Drive Point Piezometer Locations
- Drive Point Piezometer Locations with Water Level Loggers
- Stream Sample
- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

STREAM SAMPLE AND DRIVE POINT PIEZOMETER LOCATIONS

October 23, 2014	Rev **1.0**	Figure No. **6.2-2**
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

- Watercourse 3 – flows south from the wetlands in the southeast part of the site, across the transmission line cut and towards another wetland system southeast of the site. This in turn is the headwaters of Reynolds Brook, which drains in a south-westerly direction, eventually discharging through Hendsbee and Cooeycoff Lakes into Tor Bay. The downstream portion of the assessed section of Watercourse 3 is a large pool resulting from a beaver dam on the watercourse constructed just south of the site property line. In 2014, flows were measured and water quality monitored at two locations; BPSTR12 which is downstream of wetland 17, and BPSTR08 which is upstream of wetland 17. This watercourse was also sampled in 2011. The discharge measurement at BPSTR12, also on Watercourse 3, was taken at the outflow of Wetland 1. The channel is 2.0 to 10.0 m wide with low, gradual banks, and moderate slope. The stream bed consisted primarily of a mix of small and large boulders. The discharge measurement was located at a narrow, well-contained section 1.0 m wide with large boulders on each side, and consistent flow throughout the section.

  The portion of Reynolds Brook nearest to the Property is located approximately 1.0 km southeast of the site. This point (the headwaters of Reynolds Brook) is marked by the discharge from a wetland located southeast of the Property beneath Route 16.

In addition to the abovementioned watercourses, the following significant off-site surface water resources are noted in close proximity to the site:

- South-West (off-site) Watercourse – ephemeral runoff from the south-west of the site drains towards a watercourse which flows to the south-west into Hendsbee Lake, approximately 1.3 km form the site.

- Murphys Lake (Sample ID BPSTR09) - runoff from the east of the site drains towards Murphys Lake which is located approximately 100 m east of the site. Murphys Lake drains to the north into Chedabucto Bay. The discharge measurement at BPSTR09 was measured approximately 20 m downstream from the discharge from Murphys Lake. The typical channel width was 1.0 m or less and had a moderate slope. The stream bed was muddy with fine gravel. The discharge measurement section was 0.80 m wide, had well-defined banks on each side, and had consistent flow throughout the entire section.

- Fox Island Main Creek (Sample ID BPRST10) - Fox Island Main creek drains a large wetland southeast of the Property and discharges north to Indian Cove approximately located 2.0 km east of the Property boundary. None of the surface water draining off the study Property feeds Fox Island Main Creek. Water samples and discharge measurements were taken approximately 10 m upstream from the bridge crossing at Starks Road, Fox Island Main. The typical full-bank channel width is approximately 3.0 m wide, with high banks and a moderate slope. The stream was in low-flow conditions at the time of July and August, 2014 measurements. The stream bed consisted of a mix of gravel and small boulders. The discharge measurement section was 1.1 m wide, well-defined with boulders at each bank, with flow concentrated primarily in middle of the cross-section and negligible at the banks.

- Reynolds Brook – As noted, Reynolds Brook is located south of Route 16 (Marine Drive) at least 1.0 km south of the Property and flows south-west into Hendsbee Lake. Reynolds Brook itself was not inventoried for the presence of fish, but Watercourse 3, which discharges into the wetland that feeds Reynolds Brook, does not support fish.

6.2.1.3 *Flow Measurements*

Shallow and low permeability soils and the numerous wetlands suggest that relatively low infiltration rates and therefore high runoff rates are typical across the site.

As presented in Table 6.2-3, flow measurements were taken in five watercourses at the end of July 2014 and end of August 2014 (**Appendix C**). The July flows were considered representative of dry (baseflow) conditions (no precipitation for the three days prior to measurements). These measurements show flow out of Fogherty Lake in Watercourse 1 to be 0.03 L/s and flow out of the southeast wetland in Watercourse 3 to be 7.7 L/s. The August flows were also considered representative of low flow conditions and measured flows were consistently lower than during the July round of measurements.

Table 6.2-3:
Stream Discharge Summary

Sample ID	Location Description	Discharge (L/s)	Dates Measured (2014)
BPSTR06	Fogherty Lake Outflow Watercourse 1	0.031 / 0	July 30 / Aug 27
None	Watercourse 2	0 / 0	July 30 / Aug 26
BPSTR08	Wetland 17 Inflow Watercourse 3 Upstream	0 / 0	July 30 / Aug 26
BPSTR09	Murphys Lake Outflow	0.170 / 0	July 31 / Aug 27
BPSTR12	Wetland 1 Outflow (Watercourse 3 downstream)	7.73 / 0.325	July 31 / Aug 27
BPSTR10	Fox Island Creek Outflow	4.24 / 0.394	July 25 / Aug 27

6.2.1.4 *Water Quality*

Surface water quality monitoring was undertaken at 5 locations on 31st July, 2014. These samples were intended to complement data collected in August and September, 2010 at many of the same sample locations, including Fogherty Lake (AMEC 2011 – **Appendix E**). The analytical results were compared against Canadian Water Quality Guidelines (CWQG) for the Protection for Aquatic Life (PAL) Freshwater Guideline Update 7.0 (CCME 2007). The results indicate:

- Laboratory-measured pH was low (4.33 – 4.70) in all 5 samples and is outside of the acceptable CWQG PAL guideline range (6.5-9.0).
- Lead slightly exceeded the CWQG PAL guidelines at two locations.
- Iron was elevated (320 – 1600 ug/L) in all 5 samples and exceeded the CWQG PAL guidelines (300 ug/L).
- Cadmium was above the CWQG PAL guidelines at one location (0.09 ug/L).
- Ammonia was elevated (0.08 – 0.086 mg/L) in 2 samples and exceeded the CWQG PAL guidelines (0.05 mg/L).
- Aluminium was elevated (270 – 820 ug/L) in all 5 samples and exceeded the CWQG PAL guidelines (5 ug/L).

The pH of surface water features is low and colour of water is typically dark brown, both characteristics are thought to be attributable to the peaty soils which are common across the site. The low pH is likely to be the cause of the elevated dissolved metals concentrations within

the samples. None of the on-site watercourses support fish habitat. Water quality data from 2010 and 2014 are presented in **Appendix C**.

6.2.1.5 *Surface Water Use*

No consumers of surface water were identified within two kilometers of the property boundary. As noted, the freshwater streams on the property, including Fogherty Lake, do not support fish populations and so are not used for recreational fishing. No industrial water taking occurs within two kilometers of the Project site. A Designated Water Supply Area (the Walsh or Wilkins Lake Water Supply Area) is located 4.5 km southeast of the property boundary. This water supply area is located within a separate watershed that does not receive surface water runoff from the Project site.

6.2.2 Water Supply Potential

Given the yields of wells in the vicinity of the Project (Section 6.2), groundwater is unlikely to yield sufficient water to meet development needs. Surface water bodies in the area are not suitable for processing water due to their acidity. In light of this, the Project will capture rainwater and snowmelt to meet water requirements.

The estimated mean annual runoff from the quarry and lower platform areas which will drain into the stormwater ponds and will be available for use in the processing plant and for dust suppression is estimated to be 1 248 202 m^3, which equates to an average flow of 3 420 m^3 per day during the fully developed site. However, runoff volumes will be lower during the initial stages of site development. Prior to excavation of the quarry, the mean annual runoff from the lower platform is expected to be 161 467 m^3 (442 m^3 per day). This volume will be sufficient, when stored to meet Project requirements, estimated at 315-378 m^3 per day for the expected 10-12 hrs of operation during Phase 1 and rising to about 3 859 m^3 per day during Phase 3.

6.2.3 Ground Water

The Project site is not equipped with municipal water or wastewater services. The nearest municipal water supply is located in Canso, approximately 10 km east of Black Point Quarry property. Residents in the communities of Fox Island Main, Upper Fox Island along Highway 16, and Half Island Cove, rely on groundwater wells for their potable water, and each house has a private septic system.

A residential well survey was conducted in July and August, 2014 to document the number of dug and drilled wells in the vicinity of the Project site, residential water quality, and water supply aquifer characteristics. This was combined with permeability testing undertaken on boreholes drilled in the granite proposed for aggregate use, and (as noted above) stream water sampling, stream flow measurements, installation of piezometers to evaluate discharge/recharge conditions in site wetlands, additional water samples taken from the granite boreholes and a number of water level measurements in these boreholes. The following sections provide information regarding groundwater conditions at and around the site, and describe the likely effects of the quarry on local groundwater supplies. Additional information regarding groundwater is found in the Hydrogeological Technical Report presented in **Appendix A**.

Regional Groundwater Characteristics

The Nova Scotia Well Logs Database is a compilation of water supply well information provided to the province by licensed well drillers over the past several decades (NSE 2014a). The database typically contains information regarding well construction and lithology (rock types) but may also provide information on aquifer characteristics.

A total of 16 drilled wells are reportedly present within 2.0 km of the property boundaries. Most of these wells are located in Fox Island Main and along Highway 16 and were visited during the residential well survey. This information, combined with the residential well survey, provides a comprehensive data set regarding local water supply. Available data extracted from NSDNR's Interactive Groundwater Map (http://gis4.natr.gov.ns.ca/website/nsgroundwater) from the 16 drilled wells are presented on Table 6.2-4. No well logs data are available regarding dug wells.

Table 6.2-4:
Well Characteristics within Two Kilometres of the Property

Well Number	Address / Community	Depth (m)	Casing (m)	Depth to Bedrock (m)	Static Level (m)	Yield (Lpm)	Elevation (mASL)	Easting	Northing
10497	HALF ISLAND COVE	85.26	6.09	3.96	2.13	1.14	35	639500	5023500
840028	HALF ISLAND COVE	105.66	6.7	3.04	10.66	0.45	35	641188	5022332
840029	HALF ISLAND COVE	46.28	8.22	7.31	18.27	4.54	35	641188	5022332
870892	HALF ISLAND COVE	44.15	15.22	5.18	1.83	13.62	19	640500	5022500
891208	HALF ISLAND COVE	48.72	25.88	5.79	3.5	45.4	19	640500	5022500
980451	HALF ISLAND COVE	60.9	18.27	15.53	12.18	9.08	19	640500	5022500
62059	79 FOX ISLAND ROAD	103.53	7.92	6.09	6.09	1.14	15	648697	5022586
62060	79 FOX ISLAND ROAD	85.26	6.09	2.44	1.52	1.14	15	648690	5022586
62061	2238 HIGHWAY #16	85.26	19.79	18.57	-	-	34	650111	5022018
71270	169 FOX ISLAND ROAD	74.6	6.09	0.91	1.52	2.27	6	648809	5022942
810105	C/O HENRY DOBSON	90.44	6.7	3.35	3.04	4.54	35	641188	5022332
820027		75.46	6.7	3.35	1.22	6.81	33	647717	5022481
921506		38.06	8.83	7.92	6.09	18.16	30	649500	5022500
991271	FOX ISLAND	30.45	12.18	10.66	4.57	11.35	59	649500	5021500
111412	2290 HIGHWAY #16	50.24	18.27	15.83	3.04	13.62	38	649763	5022026
111413	3155 HIGHWAY #16 FOX ISLAND	62.42	15.22	11.88	3.04	22.7	35	644975	5019612
Average		68	12	7.6	5.2	10.4			

Table 6.2-4 indicates that surficial cover over bedrock is generally less than 10 m deep and drilled wells in the area typically range from 40 to 80 m deep (average 68 m). The water table is usually found about 5-6 m below ground surface.

Regionally, drilled well hydraulic characteristics are also reported in the database, for both metamorphic (Goldenville and Halifax Formation) and plutonic (granite) rocks (Table 6.2-5).

Table 6.2-5:
Drilled Groundwater Well Regional Hydraulic Characteristics

Region Name	Median Apparent Transmissivity (m2/day)	Median Q20 (Lpm)	Median Specific Capacity (m3/d/m)	Minimum Apparent Transmissivity (m2/day)	Maximum Apparent Transmissivity (m2/day)	Minimum Q20 (Lpm)	Maximum Q20 (Lpm)	Minimum Specific Capacity (m3/d/m)	Maximum Specific Capacity (m3/d/m)
Metamorphic	1.26	19.75	2.09	0.01	206.2	0.5	1801.11	0.01	448.29
Plutonic	1.43	22.7	2.47	0.06	320	1	1009	0.1	164.09

Similar hydraulic data are available on a regional basis for the surficial aquifer (Table 6.2-6).

Table 6.2-6:
Surficial Deposit Regional Hydraulic Characteristics

Groundwater Region Name	Median Apparent Transmissivity (m2/day)	Median Q20 (Lpm)	Median Specific Capacity (m3/d/m)	Minimum Apparent Transmissivity (m2/day)	Maximum Apparent Transmissivity (m2/day)	Minimum Q20 (Lpm)	Maximum Q20 (Lpm)	Minimum Specific Capacity (m3/d/m)	Maximum Specific Capacity (m3/d/m)
Glaciolacustrine/Till Plains/Colluvial	79.9	113.85	82.1	8.7	262.49	28.2	172.7	11.96	255.59

Both bedrock and surficial aquifers provide sufficient water quantities for residential use. Data from pumping tests completed in 1973 on two nearby wells are also reported from NSDNR's Interactive Groundwater Map Table 6.2-7. One well is located east of the site, at Sea Breeze Campground, and one is located west of the site, at the former Half Island Cove School near Dobson's Lake.

Table 6.2-7:
Pumping Test Data, 1973

Community	Test For	Formation	Depth (m)	Static (m)	Average Rate (m3/d)	Available Draw Down (m)	Max Draw Down (m)	Tapp (m2/d)	SC (m2/d)	Q20 (m3/d)	Q20 (l/min)	Easting	Northing
Fox Island Main	Sea Breeze	Goldenville	48.8	7.6	98.18	32	31.8	2.5	3.01	42.5	29.5	649076	5023051
Half Island Cove	School	Halifax	45.7	3	32.73	33.4	5.5	4.1	5.8	75.3	52.3	641188	5022332

Note: Tapp = apparent transmissivity; SC = specific capacity; Q20 = safe yield (20 year long-term yield)

The data indicate these two bedrock wells have intercepted significant water bearing fractures and are able to provide considerable volumes of water over the long term.

Regional groundwater chemistry for both bedrock and surficial deposits is presented in NSDNR's Interactive Groundwater Map. Table 6.2-8 presents bedrock water chemistry, which is generally based on over 200 water samples in the region. The rock type is reported as "metamorphic" indicating that these data were compiled from wells installed in Goldenville and Halifax Formation rocks, rather than the granite.

Table 6.2-8:
Regional Bedrock and Surficial Aquifer Chemistry

	Groundwater (Bedrock)	Groundwater (Surficial)
HCO3 (mg/L)	63	39
Alk (mg/L)	65	37
Na (mg/L)	17	11
K (mg/L)	1.2	1.5
Ca (mg/L)	22.5	20.3
Mg (mg/L)	3.3	3.7
F (mg/L)	0.17	0.05
SO4 (mg/L)	11	11
Cl (mg/L)	16	18
Hrd (mg/L)	70.5	68.8
TDS (mg/L)	149	153.5
pH	7.7	6.9
NO3 - NO2N (mg/L)	0	0.4
As (ug/L)	1.45	1
U (ug/L)	0.3	0.2
Fe (ug/L)	125	50
Mn (ug/L)	65	13

Regional groundwater quality is similar for many parameters, with the notable exceptions of pH, which tends to be lower in surficial groundwater and metals, which are also lower in surficial aquifers. Bedrock groundwater tends to be “harder”, containing more dissolved minerals and bicarbonate.

In addition, the Interactive Groundwater Map indicates that radionuclide potential is regionally “very likely” in granites and rocks immediately adjacent to granite in this area (i.e., within 1 km), and “likely” outside of this limit. Similarly, arsenic risk is regionally “very likely” throughout the area, from Canso to Queensport and beyond.

Residential Groundwater Characteristics

The objective of the residential well survey was to introduce the Project to residents living nearest to the site, respond to their questions, gather information regarding their well construction and water quality (to the extent this was known), collect water samples and undertake brief drawdown tests where permitted. The residential well survey included all residences at an approximate distance of 2 km west and south of the property, and all residences within about 3.5 km west of the site. This is referred to as “the vicinity of the Project” and includes all residences on Half Island Cove Road to the junction of Half Island Cove Wharf

Road; residences along Highway 16 between Route 316 and Fox Island Main Road; and residences along Fox Island Main Road and Starks Road in the community of Fox Island Main.

Of all the civic addresses visited in the vicinity of the Project, the majority (17 of 23 or 74%) obtain potable water from shallow dug wells excavated in surficial deposits. No surface water streams or lakes are used for potable water. A drilled well is present immediately south of the property boundary on Highway 16, while the remaining five drilled wells are located in Fox Island; three of these five wells are located east of Indian Cove, more than 3 km from the Property boundary. Sampled and non-sampled wells are summarized on Table 6.2-9.

Table 6.2-9:
Nearby Residential Wells

Map and Sample ID	UTM		Well Type	Notes
	Easting	Northing		
HALF ISLAND COVE ROAD AREA				
--	642692	5023616	?	Abandoned trailer
BPRWA002	642231	5023406	Dug	Dug well sample
BPRWA003	642232	5023505	Dug	Dug well sample / pumping test/logger left in unused well
BPRWA001	642088	5023441	Dug	Dug well sample / pumping test
--	642106	5023396	Dug	House is currently unoccupied
BPRWA004/5	642132	5023296	Dug	Dug well sample
--	642030	5023399	NA	Empty lot
--	642025	5023336	Dug	Abandoned trailer
BPRWA006	641731	5023150	Dug	Dug well sample
HIGHWAY 16 / UPPER FOX ISLAND AREA				
BPRWA013	643569	5021658	Dug	Dug well sample
BPRWA008	643589	5021745	Dug	Dug well sample
--	643696	5021694	Dug	Not home during well survey
BPRWA007	644835	5021376	Drilled	Drilled well sample / pump test
--	644710	5021586	Drilled	Drilled well sample - duplicate of above
BPRWA017	646643	5021585	Dug	Dug well sample
BPRWA014	647285	5021794	Dug	Dug well sample
BPRWA015	648538	5022253	Dug	Dug well sample
FOX ISLAND MAIN AREA				
BPRWA009/10	648615	5022586	Drilled	Drilled well sample
--			Dug	Not home during well survey
BPRWA016	648680	5022576	Drilled	Drilled well sample x 2 / pump test
--	648724	5022566	Dug	Not sampled; nearby wells are more representative
--	648782	5022762	Dug	Not home during well survey
--	648776	5022879	Drilled	Not sampled due to distance from site
--	648805	5022958	Drilled	Not home during well survey
BPRWA012	648466	5022724	Dug	Dug well sample
BPRWA011	649335	5023096	Drilled	Drilled well sample

Note: addresses are not given to protect privacy.

A total of 14 water samples (not including duplicates) were taken during the residential well survey. All targeted wells (defined as those closest to property boundary) were sampled, as well as additional well in the immediate vicinity. Samples were collected from 11 dug wells and 3 drilled wells, as shown on Table 6.2-9 above and on **Figure 6.2-3**.

Groundwater quality measured at residential wells is presented in Table 6.2-10.

Table 6.2-10 Residential Groundwater Quality

Sample Name				BPRWA001	BPRWA002	BPRWA003	BPRWA004	BPRWA005	BPRWA006	BPRWA007	BPRWA007_A	BPRWA007_B
			CDWQ	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	DUPLICATE of 004	Dug Well Unfiltered	Drilled Well Unfiltered	Filtered (Dissolved Values)	Unfiltered
Sample Date	**Unit**	**RDL**	**Guideline**	**16-Jul-14**	**16-Jul-14**	**16-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**28-Aug-14**	**28-Aug-14**
Field Parameters												
pH		---	---	6.57	7.52	6.15	6.33	---	6.67	7.53	---	---
Water Temperature	°C	---	---	12.8	15.1	15.7	12.1	---	17.3	12.6	---	---
Conductivity	µS/cm	---	---	140.0	272.0	398.0	108.0	---	257.0	354.0	---	---
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---	---	---
General Chemistry												
pH[4]		n/a	NV	6.76	8.10	6.55	6.36	6.37	6.73	8.17	8.14	8.20
Reactive Silica as SiO2	mg/L	0.5	NV	6.9	9.1	4.6	6.9	6.9	5.7	11.0	10.0	10.0
Chloride	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	NV	37.0	15.0	32.0	12.0	12.0	12.0	14.0	14.0	14.0
Fluoride	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	NV	5.6	6.4	6.5	2.7	2.6	3.1	9.1	9.5	9.7
Alkalinity	mg/L	---	NV	31.0	95.0	30.0	6.4	6.6	17.0	100.0	100.0	100.0
True Color	TCU	50.0	NV	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0
Turbidity	NTU	0.1	NV	0.5	0.34	3.1	0.26	<0.10	0.28	0.82	0.42	0.69
Electrical Conductivity	umho/cm	1.0	NV	190.0	230.0	180.0	67.0	67.0	76.0	250.0	250.0	260.0
Nitrate + Nitrite as N	mg/L	0.05	NV	0.082	<0.050	<0.050	1.2	1.2	<0.050	0.059	0.066	0.065
Nitrate as N	mg/L	0.050	10	0.082	<0.050	<0.050	1.2	1.2	<0.050	0.059	0.066	0.065
Nitrite as N	mg/L	0.01	NV	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	NV	<0.050	<0.050	0.053	<0.050	<0.050	<0.050	<0.050	0.051	<0.050
Total Organic Carbon	mg/L	5.0	NV	0.71	0.56	1.4	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
Ortho-Phosphate as P	mg/L	0.01	NV	<0.010	0.032	<0.010	0.025	0.027	<0.010	0.019	0.019	0.019
Total Sodium	mg/L	100.0	NV	17000.0	9500.0	14000.0	6800.0	6700.0	7000.0	31000.0	33000.0	32000.0
Total Potassium	mg/L	100.0	NV	1300.0	1100.0	5400.0	630.0	680.0	280.0	2300.0	2100.0	2100.0
Total Calcium	mg/L	100.0	NV	11000.0	26000.0	11000.0	2200.0	2200.0	6100.0	15000.0	15000.0	15000.0
Total Magnesium	mg/L	100.0	NV	4000.0	6400.0	2900.0	1600.0	1600.0	1100.0	4500.0	4600.0	4500.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	NV	31.0	94.0	30.0	6.4	6.6	16.0	99.0	99.0	98.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	NV	<1.0	1.1	<1.0	<1.0	<1.0	<1.0	1.4	1.3	1.5
Hydroxide	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Calculated TDS[5]	mg/L	1.0	NV	100.0	130.0	95.0	42.0	42.0	46.0	150.0	150.0	150.0
Hardness	mg/L	1.0	NV	44.0	91.0	39.0	12.0	12.0	20.0	57.0	57.0	57.0
Langelier Index (@ 20C)	NA	---	NV	-2.06	0.128	-2.28	-3.79	-3.76	-2.57	-0.017	-0.049	0.009
Langelier Index (@ 4C)	NA	---	NV	-2.31	-0.122	-2.53	-4.04	-4.01	-2.82	-0.268	-0.299	-0.241
Saturation pH (@ 20C)	NA	---	NV	8.82	7.987	8.83	10.1	10.1	9.3	8.19	8.19	8.19
Saturation pH (@ 4C)	NA	---	NV	9.07	8.22	9.08	10.4	10.4	9.55	8.44	8.44	8.44
Anion Sum	me/L	n/a	NV	1.79	2.47	1.64	0.61	0.61	0.74	2.59	2.59	2.60
Cation Sum	me/L	n/a	NV	1.63	2.26	1.55	0.55	0.55	0.71	2.55	2.62	2.62

Sample Name				BPRWA001	BPRWA002	BPRWA003	BPRWA004	BPRWA005	BPRWA006	BPRWA007	BPRWA007_A	BPRWA007_B
			CDWQ	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	DUPLICATE of 004	Dug Well Unfiltered	Drilled Well Unfiltered	Filtered (Dissolved Values)	Unfiltered
Sample Date	**Unit**	**RDL**	**Guideline**	**16-Jul-14**	**16-Jul-14**	**16-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**28-Aug-14**	**28-Aug-14**
Field Parameters												
% Difference / Ion Balance (NS)	%	n/a	NV	4.68	4.44	2.82	5.17	5.17	2.07	0.78	0.58	0.38
Total Suspended Solids	mg/L	---	NV	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	NV	<100.0	<100.0	<100.0	<100.0	110.0	<100.0	<100.0	<100.0	<100.0
Total Aluminum[3]	ug/L	5.0	NV	33.0	17.0	9.9	16.0	22.0	12.0	11.0	<5.0	5.7
Total Antimony	ug/L	1.0	6	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	10	<1.0	5.1	<1.0	<1.0	<1.0	<1.0	**50**	**46.0**	**48.0**
Total Barium	ug/L	1.0	1000	30.0	52.0	34.0	44.0	44.0	9.5	<1.0	<1.0	<1.0
Total Beryllium	ug/L	1.0	NV	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	5000	<50.0	<50.0	<50.0	<50	<50.0	<50.0	60.0	58.0	59.0
Total Cadmium	ug/L	0.01	5	0.048	<0.010	0.034	0.025	0.022	<0.010	<0.010	<0.010	<0.010
Total Chromium	ug/L	1.0	50	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	1.3
Total Cobalt	ug/L	0.4	NV	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40
Total Copper	ug/L	2.0	NV	38.0	<2.0	160.0	24.0	24.0	180.0	<2.0	<2.0	3.6
Total Iron	ug/L	50.0	NV	160.0	<50.0	1200.0	<50.0	<50.0	92.0	82.0	<50.0	76.0
Total Lead	ug/L	0.5	10	0.64	<0.50	1.9	<0.50	<0.50	8.5	<0.50	<0.50	<0.50
Total Manganese	ug/L	2.0	NV	210.0	22.0	330.0	<2.0	<2.0	2.3	66.0	4.3	65.0
Total Molybdenum	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	7.1	7.3	7.3
Total Nickel	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	2
Total Selenium	ug/L	1.0	10	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	NV	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Strontium	ug/L	2.0	NV	30.0	51.0	52.0	13.0	14.0	25.0	98.0	100.0	100.0
Total Thallium	ug/L	0.1	NV	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Uranium	ug/L	0.1	20	<0.10	0.25	<0.10	<0.10	<0.10	<0.10	<0.10	0.10	<0.10
Total Vanadium	ug/L	2.0	NV	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	NV	11.0	8.0	19.0	8.8	11.0	52.0	15.0	8.1	20.0
Mercury	mg/L	---	NV	---	---	---	---	---	---	---	---	---

NOTES:

NV = no value

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

Sample Name			BPRWA008	BPRWA009	BPRWA010	BPRWA011	BPRWA012	BPRWA013	BPRWA014	BPRWA015[6]	BPRWA016[6]	BPRWA016	BPRWA017
			Dug Well Unfiltered	Drilled Well Unfiltered	DPLICATE of 009	Drilled Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Drilled Well Unfiltered	DUPLICATE of 016 w/out Treat. Sys.	Dug Well Unfiltered
Sample Date	**Unit**	**RDL**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**18-Jul-14**	**22-Jul-14**	**25-Jul-14**	**30-Jul-14**	**31-Jul-14**	**29-Aug-14**	**29-Aug-14**
Field Parameters													
pH		---	6.79	6.56	---	6.28	5.99	6.72	6.62	---	7.46	---	7.68
Water Temperature	°C	---	19.7	12.6	---	14.3	18.9	16.4	17	---	10.7	---	14
Conductivity	µS/cm	---	---	---	---	104.0	260.0	240.0	165.0	---	249.0	---	197.0
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
General Chemistry													
pH[4]		n/a	7.12	6.66	6.80	6.50	5.95	7.68	6.83	7.41	7.37	7.51	7.9
Reactive Silica as SiO2	mg/L	0.5	9.6	4.9	4.9	22.0	8.0	11.0	5.7	13.0	19.0	4.8	11
Chloride	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	16.0	10.0	9.9	21.0	25.0	15.0	9.8	94.0	21.0	40.0	12.0
Fluoride	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	5.1	3.3	3.4	3.9	7.0	5.6	3.9	6.2	12.0	2.9	4.9
Alkalinity	mg/L	---	49.0	15.0	14.0	30.0	10.0	52.0	36.0	100.0	93.0	94.0	99
True Color	TCU	50.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	<5.0	8.2
Turbidity	NTU	0.1	1.2	<0.10	0.54	<0.10	13.0	0.37	0.19	1.2	<0.10	170.0	0.73
Electrical Conductivity	umho/cm	1.0	140.0	75.0	75.0	120.0	120.0	170.0	100.0	490.0	260.0	320.0	230.0
Nitrate + Nitrite as N	mg/L	0.05	<0.050	1.3	1.3	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	0.16
Nitrate as N	mg/L	0.050	<0.050	1.3	1.3	<0.050	0.067	1.1	<0.050	<0.050	<0.050	<0.050	0.16
Nitrite as N	mg/L	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	0.056	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	0.38	<0.050
Total Organic Carbon	mg/L	5.0	60	0.99	1	0.52	1.4	0.64	1.2	0.95	0.79	3.6	0.75
Ortho-Phosphate as P	mg/L	0.01	<0.010	<0.010	<0.010	0.15	<0.010	0.012	<0.010	0.04	0.015	<0.010	0.012
Total Sodium	mg/L	100.0	9900.0	5800.0	5900.0	15000.0	15000.0	7700.0	5800.0	99000.0	57000.0		8200.0
Total Potassium	mg/L	100.0	1200.0	630.0	630.0	1200.0	660.0	930.0	650.0	<100.0	400.0		1800.0
Total Calcium	mg/L	100.0	15000.0	5900.0	6000.0	4200.0	2300.0	18000.0	13000.0	<100.0	<100.0	17000.0	34000.0
Total Magnesium	mg/L	100.0	2500.0	1300.0	1300.0	3400.0	2000.0	4500.0	1200.0	<100.0	<100.0	9500.0	4100.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	49.0	15.0	14.0	30.0	10.0	51.0	36.0	99.0	93.0	94.0	98.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Calculated TDS[5]	mg/L	1.0	89.0	46.0	46.0	89.0	70.0	99.0	62.0	270.0	160.0	170.0	140.0
Hardness	mg/L	1.0	47.0	20.0	20.0	25.0	14.0	64.0	38.0	<1.0	<1.0	82.0	100.0
Langelier Index (@ 20C)	NA	---	-1.36	-2.7	-2.58	-2.73	-4.02	-0.696	-1.81	---	---	-0.65	0.061
Langelier Index (@ 4C)	NA	---	-1.61	-2.96	-2.83	-2.99	-4.27	-0.947	-2.06	---	---	-0.9	-0.188
Saturation pH (@ 20C)	NA	---	8.48	9.36	9.38	9.23	9.97	8.37	8.64	---	---	8.16	7.84
Saturation pH (@ 4C)	NA	---	8.73	9.62	9.63	9.49	10.2	8.62	8.89	---	---	8.41	8.09
Anion Sum	me/L	n/a	1.54	0.74	0.72	1.28	1.07	1.66	1.07	4.78	2.69	3.08	2.44
Cation Sum	me/L	n/a	1.41	0.67	0.68	1.17	1.05	1.63	1.04	4.32	2.48	3.04	2.44

Sample Name			BPRWA008	BPRWA009	BPRWA010	BPRWA011	BPRWA012	BPRWA013	BPRWA014	BPRWA015[6]	BPRWA016[6]	BPRWA016	BPRWA017
			Dug Well Unfiltered	Drilled Well Unfiltered	DPLICATE of 009	Drilled Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Dug Well Unfiltered	Drilled Well Unfiltered	DUPLICATE of 016 w/out Treat. Sys.	Dug Well Unfiltered
Sample Date	**Unit**	**RDL**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**17-Jul-14**	**18-Jul-14**	**22-Jul-14**	**25-Jul-14**	**30-Jul-14**	**31-Jul-14**	**29-Aug-14**	**29-Aug-14**
Field Parameters													
% Difference / Ion Balance (NS)	%	n/a	4.41	4.96	2.86	4.49	0.94	0.91	1.42	5.05	4.06	0.65	0
Total Suspended Solids	mg/L	---	---	---	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	110.0	<100.0	<100.0	280.0	<100.0	<100.0	110.0	<100.0	<100.0	<100.0	<100.0
Total Aluminum[3]	ug/L	5.0	94.0	21.0	21.0	16.0	46.0	15.0	83.0	6.3	6.9	<5.0	20.0
Total Antimony	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	6.6	<1.0	<1.0	<1.0
Total Barium	ug/L	1.0	31.0	1.9	2.0	<1.0	9.0	24.0	7.7	<1.0	<1.0	3.9	19.0
Total Beryllium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	---
Total Bismuth	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	---
Total Boron	ug/L	50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0	<50.0
Total Cadmium	ug/L	0.01	0.022	0.026	0.028	0.044	0.075	0.043	0.036	<0.010	<0.010	<0.010	<0.010
Total Chromium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Cobalt	ug/L	0.4	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	<0.40	0.63	---
Total Copper	ug/L	2.0	150.0	260.0	280.0	51.0	120.0	5.2	8.4	<2.0	2.7	<2.0	<2.0
Total Iron	ug/L	50.0	140.0	<50.0	<50.0	<50.0	2900.0	<50.0	130.0	150.0	<50.0	<50.0	<50.0
Total Lead	ug/L	0.5	<0.50	6.0	7.0	<0.50	2.1	<0.50	0.81	<0.50	<0.50	<0.50	<0.50
Total Manganese	ug/L	2.0	3.3	16.0	13.0	13.0	290.0	<2.0	320.0	<2.0	4.9	1100.0	<2.0
Total Molybdenum	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Nickel	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	6.5	<2.0
Total Selenium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10	<0.10	<0.1	<0.10	<0.10
Total Strontium	ug/L	2.0	33.0	44.0	45.0	24.0	15.0	46.0	29.0	<2.0	<2.0	57.0	93.0
Total Thallium	ug/L	0.1	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Uranium	ug/L	0.1	0.11	<0.10	<0.10	1.20	<0.10	<0.10	<0.10	<0.10	<0.10	<0.10	0.65
Total Vanadium	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	27.0	30.0	28.0	170.0	20.0	20.0	13.0	5.7	12.0	<5.0	<5.0
Mercury	mg/L	---	---	---	---	---	---	---	---	---	---	---	---

NOTES:

NV = no value

Canadian Drinking Water Quality CDWQ Guidelines: Aug 2012

3. Aluminum Aesthetic Objective (CDWQ - AO): Conventional Treatment Plants = 0.1 mg/L (100 ug/L), Other Treatment Systems = 0.2 mg/L (200 ug/L)
4. pH Objective (CDWQ): 6.5 - 8.5
5. Calculated result only includes measured parameters. Actual TDS may be higher.
6. Sample results likely affected by water softner treatment system

BOLD RED Exceeds guideline

Groundwater in the surficial deposits sampled in dug wells is generally high quality, with the only exceedances of the Canadian Drinking Water Quality (CDWQ) guidelines occurring in the aesthetic objective parameters iron, manganese and pH, and a small number of exceedances of the turbidity CDWQ guideline. The groundwater quality in the surficial deposits is indicative of recharge from rainfall having a short residence time in the subsurface, where fewer parameters have time to dissolve in the groundwater.

Groundwater in drilled wells is also generally of good quality with only one or two samples exceeding the aesthetic objectives for manganese and turbidity. Two samples plus a field duplicate from a single residential well[2] demonstrated arsenic concentrations which exceed the CDWQ Guideline. As noted above, the NSDNR Interactive Groundwater Map indicates that elevated arsenic concentrations are common in this region; in fact elevated arsenic in groundwater is well documented in the Goldenville Formation (Dummer *et al*. 2014).

Aggregate Granite Groundwater Characteristics

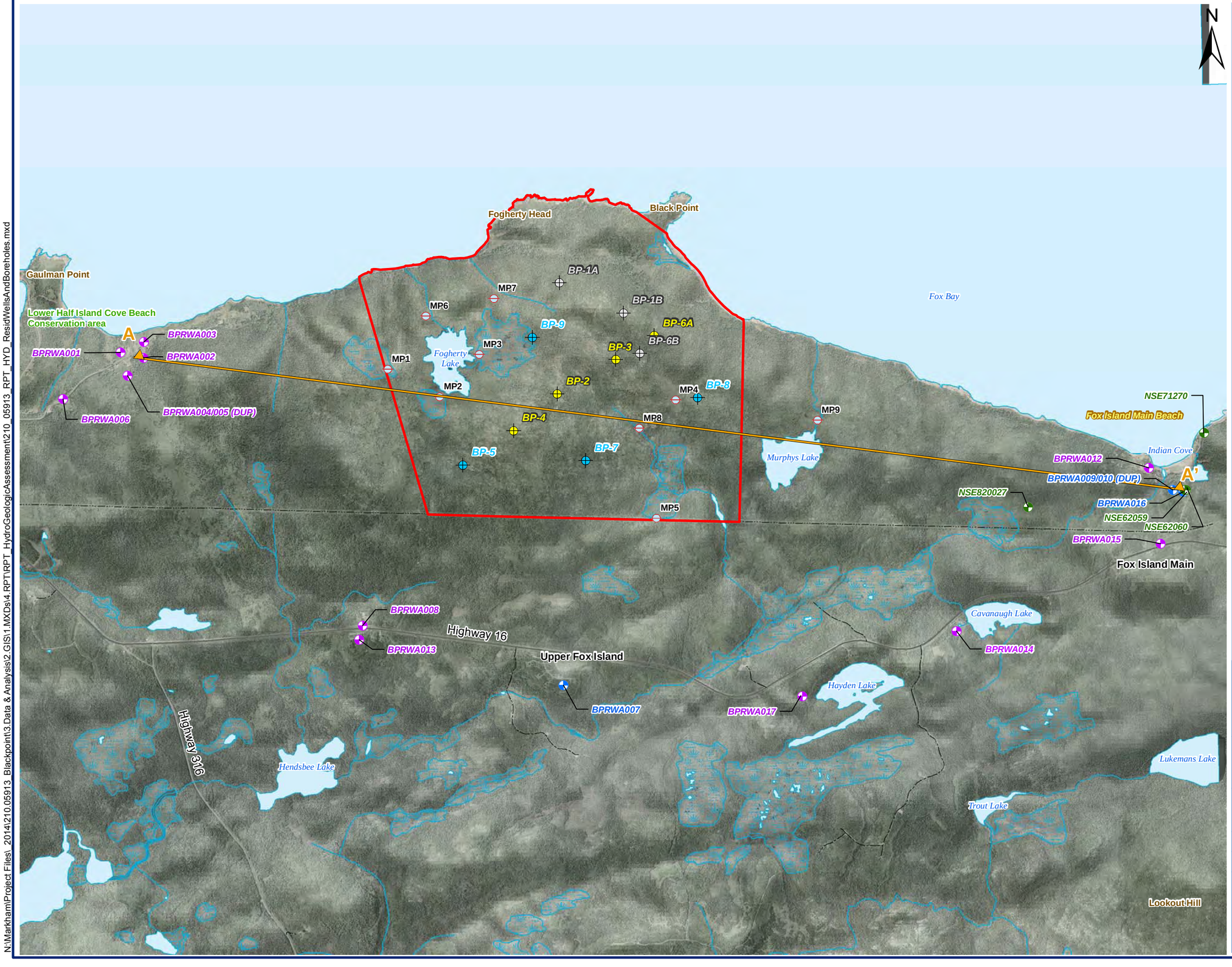
A total of 11 boreholes have been drilled within the granite to sample and asses the rock suitability as an aggregate source. Detailed drill logs describe the lithological and structural attributes encountered in the boreholes. Borehole depths ranged from 56 m to 136 m. Static water levels recorded in 2011 and 2014 are presented in Table 6.2-11.

[2] Address withheld for privacy considerations.

Table 6.2-11:
Static Water Levels

Borehole (Elevation)	Total Depth (m)[1]	Water Level (mbgs)	Water Level Elevation (masl)	Water Level (mTOC)	Water Level (mbgs)	Water Level Elevation (masl)	Water Level (mTOC)	Water Level (mbgs)	Water Level Elevation (masl)	Water Level (mTOC)	Water Level (mbgs)	Water Level Elevation (masl)
		14-Sep-11		5-Jun-14			21-Jul-14			25-Aug-14		
BP-1A (73 m)	100	2.79	70.21	-	-	-	-	-	-	-		
BP-6A (73 m)	56	4.65	68.35	n/a	3.73	69.27	n/a	4.01	68.99	n/a	4.64	68.36
BP-6B (69 m)	70	-	-	-	-	-	-	-	-	-	-	-
BP-1B (74 m)	80	-	-	-	-	-	-	-	-	-	-	-
BP-2 (82 m)	86	2.60	79.40	n/a	2.51	79.49	n/a	2.64	79.36	n/a	2.70	79.30
BP-3 (74 m)	60	3.15	70.85	n/a	3.12	70.88	n/a	3.27	70.73	n/a	3.39	70.61
BP-4 (100 m)	120	3.62	96.38	n/a	2.46	97.54	n/a	3.37	96.63	n/a	4.32	95.68
BP-5 (82 m)	89	2.89	79.11	n/a	2.33	79.67	n/a	2.33	79.67	n/a	3.54	78.46
BP-7 (70 m)	120	Drilled 2014	Drilled 2014	5.56	4.88	65.12		-0.68	70.68	6.37	5.69	64.31
BP-8 (58 m)	108	Drilled 2014	Drilled 2014	5.31	4.61	53.39	5.36	4.66	53.34	5.51	4.81	53.19
BP-9 (79 m)	130	Drilled 2014	Drilled 2014	6.17	5.49	73.51	6.3	5.62	73.38	6.57	5.89	73.11

Notes:
1: Data from boreholes logs;
n/a – not applicable / "-" no information available
masl = meters above sea level / mTOC – meters below top of casing / mgbs – meters below ground surface



LEGEND

- Cross Section A - A'
- Drilled Nova Scotia Environmental Well Location
- SPL_MiniPiezometers
- Drilled Residential Wells
- Dug Residential Wells
- Borehole (Unable to Locate)
- Borehole - Sampled with Water Level Logger
- Borehole Location
- Property Boundary
- Waterbody
- Wetland
- Watercourse
- Utility Line

0 250 500 1,000 Meters

SCALE: 1:22,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

RESIDENTIAL WELL AND BLACK POINT SITE BOREHOLE LOCATIONS

October 23, 2014	Rev 1.0	Figure No. 6.2-3
Project No. 210.05913.00000		

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As described in the Hydrogeological Technical Report (**Appendix A**), the granite bedrock is a crystalline rock with negligible primary porosity. Groundwater movement occurs within the joints and fractures. Analysis of fracture frequency reported in the drill logs indicates that the highest frequency of fractures within the granite occurs in the upper 40 m. Two fault zones were noted in the core logs for BP-8 and BP-9 and depending on their nature may act as preferential pathways or boundaries to groundwater flow. It appears that most groundwater flow occurs in the upper 40 m.

A number of slug and pumping and recovery tests were undertaken on granite core holes BP-5, BP-7, BP-8 and BP-9 (**Appendix A**). Initial slug tests indicated hydraulic conductivities of approximately 6×10^{-7} m/s to 7×10^{-7} m/s, however, later pumping and recovery tests indicated hydraulic conductivities of 2×10^{-7} m/s to 6×10^{-7} m/s. It is considered that the longer pumping and recovery tests give a better idea of the bulk granite properties due to their larger water level changes and radius of influence around the wells.

Groundwater samples were taken from four of the granite boreholes on two occasions. On the first occasion (June), a bailer was used to remove ten bailer volumes (approximately 10 L) of water prior to sampling. On the second occasion (August), an electric pump was used to withdrawn water from the well for approximately one hour before sampling. Field measurements (temperature, electrical conductivity and pH) were measured at 15 minute intervals to determine when to sample; when these parameters stabilized, water samples were taken[3]. Water quality results from both sampling events are presented in Table 6.2-12.

[3] Pumping parameters prior to sampling were: BH-5: 6.3 L/min for 135 min; BH-7: 5.7 L/min for 30 min; BH-8: 3.2 L/min for 135 min; BH-9: 2.6 L/min for 99 minutes.

Table 6.2-12 Granite Borehole Water Quality Results

Sample Name			BPBH05	BPBH05_2	BPBH07	BPB07_2	BPBH08	BPBH08_2	BPBH09	BPBH09_2
Location			Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered
Parameter	**Unit**	**RDL**	**22-Jul-14**	**27-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**
Field Parameters										
pH		---	---	5.6	---	6.9	---	6.4	---	6.9
Water Temperature	°C	---	---	9.2	---	11.4	---	9.5	---	9.6
Conductivity	µS/cm	---	---	38.7	---	83.8	---	80.0	---	118.5
% Dissolved Oxygen	%	---	---	---	---	---	---	---	---	---
Dissolved Oxygen	mg/L	---	---	---	---	---	---	---	---	---
General Chemistry										
pH [4]		n/a	5.05	5.85	6.51	6.82	6.48	6.80	6.70	6.92
Reactive Silica as SiO2	mg/L	0.5	9.6	14.0	18.0	21.0	23.0	24.0	27.0	27.0
Chloride	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Chloride (Cl)	mg/L	1.0	9.3	8.7	11.0	11.0	10.0	9.6	13.0	14.0
Fluoride	mg/L	---	---	---	---	---	---	---	---	---
Sulphate	mg/L	---	---	---	---	---	---	---	---	---
Dissolved Sulphate	mg/L	2.0	<2.0	<2.0	2.9	<2.0	2.8	2.5	<2.0	<2.0
Alkalinity	mg/L	---	<5.0	<5.0	18.0	38.0	29.0	38.0	41.0	54.0
True Color	TCU	50.0	110.0	99.0	210.0	140.0	<5.0	<5.0	62.0	130.0
Turbidity	NTU	0.1	40.0	6.0	19.0	17.0	39.0	3.2	37.0	7.6
Electrical Conductivity	umho/cm	1.0	46.0	55.0	84.0	120.0	92.0	110.0	120.0	140.0
Nitrate + Nitrite as N	mg/L	0.05	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrate as N	mg/L	0.050	0.11	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050	<0.050
Nitrite as N	mg/L	0.01	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010	<0.010
Ammonia as N	mg/L	0.05	0.072	0.060	<0.050	<0.050	<0.050	<0.050	0.15	0.19
Total Organic Carbon	mg/L	5.0	13.0 (1)	7.9	10.0 (1)	9.5	1.4	0.87	5.2 (1)	11.0
Ortho-Phosphate as P	mg/L	0.01	0.013	0.061	0.065	0.041	0.12	0.16	0.14	0.30
Total Sodium	mg/L	100.0	6700.0	6300.0	11000.0	14000.0	12000.0	10000.0	15000.0	17000.0
Total Potassium	mg/L	100.0	1100.0	370.0	2700.0	1900.0	2200.0	880.0	4600.0	4500.0
Total Calcium	mg/L	100.0	740.0	2000.0	3300.0	5900.0	5800.0	6800.0	3400.0	5800.0
Total Magnesium	mg/L	100.0	660.0	750.0	1900.0	2400.0	2300.0	3200.0	1900.0	2500.0
Biarb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	18.0	38.0	29.0	38.0	41.0	54.0
Carb. Alkalinity (as CaCO3)	mg/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Hydroxide	mg/L	---	---	---	---	---	---	---	---	---
Calculated TDS [5]	mg/L	1.0	35.0	33.0	65.0	79.0	83.0	82.0	100.0	110.0
Hardness	mg/L	1.0	4.6	8.0	16.0	25.0	24.0	30.0	16.0	25.0
Langelier Index (@ 20C)	NA	---	---	---	---	-2.16	---	-2.12	---	-1.94
Langelier Index (@ 4C)	NA	---	---	---	---	-2.41	---	-2.37	---	-2.19
Saturation pH (@ 20C)	NA	---	---	---	---	8.98	---	8.92	---	8.86
Saturation pH (@ 4C)	NA	---	---	---	---	9.23	---	9.17	---	9.11
Anion Sum	me/L	n/a	0.27	0.25	0.75	1.07	0.95	1.10	1.21	1.49
Cation Sum	me/L	n/a	0.64	0.46	0.95	1.16	1.28	1.08	1.4	1.56

Sample Name			BPBH05	BPBH05_2	BPBH07	BPB07_2	BPBH08	BPBH08_2	BPBH09	BPBH09_2
Location			Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered	Unfiltered
Parameter	**Unit**	**RDL**	**22-Jul-14**	**27-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**	**23-Jul-14**	**28-Aug-14**
% Difference / Ion Balance (NS)	%	n/a	40.7	29.6	11.8	4.04	14.8	0.92	7.28	2.3
Total Suspended Solids	mg/L	---	---	---	---	---	---	---	---	---
Total Phosphorus as P	mg/L	100.0	340.0	110.0	270.0	<100.0	820.0	200.0	420.0	310.0
Total Aluminum [3]	ug/L	5.0	2900.0	430.0	2700.0	510.0	3000.0	<5.0	1200.0	1000.0
Total Antimony	ug/L	1.0	2.2	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Arsenic	ug/L	1.0	9.5	4.8	39.0	16.0	2.1	1.0	31.0	60.0
Total Barium	ug/L	1.0	15.0	1.5	10.0	3.4	17.0	<1.0	14.0	15.0
Total Beryllium	ug/L	1.0	<1.0	<1.0	1.4	<1.0	<1.0	<1.0	<1.0	<1.0
Total Bismuth	ug/L	2.0	<2.0	<2.0	2.1	<2.0	<2.0	<2.0	<2.0	<2.0
Total Boron	ug/L	50.0	<50.0	<50.0	<50.0	<50.0	<50	<50.0	<50.0	<50.0
Total Cadmium	ug/L	0.01	0.35	0.47	1.8	1.1	0.17	0.074	0.11	0.043
Total Chromium	ug/L	1.0	18.0	<1.0	4.2	<1.0	9.4	<1.0	5.0	<1.0
Total Cobalt	ug/L	0.4	1.7	2.7	11.0	7.2	0.65	<0.40	3.1	1.60
Total Copper	ug/L	2.0	15.0	11.0	130.0	110.0	61.0	<2.0	22.0	11.0
Total Iron	ug/L	50.0	6100.0	290.0	2700.0	350.0	6600.0	<50.0	8200.0	4900.0
Total Lead	ug/L	0.5	7.3	0.71	5.7	0.9	48.0	<0.50	2.6	2.9
Total Manganese	ug/L	2.0	150.0	910.0	400.0	420.0	240.0	1100.0	1400.0	1900.0
Total Molybdenum	ug/L	2.0	3.9	<2.0	13.0	9.5	3.6	<2.0	7.0	14.0
Total Nickel	ug/L	2.0	3.0	<2.0	11.0	11.0	2.7	<2.0	4.9	2.7
Total Selenium	ug/L	1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0	<1.0
Total Silver	ug/L	0.1	73.0	0.64	75.0	6.7	17.0	<0.10	4.5	0.45
Total Strontium	ug/L	2.0	4.7	14.0	22.0	50.0	20.0	23.0	20.0	47.0
Total Thallium	ug/L	0.1	<0.10	<0.10	0.13	<0.10	<0.10	<0.10	<0.10	<0.10
Total Tin	ug/L	2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Titanium	ug/L	2.0	35.0	2.2	59.0	8.0	24.0	<2.0	22.0	18.0
Total Uranium	ug/L	0.1	17.0	47.0	260.0	430.0	14.0	4.2	20.0	37.0
Total Vanadium	ug/L	2.0	2.5	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0
Total Zinc	ug/L	5.0	390.0	130.0	1800.0	710.0	580.0	190.0	1500.0	350.0
Mercury	mg/L	---	---	---	---	---	---	---	---	---

Notes:

NV = no value; "--" = not measured

5. Calculated result only includes measured parameters. Actual TDS may be higher.

In general, groundwater in the granite exhibits elevated concentrations of metals such as aluminium, iron, manganese, lead, arsenic and uranium when compared to surface water samples. The parameter pH was low in two of eight samples (ranging from 5.05 to 5.85), indicating neutral to slightly acidic conditions within the granite. The reported arsenic and uranium concentrations are considered background levels: regional maps prepared by the province indicate that elevated concentrations of arsenic are considered very likely in the area (NSE 2005) and uranium is considered most likely to occur in areas containing granitic intrusions (NSE 2014b). Background uranium concentrations in the granite bedrock are described in Section 6.1.5.

Discharge and Recharge

Nested-pair or single drive point mini-piezometer (MP) pairs are currently in use at nine locations to determine groundwater recharge and discharge on the Property. Five piezometer installations, including piezometers MP1, MP2 and MP5 installed in wetlands, along with streams at locations MP6 and MP8 indicate downward gradients which suggest aquifer recharge is occurring at these locations. Upward vertical gradients measured at wetland areas MP3, MP4 and MP7, along with the stream at MP9 indicate that discharge from the aquifer is occurring at these locations.

6.3 Atmospheric Resources

6.3.1 General Climate and Weather Patterns

The climate of Nova Scotia is generally moderate and moist due to the surrounding bodies of water (Gulf of St. Lawrence to the north, Bay of Fundy to the west, and Atlantic Ocean to the south and east). During the summer, Nova Scotia experiences warm temperatures with winds originating from the south. This is attributed to high pressure systems moving up the Atlantic Coast from the tropics. In the winter westerly and northwesterly winds bring cold air from the northern interior of Canada to Nova Scotia.

Historical climate records were obtained from weather stations near the proposed Project site. The following Meteorological Service of Canada (MSC) weather stations were considered to represent the Project site.

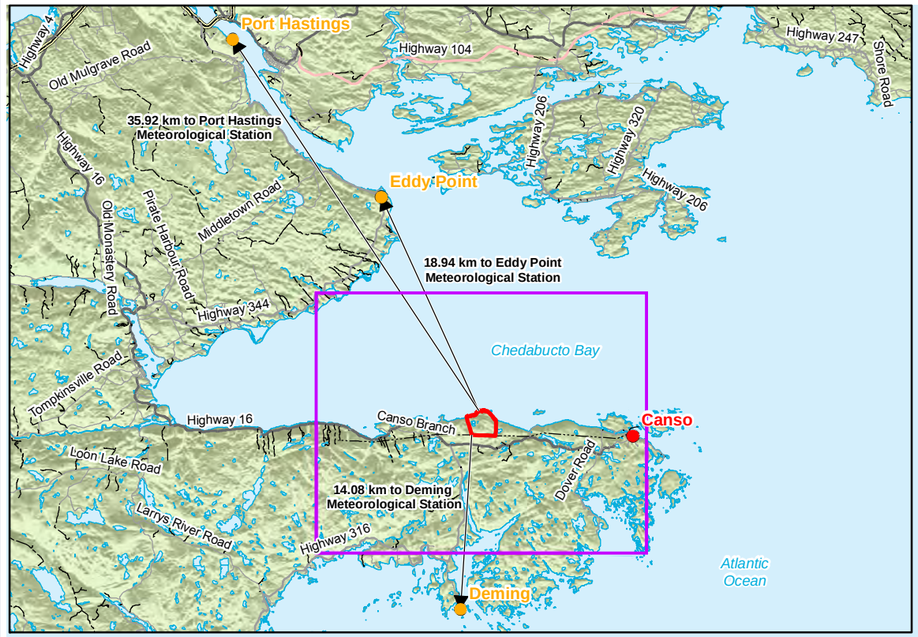
- Deming, N.S. [45°12’59.007”N, 61°10’40.090”W];
- Port Hastings, N.S. [45°38’00.000”N, 61°24’00.000”W];
- Eddy Point, N.S. [45°31'00.000" N, 61°15'00.000" W].

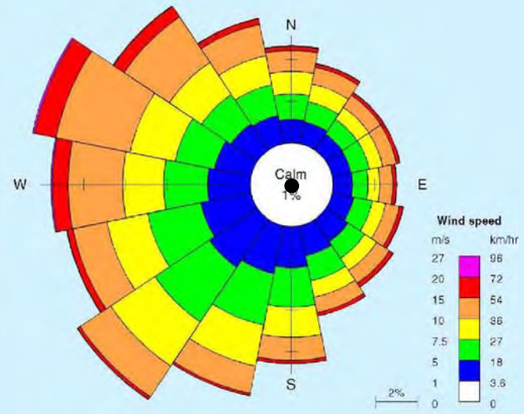
A map of the surrounding area showing the location of each meteorological station is provided as **Figure 6.3-1**. The approximate distance to these stations from the Project site is 19.8 km northwest for Eddy Point, 15 km southwest for Deming Point, and 37 km northwest for Port Hastings. Although the data accumulated from Eddy Point are older, it is more representative of the Project site due to its location on the coast of the Chedabucto Bay. None of these weather stations currently collect climatic data. Table 6.3-1 summarizes climate data collected from these stations.

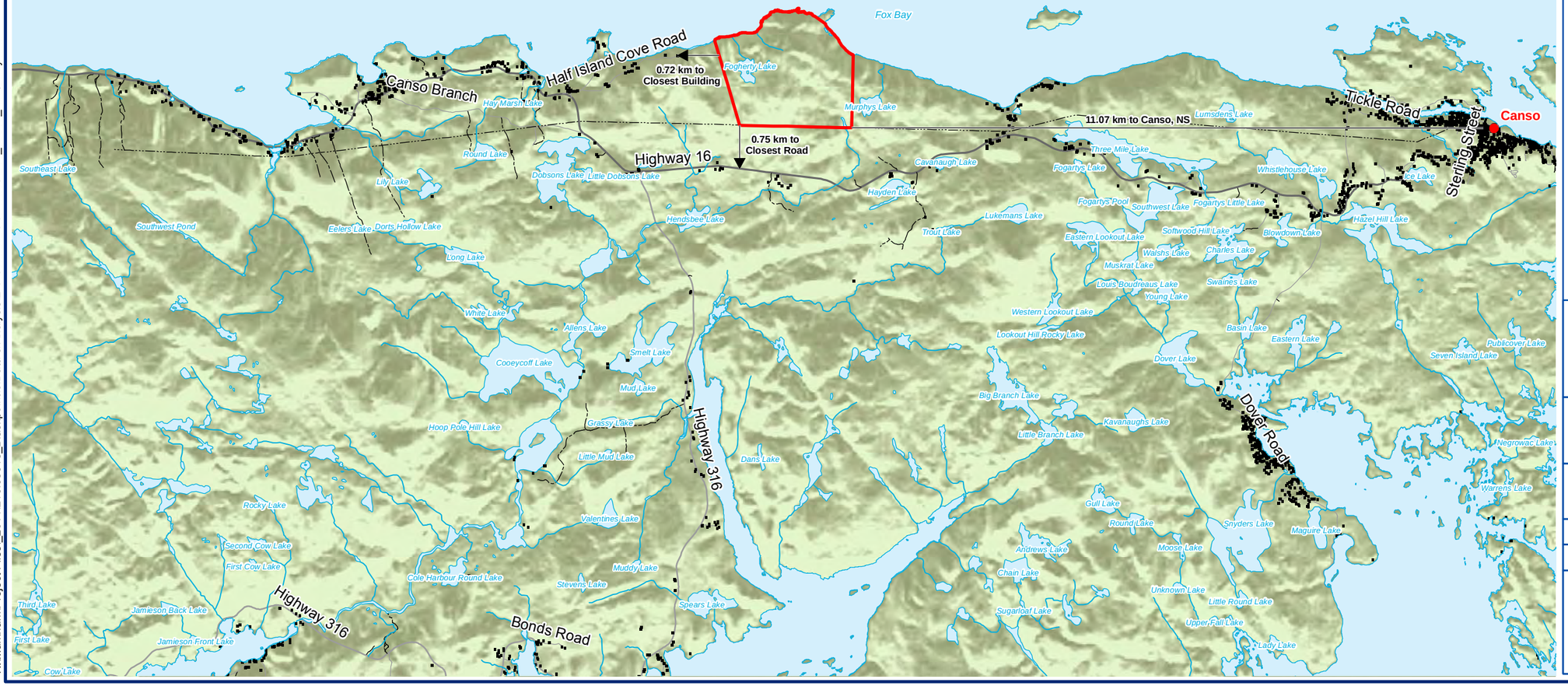
Table 6.3-1:
Climate Near the Project Site

Weather Stations	Eddy Point, N.S. 1951-1980	Deming, N.S. 1981-2010	Port Hastings, N.S. 1971-2000
Coordinates	45°31'00.000" N, 61°15'00.000" W	45°12'59.007"N, 61°10'40.090"W	45°38'00.000"N, 61°24'00.000"W
Elevation	66.10m	15.80m	23.10m
Daily Max Temperature [°C]	9.9	9.1	10.5
Daily Min Temperature [°C]	2.4	3.1	2.2
Daily Mean Temperature [°C]	6.1	6.1 +/- 1.6	6.4 +/- 0.6
Extreme Max Temperature [°C]	33.3	31.1[06/22/1976]	37.2 [07/29/1892]
Extreme Min Temperature [°C]	-25.6	-25 [02/13/1967]	-26.7 [02/03/1897]
Rainfall [mm]	1081.4	1320.8	1357.0
Snow [cm]	279.6	119.7	182.1
Extreme Snow Depth [cm]	---	86 [03/01/1962]	157 [03/17/1987]
Precipitation [mm]	1349.3	1440.5	1538.5
Extreme Daily Snow [cm]	63.0	28.2 [12/28/1977]	63.5 [12/30/1890]
Extreme Daily Rainfall [mm]	78.6	115.6 [11/18/1976]	127.8 [08/30/1968]

Source: EC: Atmospheric Environment Branch, Canadian Climate Normals (EC 2009 and EC 2015).







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LEGEND

- Building
- Annual Wind Rose Data Location (Environment Canada MSC50)
- Meteorological Station
- Populated Place of Interest
- * Distance to Place of Interest
- Property Boundary
- Waterbody
- Watercourse
- Utility Line

* Distances are measured from Air Quality Place of Interest to closest area on Property Boundary

0 0.5 1 2 3 4 Kilometers

SCALE: 1:80,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007; Annual wind rose from CBCL 2010 report. Black Point Quarry Marine Facility: Review of Engineering Study.

VULCAN MATERIALS / MORIEN RESOURCES

Black Point Quarry Project

AIR QUALITY

September 25, 2014	Rev 1.0	Figure No. 6.3-1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

6.3.1.1 *Temperature and Precipitation Normals and Extremes*

It is assumed that the climate normals for Deming, which is 15 km southwest of the Project site, are generally representative of the climate at the Project site. The design of mitigation measures and assessment of impacts are not heavily influenced by slight changes in climate normal, as would be expected from slightly longer data records. Temperature and precipitation normals recorded at the Deming, N.S. weather station are shown in Table 6.3-2. The extreme temperatures (i.e., weather events occurring <5% of the time) recorded by this weather station ranged from -25°C and +31.1°C.

At Eddy Point approximately 20 km northwest of the site, freezing rain and snowfall amounts are highest between the months of October and May, with December through to March are typified by the heaviest precipitation events (EC 2014a). According to monthly totals recorded for the years 1951-1980, Eddy Point typically experiences monthly rainfall amounts ranging from a low of approximately 89 mm to a high of approximately 165 mm, while Deming records from 75 mm to 145.2 mm (1981-2010).

More recent temperature data from the Hart Island station (45°21'00.000" N, 60°59'00.000" W) near Canso, N. S. are presented in Table 6.3-3. This station is located approximately 13.9 km east of the Project site. However, the precipitation data were not available for the Hart Island station.

Table 6.3-2:
Climate Data From Deming, N.S. (1981-2010)

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec	Year
Temperature													
Daily Maximum [°C]	-0.5	-0.9	1.3	5.3	9.7	14.3	17.9	20.2	18.1	12.8	7.6	2.7	9.1
Daily Minimum [°C]	-7.4	-7.3	-4.3	-0.2	3.5	7.9	12.2	14.6	12.2	7.3	2.3	-3.3	3.1
Daily Mean [°C]	-4.0	-4.1	-1.5	2.6	6.6	11.1	15.1	17.4	15.2	10.1	5.0	-0.3	6.1
Extreme Maximum [°C]	10.5	10.0	11.0	20.0	24.0	31.1	30.0	28.5	26.1	21.7	19.4	12.2	
Extreme Minimum [°C]	-25.0	-25.0	-19.0	-11.0	-3.5	-0.6	4.4	4.4	2.0	-4.4	-12.0	-23.5	
Precipitation													
Mean Rainfall (mm)	85.6	75.0	97.6	128.1	116.6	100.4	101.8	100.9	114.8	144.2	142.8	113.0	1320.8
Mean Snowfall (mm)	30.4	28.9	22.4	10.4	0.7	0.0	0.0	0.0	0.0	0.0	5.2	21.6	119.7
Total Precipitation (mm)	116.1	103.9	120.0	138.5	117.3	100.4	101.8	100.9	114.8	144.2	148.0	134.6	1440.5
Extreme Daily Rainfall (mm)	59.7	60.0	87.8	114.0	86.9	55.9	95.0	90.7	103.6	100.2	115.6	67.3	
Extreme Daily Snowfall (mm)	26.0	28.0	22.9	27.9	8.9	0.0	0.0	0.0	0.0	2.5	17.0	28.2	
Extreme Daily Precipitation (mm)	59.7	65.0	87.8	114.0	86.9	55.9	95.0	90.7	103.6	100.2	115.6	67.3	

Source: http://climate.weather.gc.ca/climate_normals/results_1981_2010_e.html?stnID=6336&autofwd=1

Table 6.3-3:
Temperature Data at Hart Island, N.S. 2013

Parameters	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Daily Maximum [°C]	10.4	6.9	7.4	11.1	23	25.8	29.8	23.8	23	19.5	16.7	9.5
Daily Minimum [°C]	-19.9	-16	-10.7	-3.7	0.2	7.1	11.7	12.3	7.7	1.3	-6.1	-15
Daily Mean [°C]	-4.6	-2.5	0.0	3.0	8.2	13.1	19.0	18.2	15.5	10.8	4.9	-1.6

Source: Atmospheric Environment Branch. Canadian Climate Normals 1951-1980**.** (MSC 2002)

6.3.2 Wind Normals and Extremes

Sea breezes, a wind that blows inland from the ocean at typically low wind speeds, are common along coastal regions of the province. This is due to the difference in solar insulation of land and ocean surfaces. As the land and ocean absorbs heat from the sun, warmed air rises from these surfaces which lower the pressure. The air above the surface of the ocean warms more slowly than the land, so air pressure over the ocean is higher than air pressure over the land. Wind will naturally blow from areas of higher surface pressure to lower surface pressure resulting in daytime sea breezes. The reverse can occur at night, but due to the cold coastal waters, these “land breezes” do not typically occur in Nova Scotia. Sea breezes are light in nature and accordingly will only have minimal impact on the quarry and marine facility. In addition, sea breezes, which are most common from May to October, generally come from the southwest and therefore the marine terminal will be in the lee of the land, further reducing the impact from breezes.

During the winter season, the wind typically comes from the west and northwest at an average speed of 22 km/h. In the summer, the wind typically blows from the south and southwest with an average speed of 10-15 km/h (EC 2006a). Chedabucto Bay often experiences easterly gales since the wide entrance to the Bay faces the open ocean in an easterly direction. The average and extreme wind speed and directional values are displayed in Table 6.3-4.

Table 6.3-4:
Wind Statistics, Eddy Point NS.

Month	Average Speed (km/h)	Most Frequent Direction	Extreme Hourly Speed (km/h)	Direction	Extreme Gust Speed (km/h)	Direction
January	19.5	W	70	SSE	97	ENE
February	19.4	NW	64	NNW	106	WNW
March	19.1	NW	77	W	130	SW
April	16.6	NW	71	E	93	E
May	15.6	NW	55	NE	85	S
June	14.1	S	64	SVL	89	NNE
July	13.2	Calm	60	S	87	S
August	12.7	Calm	44	SSW	65	NW
September	14.7	S	50	WNW	89	W
October	16.6	W	64	S	137	S
November	17.9	W	61	W	91	NW
December	19.2	W	69	SSE	93	S
Year	16.6	NW	77	W	137	S

Source: Atmospheric Environment Branch. Canadian Climate Normals 1951-1980. (in JWEL 2004)
Elevation: 66.1 m

The one-hour probabilities of winds exceeding a given speed were calculated for a five year set of recorded data from Eddy Point and are presented in Table 6.3-5 (JWEL 2004).

Table 6.3-5:
Frequency of Wind Speeds at Eddy Point, N.S. Weather Station

Velocity in Knots and (km/h)	Frequency (%)
0.1 (0.2)	99.9
7.6 (14.1)	50.0
16.4 (30.4)	10.0
25.5 (47.3)	1.0
33.0 (61.1)	0.1
40.0 (74.1)	0.01

Source: Atmospheric Environment Branch. Canadian Climate Normals 1951-1980. (MSC 2002)

The MSC50 Environment Canada hourly wind data were also used to characterize the wind conditions for the Project site (CBLC 2010). The annual wind rose and location from the MSC50 data is presented in **Figure 6.3-1**. Note, the MSC50 data is from a wind hindcast model, which generated 54 years of hourly wind direction and intensity from many sources and are not real-time measurements such as those presented above. The MSC50 data is from a single grid point located approximately 6 kilometres northeast of the Project site. This grid point was selected because it was the closest of the six available MSC50 grid points in Chedabucto Bay. It is anticipated that the wind and wave conditions at this grid point will differ somewhat from the conditions along the coastline at the Project site, as it is located towards the middle of Chedabucto Bay. The model showed winds predominantly from the northwest during the winter and fall months and predominantly from the southwest during late spring and summer months.

Data for wind direction and intensity, and wave direction and height, both in percentage and hours per year, are given in Table 6.3-6. These data indicate that winds in excess of 20 m/s (i.e. 72 km/h) were present 0.42% of the year (36.51 hours) when averaged over the past 54 years. Winds in excess of 27 m/s (97 km/h) were not recorded on a yearly basis, when averaged over the past 54 years. Wave heights at the MSC50 grid point near the Project site were less than 2 metres in height 92.77% of the time whereas waves from 2 to 3 metres and 3 to 4 metres were present 5.96% and 1.02% of the time, respectively. Waves in excess of 4 metres were relatively minor and only present over 0.25% of the year on average.

Table 6.3-6 Wind and Wave Direction and Intensity

Wind Direction and Intensity by Percent Occurance

Wind Bin [m/s]		Percent Occurance N	NE	E	SE	S	SW	W	NW	Total in Bin	Exceedence of lower wind limit
27 -	35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20 -	27	0.05	0.04	0.03	0.03	0.01	0.03	0.14	0.08	0.42	0.42
15 -	20	0.42	0.35	0.33	0.37	0.3	0.33	1.47	1.30	4.86	5.28
10 -	15	2.08	1.46	1.28	1.39	2.14	3.32	5.26	5.32	22.26	27.54
7.5 -	10	2.22	1.44	1.18	1.39	2.84	4.72	4.01	3.72	21.52	49.06
5 -	7.5	2.44	1.81	1.61	1.99	3.72	5.94	4.29	3.44	25.24	74.30
1 -	5	2.35	1.88	1.89	2.48	3.84	5.26	4.13	3.07	24.91	99.20
0 -	1	0.07	0.06	0.08	0.09	0.12	0.13	0.13	0.1	0.78	100.00
		9.64	7.05	6.40	7.74	12.96	19.73	19.42	17.04	100.00	

Wind Direction and Intensity by Annual Durations

Wind Bin [m/s]		Hours Per Year N	NE	E	SE	S	SW	W	NW	total in bin	Exceedence of lower wind limit
27 -	35	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
20 -	27	4.49	3.45	2.69	2.58	0.87	2.44	12.67	7.31	36.51	36.51
15 -	20	36.78	31.11	28.58	32.31	26.42	28.75	128.56	113.67	426.18	462.69
10 -	15	182.69	128.13	112.54	121.93	187.29	291.38	460.99	466.67	1951.61	2414.3
7.5 -	10	194.56	126.29	103.65	121.43	249.00	413.59	351.10	326.47	1886.10	4300.40
5 -	7.5	214.03	158.49	141.2	174.63	325.76	520.83	375.85	301.45	2212.32	6512.72
1 -	5	205.98	164.78	165.82	217.32	336.76	461.19	362.36	269.32	2183.54	8696.26
0 -	1	6.22	5.62	6.80	8.09	10.15	11.55	11.18	8.96	68.56	8764.82
		844.75	617.87	561.28	678.30	1136.31	1729.72	1702.72	1493.85	8764.82	

Wave Direction and Height by Percentage Occurance

Hsig Bin [m]		Percent Occurance N	NE	E	SE	S	SW	W	NW	total in bin	Exceedence of lower wave limit
7 -	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 -	7	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5 -	6	0.00	0.00	0.04	0.00	0.00	0.00	0.00	0.00	0.04	0.04
4 -	5	0.00	0.00	0.13	0.03	0.00	0.00	0.00	0.00	0.16	0.21
3 -	4	0.01	0.06	0.53	0.19	0.00	0.00	0.00	0.01	0.81	1.02
2 -	3	0.15	0.35	1.94	0.98	0.12	0.12	0.70	0.58	4.94	5.96
1 -	2	2.64	2.93	5.19	4.57	1.51	2.62	5.52	6.06	31.05	37.01
0.5 -	1	1.81	2.32	5.23	6.93	3.73	4.75	6.85	2.75	34.36	71.38
0 -	0.5	0.33	0.54	5.06	11.83	7.28	1.34	1.77	0.47	28.62	100.00
	total	4.93	6.21	18.13	24.53	12.65	8.84	14.84	9.87	100.00	

Wave Direction and Height by Annual Durations

Hsig Bin [m]		Hours Per Year N	NE	E	SE	S	SW	W	NW	total in bin	Exceedence of lower wave limit
7 -	8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
6 -	7	0.00	0.00	0.25	0.00	0.00	0.00	0.00	0.00	0.25	0.25
5 -	6	0.00	0.00	3.44	0.11	0.00	0.00	0.00	0.00	3.55	3.80
4 -	5	0.00	0.25	11.60	2.56	0.00	0.00	0.00	0.00	14.42	18.22
3 -	4	0.49	5.36	46.87	17.07	0.25	0.18	0.35	0.53	71.11	89.33
2 -	3	13.33	30.93	169.69	85.62	10.78	10.82	61.31	50.64	433.10	522.43
1 -	2	231.20	256.83	455.03	400.92	132.73	230.11	483.65	531.65	2722.11	3244.54
0.5 -	1	158.33	203.60	458.56	607.14	327.38	416.16	600.32	240.94	3012.42	6256.96
0 -	0.5	28.53	47.64	443.99	1037.08	638.01	117.54	154.87	41.22	2508.88	8765.84
	total	431.87	544.61	1589.43	2150.50	1109.15	774.81	1300.49	864.97	8765.84	

6.3.3 Adverse Weather

The Atlantic coast of Nova Scotia and the south coast of Newfoundland experience more storms over the course of one year than any other region in Canada (EC 2006a). These storms bring high winds along the coast, heavy precipitation, storm surges exceeding 1.0 m, freezing rain, and peak waves nearing 14 meters in height (EC 2006a). The winds that affect the coast and mainland Nova Scotia can exceed 150 km/h, and may result in extreme wind chills during the winter. Additionally, Nova Scotia can experience reduced visibility due to precipitation events and fog, as well as blizzards and ice storms in the winter.

Nova Scotia lies within the limit of the Atlantic Hurricane system. Hurricanes tend to develop within or east of the Caribbean Sea with many storms moving up the eastern seaboard. There have been 19 Atlantic hurricanes that have made landfall in Nova Scotia over the past 100 years (Environment Canada 2014d). Of these, 16 were Category 1 storms with wind speeds from 119 to 153 km/h and three were Category 2 intensity with wind speeds from 154 to 177 km/h. In the past 100 years there have been no storms reaching Category 3, 4 or 5 intensities. In addition, over the past 100 years there have been 19 tropical storms (wind speeds from 63 – 118 km/h) that have made landfall in Nova Scotia. The potential impacts on Nova Scotia, especially in coastal regions including the Project site in Chedabucto Bay where these storms may make landfall, are high winds, storm surges and heavy rainfall. Additional information regarding the impacts of severe weather, including climate change effects, is presented in Section 8 Effects of the Environment on the Project.

The majority of Atlantic hurricanes and tropical storms that move up the eastern seaboard dissipate or are significantly attenuated as they come into contact with the cold waters off the northeastern coast of Canada and the United States. The resulting impact on coastal regions of Nova Scotia is heavy tidal swells and high waves. The peak hurricane season in Nova Scotia usually falls between September and October. It should be noted however that hurricanes have been landing in Nova Scotia more frequently as of late, including Hurricane Juan in 2003, and can develop outside the September – October period (Wightman 2012).

Given its position extending into the Atlantic Ocean, Nova Scotia, especially coastal regions, experiences a considerable number of fog days, typically in the spring to early summer. Halifax International Airport has 122 days/yr with at least 1 hour of fog, largely due to the chilled air above the Labrador Current mixing with the moist warm air from the Gulf Stream. Coupled with sea breezes, these bands of fog that lie off the coast of Nova Scotia during the daytime hours have a tendency to move inland into the bays and inlets at night. The nearest station to the Project site monitoring this data is near Canso. Canso is approximately 12 km from the Project site and is an appropriate representation of conditions at the Project site because both locations are along the southern coast of the Chedabucto Bay. Canso experiences 115 days/yr of at least 1 hour of fog cover (EC 2006a).

Fog, ice fog, freezing fog, precipitation and other severe weather can pose a serious threat or risk to marine vessels in the proposed Black Point area. The monthly average number of occurrences with adverse weather that were monitored at South Side Harbour Station near Canso, N.S. is presented in Table 6.3-7 (Farmzone 2014).

Table 6.3-7:
Adverse Weather Events at South Side Harbour, N.S. Over Last 30 Years

Days With	Jan	Feb	Mar	Apr	May	Jun	July	Aug	Sept	Oct	Nov	Dec
Freezing Rain / Freezing Drizzle	5	3	2	2	0	0	0	0	0	0	1	1
Thunderstorms	0	0	0	0	0	0	1	0	0	0	0	0
Hail	0	0	0	0	0	0	0	0	0	0	0	0
Fog, Ice Fog, Freezing Fog	Data Unavailable											
Haze or Smoke	Data Unavailable											
Blowing Dust	Data Unavailable											
Blowing Snow	Data Unavailable											

Source: Farmzone 2014. The Weather Network 2014. Adverse Weather for Canso, N.S.

Note: Fog Forms, Haze/Smoke, and Blowing Dust/Snow were not recorded over the 30 years that data were collected from the South Side Harbour Station in Canso, N.S. However, 115 days of fog persisting for at least 1 hour were recorded in Canso, N.S. in 2013 (EC 2006a).

On the coastline of Chedabucto Bay, visibility can often be reduced to one-half nautical mile twelve months of the year. However, reduced visibility attributed to dense fog is much more likely in the late spring and early summer (July being the month with the most fog) when the warm air from the south flows over the cold coastal waters of the Atlantic Ocean. By early fall in Nova Scotia, with contributions from cool dry air and elevated ocean temperatures, the fog dramatically decreases. During the winter season, poor visibility occurs less than 10 percent of the time and can often be attributed to snow or heavy rain.

A further concern for ships travelling into and out of Chedabucto Bay is the build-up of ice on the ship or any other structures, including the shoreline (“shorefast ice”) due to freezing spray. Freezing spray occurs when ocean spray (as a result from increased winds, heavy seas and even the motion of the vessel) spreads over the ship and freezes on point of contact. The typical seasonal range for freezing spray occurs between November and April; however it is highest in February (JWEL 2004).

North westerly or northerly winds generally contribute to freezing spray. When the strong, cold winds are persistent from the northwest, fall and winter temperatures in Nova Scotia can plummet. When air temperatures drop below the freezing point of salt water, i.e. –2°C or lower, freezing spray conditions in seawater can exist.

6.3.4 Regional Ambient Air Quality

6.3.4.1 *Overview*

Air quality in this region is generally good and the pollutant levels meet national and provincial quality standards and objectives. This can be largely attributed to its small population, small industrial base, and climatic conditions that provide excellent dispersion of air contaminants (NSE 1998). The ambient air quality also benefits from the mixture of relatively clean polar and Arctic air masses. However, on some occasions, there has been a tendency for the long-range transport of air masses, originating in central Canada and the eastern seaboard, to enter into the Nova Scotia area and cause poor air quality conditions. (EC 2014b). Historically, these air

masses have imported gaseous sulphur compounds responsible for acid rain, which has caused considerable degradation to the Province's surface water resources.

The Air Quality Health Index (AQHI) is measured for Halifax, Sydney, Kentville, Greenwood, Pictou, and Port Hawkesbury. The AQHI measures the current levels of outdoor air pollution and related human health risks using a scale of 1 to 10 representing low to very high risk levels. Three air pollutants are measured in order to calculate the AQHI and include ground-level ozone (O3), particulate matter less than 10-micron in diameter (PM2.5) and nitrogen dioxide (NO2). The closest monitoring station to the Project site is Port Hawkesbury and the current air quality levels can be viewed online at the Nova Scotia Environment website at www.airhealth.ca.

The Project site is located in a rural setting with little industrial development; the closest industrial development is in Port Hawkesbury approximately 40 km east of the Black Point property. Industrial sites that reside within a 50 km radius include: the Pacific West Paper Mill, Point Tupper Generating Station, ExxonMobil Point Tupper Fractionation Plant, NuStar Terminals hydrocarbon trans-shipping facility and the Goldboro (LNG) gas plant. There is also several mineral extraction and shipping facilities within 50 km of the Project site, including the Martin Marrietta aggregate quarry and marine facility and the Georgia Pacific gypsum load-out facility, both located along the Canso Strait. Aside from this, there are no other anthropogenic sources within 100 km that could negatively affect the ambient air quality.

6.3.5 Ambient Air Quality Standards

Nova Scotia Department of the Environment (NSE) has set maximum permissible ground level concentrations for ambient air quality in the province of Nova Scotia (Table 6.3-8).

Table 6.3-8:
NS Ambient Air Quality Standards

Contaminant	Averaging Period	Maximum Permissible Ground Level Concentration	
		(µg/m³)	(pphm)
Carbon Monoxide (CO)	1 hour	34,600	3,000
	8 hours	12,700	1,100
Hydrogen Sulphide (H_2S)	1 hour	42	3
	24 hours	8	0.6
Nitrogen Dioxide (NO_2)	1 hour	400	21
	Annual	100	5
Ozone (O_3)	1 hour	160	8.2
Sulphur Dioxide (SO_2)	1 hour	900	34
	24 hours	300	11
	Annual	60	2
Total Suspended Particulate (TSP)	24 hours	120	-
	Annual	70	-

Source: Nova Scotia *Air Quality Regulations*, Schedule A.

In 2012, provincial jurisdictions agreed to the implementation of a new air quality management program. The new Canadian Ambient Air Quality Standards (CAAQS) are authorized as new objectives under the Canadian Environmental Protection Act, 1999 (CEPA) and replace the current Canada Wide Air Quality Standards under CCME (2000). Currently, standards for particulate matter less than 2.5-micron in diameter (PM2.5) and ground-level ozone (O3) have been developed. CEPA is currently working on baseline standards for nitrogen dioxide (NO2) and sulfur dioxide (SO2). The CAAQS are voluntary objectives. Table 6.3-9 details the new air quality standards for PM2.5 and ozone to be established by 2015 and 2020.

Table 6.3-9:
Canadian Ambient Air Quality Standards for $PM_{2.5}$ and Ozone

Pollutant	Averaging Time	Standard 2015	Standard 2020
$PM_{2.5}$	24- Hour	28 µg/m³	27 µg/m³
	Annual	10 µg/m³	8.8 µg/m³
Ozone	8-hr	63 ppb	62 ppb

Source: CCME, 2010

6.3.6 Regional Air Quality Baseline

Ambient air quality in Nova Scotia is monitored using a network of 13 sites operated by NSE and Environment Canada through the National Air Pollution Surveillance (NAPS) Network. Motor vehicles, electrical power generation, and pulp and paper processing are the major local sources of air pollutants in the province. Common air pollutants monitored regularly are sulphur dioxide (SO_2), total particulate matter (TPM), PM2.5, particulate matter less than 10 microns in diameter (PM10), carbon monoxide (CO), O_3, and NO_2. There is no air quality monitoring station

in Black Point. The closest NSE monitoring site to the Project site is located in Port Hawkesbury at the old Post Office, approximately 38 km from the site.

The province had an ambient air monitoring station running in the Port Hawkesbury/Point Tupper area, which measured the concentrations of SO_2, Hydrogen Sulphide (H_2S), and TSP. The measured values at these sites were published in 1993 and are presented in Table 6.3-10. The most recent data available for this monitoring station were from a report published by Environmental Canada in August 2013. According to this report, the SO2 concentrations at the Post Office site were 231 ppb (1-hour max) and 41 ppb (24-hour max) in 2007 (EC 2013a). The proposed Project area, being very much undeveloped, would probably have better air quality and thus less airborne emissions compared to Point Tupper due to Point Tupper's proximity to local industry.

Table 6.3-10:
Ambient Air Quality at Nearest Monitoring Stations

	1-Hour Max Concentration	24-Hour Max Concentration	Annual Mean Concentration	Total Number of Exceedances of 1-Hour N.S. Standard
Sulphur Dioxide (SO_2)				
Point Tupper (1993)	538 ppb	196 ppb	8.0 ppb	10
Old Post Office (1993)	100 ppb	23 ppb	4.0 ppb	Not Available
Hydrogen Sulphide (H_2S)				
Point Tupper (1993)	61.8 ppb	16.6 ppb	0.7 ppb	9
Particulate Matter 2.5 microns (PM2.5)				
Port Hawkesbury (2013)	Not Available	Not Available	6 ug/m^3	Not Available
Nitrogen Dioxide (NO2)				
Port Hawkesbury (2013)	Not Available	Not Available	9.4 ug/m^3	Not Available
Total Suspended Particulate (TSP)				
Point Tupper (1993)	Not Available	60 µg/m^3	23 µg/m^3	2
Old Post Office (1993)	Not Available	55 µg/m^3	25 µg/m^3	Not Available

Source: NSDOE 1994 Ambient Air Quality in Nova Scotia (Point Tupper and Old Post Office); Environment Canada 2013 National Air Pollutant Surveillance (NAPS) Monitoring Results 2013 (Port Hawkesbury).

Based on the information above, background concentrations of criteria air pollutants are most likely not exceeding current provincial and national standards at the proposed Black Point Quarry site.

6.3.7 Ambient Noise (Terrestrial and Marine)

The existing terrestrial noise environment has been determined by measurement at two representative geographic locations (one inland, and one nearer the coast). The locations are the residential receptors located nearest to the Property boundary. Noise data were recorded in A-weighted decibels (dBA) and reported in three categories:

1. as equivalent continuous noise level (L_{eq}),

2. as the noise level exceeded for 10% of the time (L_{10}), which is used to give an indication of the upper limit of fluctuating noise, such as that from road traffic; and

3. as the noise level exceeded 90% of the time (L_{90}). This last parameter is generally taken to be the ambient or background noise level.

At both locations, measurements were collected over 1-hour intervals. This data have been collated to report results over the daytime (7am to 7pm), evening (7pm to11pm), and night-time (11pm to 7am) periods. Time periods corresponding to wind speeds greater than 20 km/h or periods of precipitation have not been included in the summary analysis. The results are summarised in Table 6.3.11.

Table 6.3-11:
Measured Ambient Noise Levels

Location	Time Period	Sound Level (dBA)		
		L_{eq}	L_{90}	L_{10}
Location #1 Coastal Half Island Cove Road	Daytime (7am to 7pm)	38.3	27.1	43.2
	Evening (7pm to 11pm)	31.7	28.9	34.4
	Night-time (11pm to 7am)	33.1	28.2	37.0
Location #2 Inland Eagle Valley Road	Daytime (7am to 7pm)	51.0	24.2	56.3
	Evening (7pm to 11pm)	48.9	25.8	53.9
	Night-time (11pm to 7am)	42.1	24.3	35.8

As is expected for a remote rural environment, existing L_{90} background noise levels are very low, below 30 dBA in all time periods at both locations. At each location, little temporal variation was observed in background noise levels throughout the daytime, evening and night-time. The location near the coast had slightly higher background noise levels than the inland location. However, the L_{eq} (or average) noise levels were higher at the inland location, probably due to the influence of road traffic noise.

At the measurement location west of the Project site near the coast, the dominant noise sources noted were natural, including waves, birds, and the movement of leaves. At the location further inland traffic noise from the road was observed, in addition to natural noise sources.

Ambient underwater noise levels in the Project area have not been measured. While there are no existing localised anthropogenic sources, underwater noise can propagate over large distances. For this reason, both natural and anthropogenic sources may contribute to the existing underwater noise environment. Natural underwater noise sources include wind, waves, precipitation, sea ice, marine fauna, and seismic background activity. Anthropogenic noise sources include commercial fishing, shipping, seismic exploration activity, sonar equipment, construction and industrial activity, and distant explosive detonations. Whether natural or anthropogenic sources dominate in the Project area at any particular time and location depends on changing natural conditions, and the proximity and level of the human activities.

Appendix D (Noise and Vibration Technical Report) provides a more detailed description of the existing ambient noise environment. This report also explains the technical terminology used to describe noise levels.

6.3.8 Ambient Light

Given its remote location, there are no existing data sources for summarizing the current light levels in the vicinity of the Project. The Project site is it not easily accessible and so transitory ambient light sources from vehicles are rare (from the occasional ATV) to non-existent. Given this, ambient light levels are expected to be minimal and typical of an undeveloped rural area.

The largest artificial light sources in the Project area are the nearest residences on Half Island Cove Road and in Fox Island Main, and vehicle traffic along Highway 16. Additional light originates from passing and anchored ships, which are visible from the shore of the Property. Estimates indicate that 500 – 600 ships traverse Chedabucto Bay annually, not including fishing and recreational vessels (G. Freer, pers. comm. 2014).

6.4 Terrestrial Environment

The description of the terrestrial environment includes habitat, vegetation and wildlife found in the Project site and nearby areas. It also includes birds observed in the marine areas adjacent to the Project site.

Between 2010 and 2014 a number of desk top reviews and field surveys were conducted within the Project area to gather field data for a description of the existing terrestrial environment. The work was carried out in particular to:

- Describe existing habitats and develop a habitat map;
- Confirm, identify, and describe significant habitats including wetlands;
- Delineate and functionally assess wetlands in Project Study Area;
- Identify high potential habitats for rare vascular plant species;
- Determine likely lichen habitat, conduct a rare lichen survey, and evaluated existing habitats for their potential to support rare lichen species;
- Identify and describe indications of previous disturbance; and
- Record (opportunistic) wildlife sightings.

Table 6.4-1 provides a summary of the various terrestrial environment baseline field surveys.

Table 6.4-1:
Terrestrial Environment Baseline Field Surveys

Ecological Component	Type of Survey and Information Collected	Survey Date
Vascular Plants	Included species at risk (SAR)/species of conservation concern (SOCC); Compiled vascular plant species list for entire Project site	June 2010; August 2010; August 2014
Lichens	Focused surveys for Species at Risk (SAR)/species of conservation concern (SOCC)	June 2010; August 2014
Birds	Compiled species lists including passerine migration, early and late breeding birds, raptors (owls), early and late shorebird migrants	April 2010; May 2010; June 2010; August 2010; September 2010 January 2011
Mammals	Moose fall rut surveys; general mammal surveys were conducted in conjunction with other taxonomic groups	Targeted survey in September 2014; casual observation as part of various surveys listed in this table

Ecological Component	Type of Survey and Information Collected	Survey Date
Wetlands	Wetland delineations, habitat assessments and functional assessments	August 2010; July 2011; August 2014
Herpetiles	Surveys conducted in conjunction with other taxonomic groups	Part of various surveys listed in this table
Odonates	Compiled lists of species utilizing Project site	June/July 2010; August 2010

Field surveys were supplemented by a review of existing information from various information sources including Species of Conservation Concern (SOCC) databases, federal and provincial government departments and agencies, non- profit groups, internet websites, existing reports and knowledgeable individuals. Specific sources utilized include:

- Atlantic Canada Conservation Data Centre (ACCDC);
- NSDNR;
- NSE;
- NSMNH;
- Canadian Wildlife Service (CWS)/ EC; and
- Other sources as indicated where applicable.

6.4.1 Terrestrial Habitat and Vegetation

The following description of existing terrestrial habitat at the Black Point Project Area is based on observations during field surveys conducted in June 2010, August 2010 and August 2014 as well as compiled data from existing sources.

Ecological Land Classification (ELC) links the abiotic and biotic components of each ecosystem. Climate, landform, and soil influence the distribution of vegetation (NSDNR 2003). ELC therefore provides information on the factors that influence habitats present at the Project site. The site is located in the Acadian Forest Ecozone, the Atlantic Coastal Ecoregion (Ecoregion 8) and the Eastern Shore Ecodistrict (Ecodistrict # 820) (NSDNR 2006). Ecodistrict 820 has an annual precipitation of 1426 mm, a growing season of 195 days, a mean annual temperature of 5.8°C, a mean summer temperature of 14.8°C and a mean winter temp of -3.7°C (NSDNR 2003).

Large portions of the District 820 are covered with forest. The presence of the Atlantic Ocean has more influence on the forests in this ecodistrict than the soils, geology or landform. The ocean provides a consistent coastal climate, resulting in the absence of Red Spruce (*Picea rubens*), Sugar Maple (*Acer saccharum*), White Pine (*Pinus strobus*) and American Beech (*Fagus grandifolia*) in coastal forests. Coastal forest is typically dominated by Balsam Fir (*Abies balsamea*), Black Spruce (*Picea mariana*) and scattered White Spruce. The coastal forests are short lived and usually exist less than 100 years, but the moist climate is conducive to natural regeneration. Typically, most stands of Balsam Fir and Black Spruce have already developed a layer of regeneration while the overstorey breaks up. The influence of the ocean extends inland until it reaches the 60 m contour. Therefore, the Project site is influenced by the ocean (NSDNR 2003).

The Black Point Quarry Project Area encompasses two Ecosections (NSDNR 2006). Ecosection WCKK applies to the western section of the Project Area as well as the northern boundary between the Atlantic coast and the steep cliff. The central and eastern portion of the

Area is classified as Ecosection WCHO. Descriptions of the climatic, geographic and ecological conditions such as disturbance patterns associated with this classification can be found in NSDNR (2003). Ecosections describe the more permanent physical features of topographic patterns, soil texture and soil drainage (NSDNR 2003). Ecosection WCKK indicates well drained, coarse textured soil on hilly terrain. Ecosection WCHO indicates well drained, coarse textured soil on hummocky terrain (NSDNR 2006).

Study Method

In preparation for the vascular plant field surveys, maps of existing habitat were assembled, indicating streams, wetlands and habitats including forest types. A priority species list was prepared prior to conducting field work in order to help guide the plant surveys by identifying plant species at risk /conservation concern potentially present on the site. In order to prepare this priority list an ACCDC data search was obtained to identify any plant species at risk/conservation concern previously identified within 100 km radius of the site.

Surveys within the Project site focused on habitats suitable for potential vascular plant species at risk. Habitats with high potential for species at risk include freshwater and marine wetlands, as well as floodplains of streams and rivers. Forest habitats, except forests in flood plains, are estimated to have medium to low potential for rare vascular plants. Surveys for rare vascular plants were timed to cover both early and late phenology. Further details regarding survey methods and photos are provided in **Appendix E**.

6.4.1.1 *Habitat Survey Results*

Forest inventory mapping available from NSDNR is based on aerial photography and satellite data. For Guysborough East, which includes the Black Point Quarry site, the mapping used the aerial photography from 1990 to 1998, satellite data last obtained 1999-2002, and treatment data from 2003. The current Forest Inventory Map (NSDNR 2007/2012) was reviewed (NSDNR 2013) and supplemented with field data to prepare a terrestrial habitat map of the Project Area (Figure 6.4-1).

The majority of the Project site consists of a mix of coniferous forest and open/shrub barren vegetation. Vegetation on the Project site remains relatively unaltered with the exception of a few property cut lines, ATV trails and skidder tracks (constructed for underground exploratory testing). A number of treed and open bogs are located on the site while other wetland types present include fen, swamp and marsh. Mixed forests are uncommon but occur in patches on the main portion of the site.

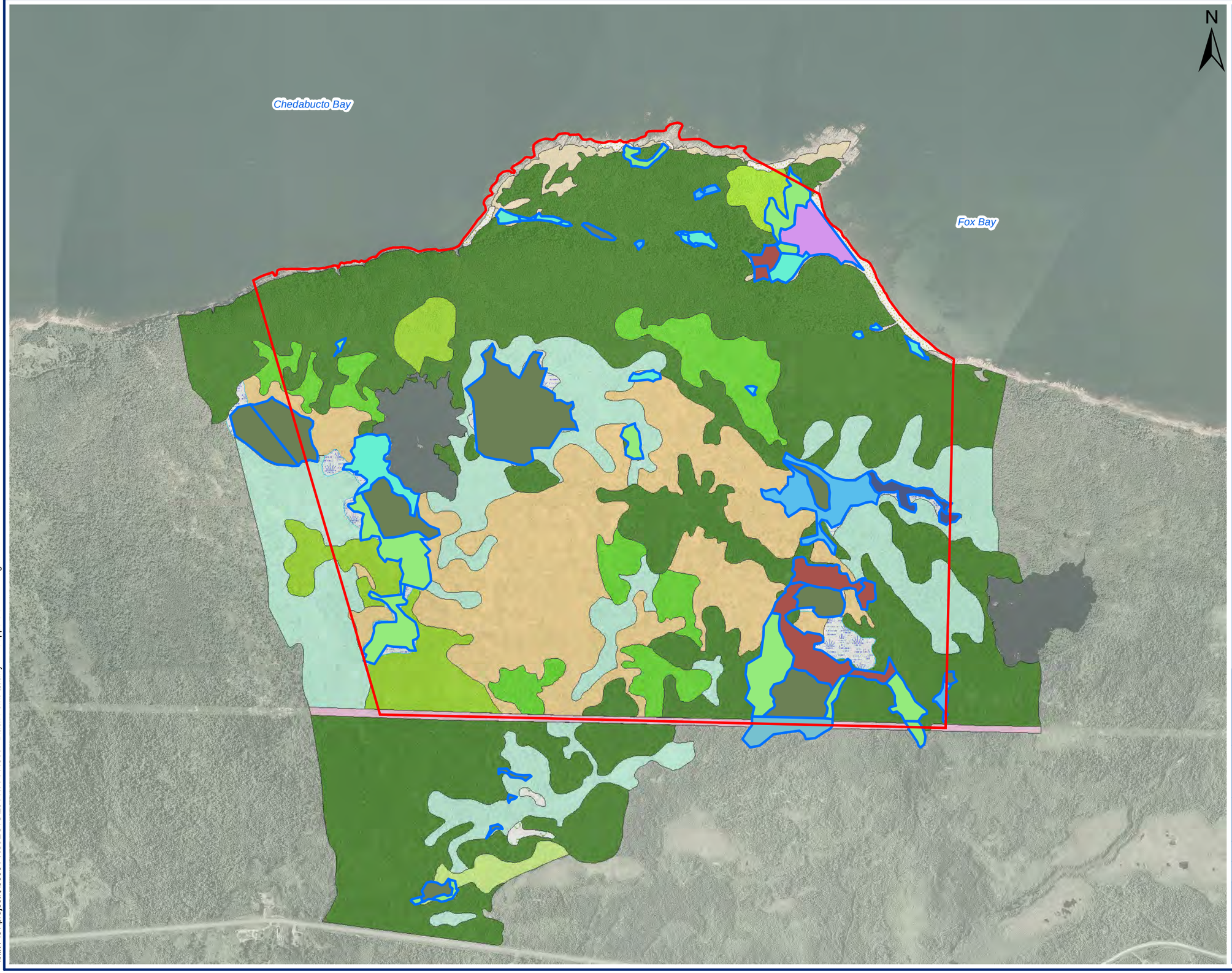
A steep cliff is located near the north end of the Study Area which separates the northern portion from the rest of the Project site. Coniferous forest dominates the cliff and lower north end of the site while a disturbed regenerating forest was also noted in this area as well as a number of wetlands (fen, marsh and bog types). Habitat located immediately adjacent to the coast includes low shrub coastal barrens, rock cliffs, and cobble/boulder/sand beaches.

The following description of habitat is based on the most frequent plant species observed in 2014, and tree size where applicable. Seven habitat types and plant communities were identified, including one category of wetlands, containing several wetland classes. The habitat types are summarized in Table 6.4-2. Photos depicting habitat types are provided in **Appendix E**. Photos of wetlands are also provided in the separate wetland survey report (**Appendix F**). A

delineation of habitat types in the Black Point Study Area is shown on Figure 6.4-1 as well as Figure 6.4-2. The individual types are described in more detail below.

Table 6.4-2:
Habitat Types - Definitions and Summaries

Picture #	Type	Definition and Summaries
2-1; 2-2	Natural Stand: Coniferous Forest	Forest stands composed of more than 75% coniferous (softwood) trees. In the Project footprint, the trees in these polygons are more mature than the trees in "young coniferous forest". Dominated by Black Spruce and Balsam Fir, mature or nearing maturity, with tree diameters for Balsam Fir and Black Spruce from about 15 cm diameter at breast height (dbh[3]) to 20 cm and occasionally 30 cm dbh; Red Maple and Heartleaf Birch (*Betula cordifolia*) are few and up to 20-30 cm dbh.
2-6	Tall Shrubs	At the Project site, tall shrubs with an estimated height of around 2 m, dominated by Huckleberry, Mountain Holly and Pin Cherry. NSDNR categorized this area as "brush", which is defined as any area containing less than 25% merchantable tree cover and contains non-merchantable woody plants consisting of at least 25% cover.
	Young Coniferous Forest	Areas of re-growth, most often following forestry activity, and other disturbance. Dominated by young trees (saplings) with occasional patches of shrubs (often Mountain Holly (*Nemopanthus mucronatus*), Witherod (*Viburnum nudum*) or alders (*Alnus incana*)). Older regenerating forest[5] is dominated by young Balsam Fir with an estimated height of 6-10 m.
2-10	Riparian	Habitat along watercourses. In the Project footprint, there is little such habitat. Long stretches of streams have no real floodplain, possibly due to the steep gradient of the terrain.
2-4 ;2-5	Barren	Any area of less than 25% live tree cover containing "ericaceous" vegetation with less than 50% rock out crops and/ or boulder cover and less than 50% other woody plant cover. Area dry and firm in summer. Indicator plants: Bearberry (*Arctostaphylos uva-ursi*), Rhodora (*Rhododendron canadense*), Blueberry (*Vaccinium* sp.), Huckleberry (*Gaylussacia* sp.) and Lambkill (*Kalmia angustifolia*).
2-7	Natural Stand: Mixed Forest	Forest stands composed mostly of Balsam Fir, White Birch, Red Maple, and Black Spruce.
See Appendix F	Fresh Water Wetlands	"Any wet area not identified as a lake, river or stream". Encompasses the wetland classes: fen, marsh, swamp, and open water; definition extended to include wetland class bog.



LEGEND

- Site Boundary

Terrestrial Habitats

- Wetland
- Coniferous Forest
- Open Coniferous Forest
- Open Mixed Forest
- Regenerating Coniferous Forest
- Regenerating Forest
- Bog
- Coastal Barren
- Open Barren
- Shrub Barren
- Sand Gravel Beach
- Powerline Transmission Corridor

DelineatedWetlands

- Bog
- Fen
- Forested Swamp
- Fresh Marsh
- Shrub Bog
- Shrub Fen
- Shrub Swamp
- Treed Bog

0 125 250 500 Meters

SCALE: 1:12,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

BLACK POINT TERRESTRIAL HABITATS

September 24, 2014	Rev 1.0	Figure No. 6.4-1
Project No. 210.05913.00000		

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Coniferous Forest

Coniferous forest is a forest dominated by coniferous trees (greater than 75%). The dominant tree species is Balsam Fir and Black Spruce (occasionally White Spruce closer to the coast). A few Mountain Ash (*Sorbus* sp.), Heart-leaf Birch and Red Maple are scattered throughout. The coniferous forest can be more or less open, resulting in various light conditions. The ground cover is dominated by feather mosses with up to 95% cover (e.g., *Hylocomium splendens*, *Pleurozium shreberi*); other mosses including *Dicranum* sp., *Ptilidium crispa- castrensis*, and occasionally peatmoss (*Sphagnum* sp.) occur. Sparse patches of terricolous lichens (such as reindeer lichen and related species (*Cladonia rangiferina (Cladonia sp. / Cladina* sp., C. *maxima*) are found infrequently. Herbaceous plants such as Bunchberry (*Cornus canadensis*), Sarsaparilla (*Aralia nudicaulis*), Starflower (*Trientalis borealis*), Twin Flower (*Linnaea borealis*), Canada Mayflower (*Maianthemum canadensis*) Goldthread (*Coptis trifolia*), Common Wood Sorrel (*Oxalis montana*) and ferns (e.g., *Dryopteris* sp., *D. felix femina*, or Bracken (*Pteridium aquilinium*), and in damp areas occasionally Cinnamon Fern (*Osmunda cinnamomea*)) are sparse.

Sheep Laurel (*Kalmia angustifolia),* blueberries (*Vaccinium* sp.), and seedlings or saplings of trees and Witherod contribute to a sparse low shrub stratum. Standing and fallen woody debris occur in many areas. Some patches of open coniferous forest can also have a well developed layer of low shrubs, mostly Lambkill, as well as herbaceous plants and mosses. Local relief in coniferous forests on the Site is generally hummocky.

Young (Regenerating) Coniferous Forest

This habitat type encompasses both younger and older regenerating forests. Regenerating forests are areas of re-growth, usually following apparent clear-cut harvesting or other disturbances. These young forests consist of dense stands or young trees dominated by young trees (seedlings, saplings) and shrubs (often Mountain Holly, Witherod, or Alders). Balsam Fir is the dominant tree species, accompanied by spruce (Black Spruce with some White Spruce), and scattered Heart-leaf Birch, Red Maple, and Mountain Ash. Herbaceous ground vegetation is often sparse due to the density of the woody vegetation. Ground cover consists of patches of conifer needles or patches of feather mosses with bunchberry where there is more. This habitat type is primarily located in the northern end of the Study Area, southwest of Wetland 2 (WL2).

Tall Shrub Habitat

Tall shrub habitat is dominated by tall Huckleberry, Mountain Holly and Witherod, scattered alders and occasionally Rhodora, with scattered tree saplings (Balsam Fir, Black Spruce, Red Maple, Mountain Ash, Heart-leaf Birch). The shrubs are an estimated 2 m or more high, and the tree saplings reach an estimated 4 to 6 m height. Ground cover consists of mosses (e.g., peatmoss (*Sphagnum* sp.) and others such as *Dicranum* sp.), ferns (*Dryopteris* sp., bracken, occasionally Ladyfern (*Dryopteris filix- femina*)), Bunchberry and scattered Sarsaparilla. Low shrubs in the understorey are sparse: Lambkill and Velvet-leafed Blueberry (*Vaccinium myrtilloides*) occur, and occasionally Labrador Tea (*Rhododendron groenlandicum*) and Huckleberry. A few scattered larger trees can be found, e.g., Black Spruce, Larch (*Larix laracina*) Balsam Fir or Heart-leaf Birch with a diameter at breast height (dbh) of an estimated 15 to 20 cm. Tall shrub habitat is located throughout the Study Area however it is the dominant habitat in the central portion.

Barren

Much of the Project Site is dominated by low barren vegetation. This habitat type can either be dominated by shrub species such as huckleberry (*Gaylussacia baccata*), late low blueberry and common juniper (*Juniperus communis*) growing to heights of less than one metre. Other forms of this habitat type are dominated by black crowberry mats growing over rocks. This type of barren is typically located closer to the coast (on headlands), but can occur inland over bedrock outcrops.

Riparian

Riparian habitats are found along the small watercourses throughout the Study Area. There is little such habitat within the Study Area where long stretches of streams have no real floodplain, possibly due to the steep gradient of the terrain and the small size of the streams. Consequently, species composition is often similar to the surrounding habitats. A few submergent aquatic vascular plants such as Burreed (*Sparganium* sp.) were found, e.g., in Wetland 1. A stretch of well- developed riparian habitat was found along the un-named streams associated with Wetland 1 and Wetland 14. These areas are dominated by a thick Sphagnum ground layer, Cinnamon Fern, Balsam Fir and Black Spruce.

Mixed Forest

Mixed forest patches are scattered throughout the Project site. These areas are dominated by canopy species such as red maple (*Acer rubrum*), heart-leaved paper birch (*Betula papyrifera var. cordifolia*), balsam fir, and understorey species including lambkill, late low blueberry, twinflower, bunchberry, starflower and wild sarsaparilla (*Aralia nudicaulis*). This habitat type is generally located in the southern end of the Project Site but does occur in patches closer to the coast.

Fresh Water Wetlands

Twenty-two freshwater wetlands were detected during the surveys in August 2010, July 2011 and September 2014. Wetland types encountered within the Project Site include open/treed bogs, fens, and treed/shrub swamps. Wetlands surveyed within the Project Area are described in more detail below in Section 6.4.2 and in the 2014 Wetland Baseline Survey Report (**Appendix F**).

Other Habitat

In addition to the vegetation as described above, the following plant communities were noted during the course of the field surveys. The ocean shoreline vegetation is typical of marine shores and includes Beach Pea, Sea Rocket (*Cakile edentula*), Oysterleaf (*Mertensia maritima*), Seaside Plantain, Scotch Lovage, and Sea Lavender. Seaweeds (*Fucus sp., Ascophyllum sp*.) are attached to the rocks in the intertidal and subtidal zone.

6.4.1.2 *Plant and Lichen Species of Conservation Concern (SOCC)*

A total of 189 vascular plant species were recorded during the field surveys conducted in 2010 and 2014. A complete list of plant species recorded for the site is provided in **Appendix E**. No

plant species listed by the Species At Risk Act (SARA) or the Nova Scotia Endangered Species Act (NSESA) was recorded during the field surveys. Two plant species of conservation concern were recorded. Plant and lichen Species at Risk (SAR) and species of conservation concern are discussed further in Section 6.7.

One vascular plant species of conservation concern was detected on the Project site during the June 2010 surveys. Southern Twayblade (*Listera australis)* has an ACCDC rarity rank of S2. This species was encountered along two streams located within the Project Area. One location contained over 40 individuals within a relatively small area whereas only one individual was found at the second location. An additional plant species of conservation concern, Northern Comandra (*Geocaulon lividum* – ACCDC rank S3) was detected during the August 2014 field survey. This species was noted in Wetland 18 (WL18) in the open bog portion of this wetland. Numerous individuals were reported throughout this wetland.

Lichen surveys were conducted within the Project Site in June 2010 and August 2014. A list of species recorded and methodologies are discussed in **Appendix E**. Three lichen species of conservation concern were noted during the 2014 surveys and include: Black-footed Reindeer Lichen (*Cladonia stygia*: ACCDC S2S3; Canadian General Status rank 3), Naked Kidney Lichen (*Nephroma bellum*: ACCDC S3?; Canadian General Status rank 3) and Coastal Bushy Beard Lichen (*Usnea flammea*: ACCDC S2S3; Canadian General Status rank 3). In addition, Angelhair Ramalina Lichen *Ramalina thrausta*, detected in 2010, is still considered a species of conservation concern, with a General Status rank of 3.

6.4.1.3 *Indications of Past Disturbance*

As discussed above, the majority of the Project site is in a natural state with little evidence of disturbance, except for past clearing on the lower platform where homesteading occurred. Some vegetation cutting has occurred to clear property boundaries and a small number of ATV trails are present on site. Recently a number of skidder trails have been cleared to allow a drill rig access to various test pit locations throughout the site for underground exploratory purposes. There is also some evidence of past tree clearing (indicated by remaining stumps) in various portions of the site.

6.4.2 Wetlands

6.4.2.1 *Study Methods*

Several definitions of “wetland” exist in literature:

- Lands that are seasonally or permanently covered by shallow water, including lands where the water table is at or close to the surface. The presence of abundant water causes the formation of hydric soils and favours the dominance of either hydrophytic or water-tolerant plants. The five major types of wetlands are: marshes, swamps, bogs, fens and shallow open waters (EC 2013b).
- A wetland is land “where the water table is at, near, or above the surface or which is saturated for a long enough period to promote such features as wet-altered soils and water tolerant vegetation” (EC 1996).
- A wetland is land that is “saturated with water long enough to promote wetland or aquatic processes as indicated by poorly drained soils, hydrophytic (i.e., water-loving) vegetation and various kinds of biological activity which are adapted to a wet environment” (GC 1991).

- Wetlands are areas of "marsh, fen, peatland or water, whether natural or artificial, permanent or temporary, with water that is static or flowing, fresh, brackish or salt, including areas of marine water the depth of which at low tide does not exceed six metres" (United Nations Educational, Scientific and Cultural Organization (UNESCO) 1987).

Although each definition is slightly different, the relevant common aspects adopted for the purpose of this report that define a wetland are:

- Land that is saturated or covered by water for some time during the growing season;
- Poorly drained soils; and
- Predominantly hydrophytic vegetation.

Following this definition, wetland determinations were based on the following three criteria:

- Majority of dominant vegetation species are wetland associated species;
- Hydrologic conditions exist that result in periods of flooding, ponding, or saturation during the growing season; and
- Hydric soils are present.

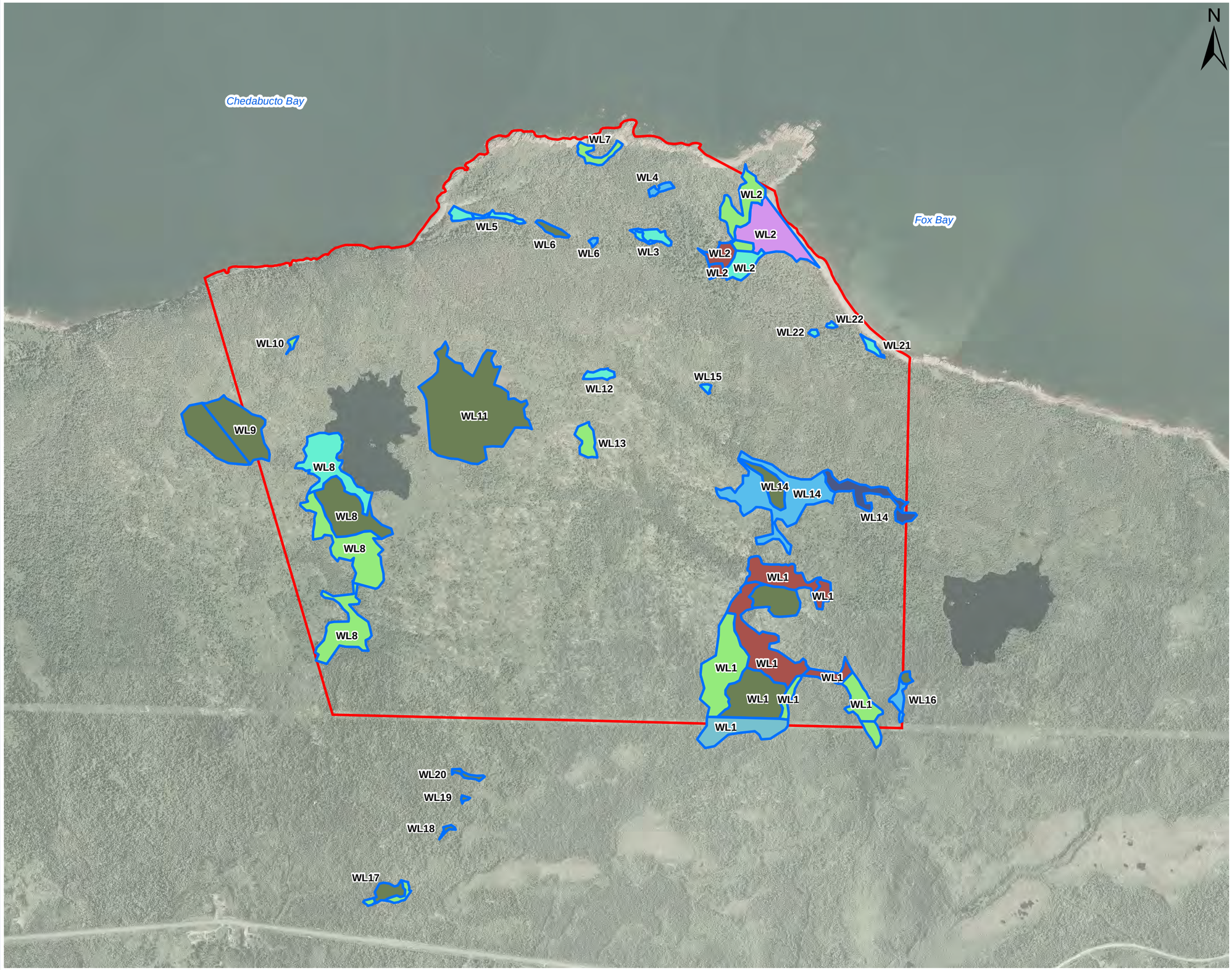
A combination of desktop review and field work was utilized to identify and assess wetland habitat occurring within and/or adjacent to the Project area. Wetland delineations were conducted according to standard methodologies approved by NSE (NSE 2014c). The determination of wetland habitat in the field was based largely on the Corps of Engineers Wetland Delineation Manual (the Manual) (Environmental Laboratory 1987) and the Regional Supplement to the Corps of Engineers Wetland Delineation Manual (US Army Corps of Engineers (USACE), 2012). Functional assessments were conducted using the NovaWET method which has been developed by NSE for the purpose of assessing wetland functions in NS. A field report is presented in **Appendix F** which provides further details related to the methodologies used to delineate and assess all wetlands identified as well as detailed results of the wetland study.

6.4.2.2 *Wetland Survey Results*

A total of 22 wetlands were identified within the Project footprint and/or determined to be hydrologically connected downstream (Figure 6.4-2 and Table 6.4-3). 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. Other wetland types identified include swamp and marsh as well as complexes including a combination of a number of these wetland types. The total area of wetland habitat identified within the Project Study Area is approximately 57 ha.

Ten (10) of the 22 wetlands surveyed were found to occur directly within the proposed footprint of the Pit, Fill Areas and Plant Location (WL1, WL3 – WL6 and WL11-WL15 inclusive in Table 6.4-3). Four (4) wetlands surveyed were also found to occur within the proposed footprint of the access road (WL12- WL20 inclusive). Seven (7) wetlands surveyed (WL7-WL10, WL16, WL21 and WL2) were found to occur outside the proposed footprint of all Project components however these wetlands may be indirectly impacted by the project and as such were included in the surveys. Complete wetland delineation, habitat assessments and functional assessments were conducted for all 22 wetlands surveyed.

Table 6.4-3 provides a summary of all wetlands assessed along with their general characteristics and corresponding coordinates (UTM Zone 20, NAD 83).



LEGEND

Site Boundary

DelineatedWetlands

- Bog
- Fen
- Forested Swamp
- Fresh Marsh
- Shrub Bog
- Shrub Fen
- Shrub Swamp
- Treed Bog

0 125 250 500 Meters

SCALE: 1:12,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

BLACK POINT WETLAND HABITAT

September 24, 2014	Rev **1.0**	Figure No. **6.4-2**
Project No. 210.05913.00000		

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Table 6.4-3:
Wetland Locations and Characterizations

Wetland #	Coordinates		Type	Size (ha)	Landscape Position	Water Flow Path	Landform
	Easting	Northing					
1	645437	5022529	Bog/Swamp Complex	16.5	Lotic Stream	Throughflow	Basin
2	645430	5024058	Fen/Swamp/ Marsh Complex	6	Lotic Pond	Inflow	Basin
3	645076	5024059	Riparian Fen	0.5	Lotic Stream	Throughflow	Slope
4	645076	5024059	Bog	0.2	Terrene	Isolated	Basin
5	644431	5024129	Riparian Fen	0.5	Lotic Stream	Throughflow	Slope
6	644737	5024077	Bog	0.3	Terrene	Outflow	Basin
7	644845	5024349	Riparian Treed Swamp	0.5	Lotic Stream	Throughflow	Slope
8	644009	5023134	Swamp/Bog/Fen Complex	10.3	Lotic Stream	Throughflow	Flat
9	643617	5023397	Bog	4.6	Terrene	Isolated	Flat
10	643857	5023694	Riparian Treed Swamp	0.1	Lotic Stream	Throughflow	Slope
11	644458	5023456	Bog	9.0	Terrene	Isolated	Flat
12	644737	5024077	Bog/Fen Complex	0.3	Terrene	Outflow	Basin
13	644860	5023362	Treed Swamp	0.6	Terrene	Isolated	Slope
14	645506	5023190	Fen/Bog Complex	6.2	Lotic Stream	Throughflow	Slope
15	645265	5023544	Riparian Fen	0.07	Lotic Stream	Throughflow	Slope
16	645920	5022505	Bog	0.45	Terrene	Isolated	Basin
17	644193	5021827	Bog/Swamp Complex	0.74	Terrene	Outflow	Basin
18	644396	5022050	Bog	0.07	Terrene	Isolated	Basin
19	644440	5022148	Bog	0.04	Terrene	Isolated	Basin
20	644447	5022225	Bog	0.15	Terrene	Isolated	Basin
21	645820	5023684	Fen	0.19	Lotic Stream	Inflow	Slope
22	645630	5023728	Riparian Fen	0.1	Lotic Stream	Throughflow	Slope
Total Wetland Area (ha)				57.3			

The functional assessments conducted for the 22 wetlands located within the Project site determined that the overall watershed condition within which these wetlands are located is in a relatively unaltered state with wetland habitat covering approximately 11% of the total land area of the watershed. The buffer area surrounding these wetlands is fully vegetated and relatively unaltered providing high quality wildlife habitat and water quality functions. All wetlands assessed were determined to provide high floristic quality where the plant community is composed of native species characteristic of the wetland type with a very minor component of non-native species. Table 6.4-4 presents a summary of the various significant functions for which each wetland was assessed to provide (see **Appendix F** for more details regarding the functional assessments).

Table 6.4-4:
Wetland Functional Assessment Summary

Significant Function	WL1	WL2	WL3	WL4	WL5	WL6	WL7	WL8	WL9	WL10	WL11	WL12	WL13	WL14	WL15	WL16	WL17	WL18	WL19	WL20	WL21	WL22
SF1-Watershed condition (H-Significantly modified, M-Modified, L-Relatively unaltered)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF2-Proportion of WL area in watershed & opportunity for floodwater detention (H,M,L)	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
SF3-Rate the general wetland condition/integrity (H,M,L)	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF4-Rate the overall condition and integrity land adjacent to wetland (H,M,L)	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
SF5-Is the WL a WSS? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF6-Does the WL support commercial/recreational fish/shellfish? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
**SF7-Species of concern (Fed/Prov)? Specify.*	S2	N	N	N	N	N	N	S2	N	S3	S2	S2	N	N	N	N	S2	S2,S3	S2	S2	N	N
SF8-Wetland has conservation/ compensation agreements/activity? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF9-Wetland is calcerous fen, black ash or cedar swamp? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF10-Within Drinking Water Protected Area (designated watershed/wellfield) (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF11-WL within a floodplain and upstream of or within of a populated area? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF12-Fed/Prov/Municipal area of interest? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF13-WL hydrologic condition	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT	NAT
SF14-WL important for maintaining stream flow? (Y/N)	Y	N	Y	N	N	Y	N	Y	N	N	N	N	N	Y	N	N	Y	N	N	N	N	N
SF15-WL ability to detain surface water (H,M,L)	M	H	M	M	M	M	M	M	M	M	M	M	M	H	M	M	H	M	M	M	M	M

Significant Function	WL1	WL2	WL3	WL4	WL5	WL6	WL7	WL8	WL9	WL10	WL11	WL12	WL13	WL14	WL15	WL16	WL17	WL18	WL19	WL20	WL21	WL22
SF16-Wetland improves water quality? (Y/N)	Y	Y	Y	N	N	Y	Y	Y	N	Y	N	N	N	Y	Y	N	Y	N	N	N	Y	Y
SF17-Evidence of excess nutrient loading/ contamination? (H,M,L)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF18-WL contributes to water quality in downstream resources (H,M,L)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
SF19-WL serves as a recharge site (Y/N)	N	N	N	N	N	N	N	N	Y	N	Y	N	N	N	N	Y	N	Y	Y	Y	N	N
SF20-WL serves as a discharge site (Y/N)	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
SF21-WL ability to stabilize shoreline (H,M,L)	M	H	L	L	L	L	M	M	L	M	L	L	L	M	M	L	L	L	L	L	L	M
SF22-Is the plant community unique or rare regionally or provincially? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF23-Does the WL contain a diversity of plant communities (H,M,L)	H	H	L	L	M	L	L	H	M	L	M	L	L	M	L	L	M	M	M	M	L	L
SF24-Rate the overall integrity/quality of plant community? (H,M,L)	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H	H
**SF25-Are there any observed rare or endangered plant species? Specify.*	S2	N	N	N	N	N	N	S2	N	S3	S2	S2	N	N	N	N	S2	S2,S3	S2	S2	N	N
SF26-Does wetland support fish/fish habitat? (Y/N)	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
**SF27-Rare or endangered fish/wildlife species found in the wetland?*	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N	N
SF28-Overall fish and wildlife habitat quality (H,M,L)	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M	M
SF29-Rate the wetland's community use/ value (H,M,L)	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L

Notes:

* SF7/SF25/SF27 is considered a red rated function if a species present is listed by SARA or NSESA as Endangered/Threatened/Special Concern; NSDNR - Red listed; or Ranked by ACCDC as S1

Cells highlighted in red indicate this function is considered to be critical to the watershed or represent a highly degraded watershed. These functions are typically unique or rare or associated with a high risk to the watershed if lost (NSE 2014c).

unless otherwise stated: H=High; M=Moderate/Medium; L=Low; Y=Yes; N=No; NAT=Natural

Wetland 1 (WL1)

WL1 is a fen/bog/swamp wetland complex approximately 16.5 ha in total area located in the southeast end of the Project Area. An un-named stream flows into this wetland from the northwest corner and outlets from the southeast corner. A shrub and treed swamp borders the stream as it flows through the wetland. A power transmission corridor is present along the southern end of this wetland. This wetland may significantly contribute to the maintenance of water flow to the unnamed stream that constitutes the inlet and outlet of this wetland. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL1.

Wetland 2 (WL2)

WL2 is characterized as a wetland complex comprised of marsh, fen and swamp wetland types. This wetland borders a small pond at the northern boundary located behind a barrier beach. Two small unnamed streams enter this wetland on the south side but there is no evidence of an outlet channel. There is evidence that this area does receive periodic salt water influx during storm events (presence of dried seaweed and ocean litter such as lobster traps and buoys) however the vegetation present in this wetland indicate that this is a fresh water pond. This wetland provides a high diversity of habitat that can be utilized by various wildlife species. WL2 may also serve to stabilize the shoreline during storm events.

Wetland 3 (WL3)

WL3 is characterized as a sloped throughflow fen wetland located in the northern end of the Project Area. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. This wetland may significantly contribute to the maintenance of water flow to the unnamed stream that constitutes the inlet and outlet of this wetland which flows east and connects to WL2.

Wetland 4 (WL4)

WL4 is characterized as an isolated treed bog wetland located near the coast in the northern end of the Project Area. Dominant species in this wetland include Cinnamon Fern, Three-seeded Sedge (*Carex trisperma*) and Black Spruce. The land surrounding the wetland is dominated by coniferous forest and is in a natural state and fully vegetated. Although the wetland contains low diversity in terms of species and plant communities, the plant community present is considered of high quality.

Wetland 5 (WL5)

WL5 is characterized as a sloped throughflow fen wetland at the northern end of the Project Area. This wetland contains a mix of herb and shrub dominated areas. The herb fen portions of this wetland are dominated by Cottongrass (Eripohorum sp), and Bog Aster (*Oclemena nemoralis*) while the shrub portion is dominated by Alder and Mountain Holy. Broadleaf cattail (*Typha latifolia*) is present within the small stream that flows through this wetland.

Wetland 6 (WL6)

WL6 is characterized as an outflow bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. This wetland is important in maintaining stream flow of the unnamed stream that originates from the west and east ends of this wetland. These outflow streams hydrologically connect Wetland 6 to Wetland 5 in the west and WL3 in the east.

Wetland 7 (WL7)

WL7 is characterized as a throughflow swamp wetland which occurs at the forest edge at the northern end of the Project Site. Dominant species in this wetland include Cinnamon Fern, Three-seeded Sedge (*Carex trisperma*) and Black Spruce. The land surrounding the wetland is dominated by coniferous forest and is in a natural state and fully vegetated.

Wetland 8 (WL8)

WL8 is characterized as a wetland complex comprised of a mix of bog, fen and swamp types that follows an un-named watercourse along the western end of the Project Area. This wetland may significantly contribute to the maintenance of water flow to this stream which southwest beyond the Project Area. The Bog Portion of this wetland may also serve as a groundwater recharge site which is based on the lack of perennial outlet channel, type of wetland and conditions of upland soil. Wetland 8 contains a high diversity of plant communities providing habitat to a variety of wildlife species. Two lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) and Coastal Bushy Heard Lichen (*Usnea flammea* – ACCDC rank; S2S3) were recorded in WL8.

Wetland 9 (WL9)

WL9 is characterized as an isolated domed bog wetland located on the western boundary of the Project Area. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. This wetland may serve as a groundwater recharge site which is based on the lack of perennial outlet channel, type of wetland and conditions of upland soil. The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL9.

Wetland 10 (WL10)

WL10 is characterized as a throughflow treed swamp wetland located in the western end of the Project Area. An ATV trail was noted to run through the southern end of this wetland. Although this wetland contains low diversity of plant communities, the community present is of high quality. One lichen species of conservation concern, Naked Kidney Lichen (*Nephroma bellum* – ACCDC rank; S3?) was recorded in WL10.

Wetland 11 (WL11)

WL11 is characterized as a large isolated domed bog wetland located in the central portion of the Project Area near Fogherty Lake. This wetland may serve as a groundwater recharge site. The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL11.

Wetland 12 (WL12)

WL12 is characterized as an outflow bog / fen wetland located in the central portion of the Project Area. A skidder trail has been constructed through this wetland however the integrity of the wetland and surrounding buffer is considered to be high. Although this wetland contains low diversity of plant communities, the community present is of high quality. One lichen species of conservation concern, Coastal Bushy Beard Lichen (*Usnea flammea* – ACCDC rank; S2S3) was recorded in WL12.

Wetland 13 (WL13)

WL13 is characterized as an isolated treed swamp wetland located in a depression in the landscape in the central portion of the Project Area. Vegetation surrounding the wetland consists of a mix of coniferous forest and shrub barren. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated.

Wetland 14 (WL14)

WL14 is characterized as a wetland complex comprised of a mix of bog and fen types. The plant community in this wetland was determined to be relatively intact with moderate species diversity and little to no influence of invasive/non-native species. This complex consists of a number of different wetland types and as such it is considered to have a moderate diversity of high quality vegetation communities. This wetland may significantly contribute to the maintenance of water flow to the unnamed stream that constitutes the inlet and outlet of this wetland which flows to the east eventually into Murphy's Lake.

Wetland 15 (WL15)

WL15 is characterized as a sloped throughflow fen wetland located in a depression in the landscape. A skidder trail is present through the east side of the wetland. A small watercourse flows through this wetland from west to east, eventually connecting to Wetland 14. Vegetation surrounding the wetland consists of a mix of coniferous forest and tall shrub barren. Although this wetland contains low diversity of plant communities, the community present is of high quality.

Wetland 16 (WL16)

WL16 is characterized as an isolated bog wetland. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. This wetland is located at

the eastern boundary of the Project Area. Wetland 16 may serve as a groundwater recharge site.

Wetland 17 (WL17)

WL17 is characterized as an outflow bog / swamp wetland complex located along the proposed access road to the Site. This wetland may significantly contribute to the maintenance of water flow to the unnamed stream that originates from this wetland and extends to the west of the Site. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. Two lichen species of conservation concern, Coastal Bushy Beard Lichen (*Usnea flammea* – ACCDC rank; S2S3) and Naked Kidney Lichen (*Nephroma bellum* – ACCDC rank S3?) was recorded in WL17.

Wetland 18 (WL18)

WL18 is characterized as an isolated bog wetland located along the proposed access road to the Project Site. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. One plant species of conservation concern, Northern Comandra (*Geocaulon lividum* – ACCDC rank; S3) was recorded in WL18. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was also recorded in WL18. This wetland may also serve as a groundwater recharge site.

Wetland 19 (WL19)

WL19 is characterized as an isolated bog wetland located on the proposed access road to the Project Site. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL19. This wetland may also serve as a groundwater recharge site.

Wetland 20 (WL20)

WL20 is characterized as an isolated bog wetland located on the proposed access road to the Project Site. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. One lichen species of conservation concern, Black-footed Reindeer Lichen (*Cladonia stygia* – ACCDC rank; S2S3) was recorded in WL20. This wetland may also serve as a groundwater recharge site.

Wetland 21 (WL21)

WL21 is characterized as a sloped inflow fen wetland located at the north east corner of the Project Area. Although there is no outflow channel present, outflow from this wetland likely occurs under/through the boulder, cobble beach located along the northern boundary of this wetland. An old ATV trail is present through this wetland however there is a second more recently used trail travelling around the wetland indicating that users are now avoiding the wetland. The plant community in this wetland was determined to be relatively intact with

moderate species diversity and little to no influence of invasive/non-native species. Although this wetland contains low diversity of plant communities, the community present is of high quality.

Wetland 22 (WL22)

WL22 is characterized as a sloped throughflow fen wetland located at the north east end of the Project Area. The integrity of this wetland and surrounding buffer is considered to be high where impacts to this wetland are minimal and the adjacent buffer area is considered to be in a natural state and fully vegetated. This wetland consists of two open fen portions connected by a small watercourse. Although this wetland contains low diversity of plant communities, the community present is of high quality.

6.4.3 Terrestrial Wildlife

Important Terrestrial Fauna Habitats

Significant habitats include sites where SAR or species of conservation concern occur, habitats that are rare in NS, and sites where unusually large concentrations of wildlife occur (NSEL 2009). The NSDNR maintains a Significant Species and Habitats (SigHab) database (NSDNR 2012a), which in addition to sites described above may also report habitats that are critical for species that are not rare but are valued by humans, or are sensitive to human developments.

The NSDNR (SigHab) database (NSDNR 2012a) was reviewed in order to obtain a complete list of significant habitats identified within 100 km of the Project footprint. It should be noted, however, that this database may not be comprehensive or up to date for the Project area. A total of 956 significant habitat polygons (identified by unique site ID numbers) are located within 100 km of the proposed Project site, including:

- 170 deer wintering areas;
- 127 migratory bird areas;
- 193 areas with species of concern;
- 39 areas for SAR; and
- 427 areas considered “other habitats”.

Forty-one of these significant habitats are located within 20 km of the Project site (Figure 6.4-5), only one (for Harlequin Duck) overlap with the Project site. Almost half of the significant habitats (18) are areas with avian species of concern; the others are migratory bird areas (10), areas with avian SAR (4), deer wintering areas (1), and “other habitats” (8) which include important habitats for Common Eider and nesting areas for raptors or colonial species.

Table 6.4-5:
Significant Habitats Within 20 km of the Project Site

Site #	Type	Primary Species	Approximate Location in relation to Project area
RI360	Species of concern	Common Tern	Across Chedabucto Bay, approximately 19 km to the north.
RI358	Migratory bird	Common Eider	Across Chedabucto Bay, approximately 19 km to the north.
RI323	Migratory bird	Double-crested Cormorant	Across Chedabucto Bay, approximately 18.7 km to the northeast.
RI324	Species of concern	Common Tern	Across Chedabucto Bay, approximately 18.5 km to the northeast.
RI367	Migratory bird	Whimbrel	Across Chedabucto Bay, approximately 16.5 km to the northeast.
GU855	Migratory bird	Unspecified	Across Chedabucto Bay, approximately 18.8 km to the west-northwest.
GU858	Migratory bird	Unspecified	Located 16.0 km to the east.
GU915	Migratory bird	Common Eider	Nearest point is 16.4 km to the south-southeast.
GU875	Migratory bird	Common Eider	Nearest point is 15.5 km to the south-southwest.
GU874	Species of concern	Common Eider	Nearest point is 16.9 km to the southwest.
GU876	Other habitat	Significant area	Located 15.5 km to the south-southwest.
GU873	Species of concern	Common Eider	Located 17.5 km to the southwest.
GU872	Species of concern	Common Eider	Nearest point is 17.9 km to the southwest.
GU877	Migratory bird	Common Eider	Nearest point is 16.9 km to the south-southeast.
GU938	Species of concern	Roseate Tern	Located 19.5 km to the southwest.
GU940	SAR	Tern (unclassified)	Nearest point is 14 km to the south-southwest.
GU985	Other habitat	Bald Eagle	Located 13.8 km east of the site.
GU871	Migratory bird	Waterfowl	Nearest point is 15.5 km to the southwest.
GU988	Deer wintering area	White-tailed Deer	Nearest point is 19 km to the west-northwest, across Chedabucto Bay.
RI705	Other habitat	Common Eider	Across Chedabucto Bay, approximately 18 km to the northeast.
RI706	Other habitat	Common Eider	Across Chedabucto Bay, approximately 18.3 km to the northeast.
RI707	Other habitat	Common Eider	Across Chedabucto Bay, approximately 18.3 km to the northeast.
RI708	Other habitat	Common Eider	Across Chedabucto Bay, approximately 18.8 km to the northeast.
GU990	SAR	Harlequin Duck	Nearest point is 7.6 km to the south-southeast.
GU991	SAR	Harlequin Duck	Nearest point is 9.2 km to the east.
GU992	SAR	Harlequin Duck	Extends along part of the coast of the Canso peninsula, including the northern edge of the Project area.
GU994	Migratory bird	Double-crested Cormorant	Located 12.5 km to the east.
GU995	Species of concern	Tern (unclassified)	Located 14.8 km to the northwest, across Chedabucto Bay.
GU1002	Species of concern	Tern (unclassified)	Located 16.3 km to the south-southwest.
GU1004	Species of concern	Tern (unclassified)	Located 15.9 km to the south-southwest.
GU1005	Species of concern	Tern (unclassified)	Located 9.6 km to the west.

Site #	Type	Primary Species	Approximate Location in relation to Project area
GU1006	Species of concern	Tern (unclassified)	Located 4.6 km to the west.
GU1007	Species of concern	Tern (unclassified)	Nearest point is 17.5 km to the east.
GU1008	Species of concern	Tern (unclassified)	Located 13.5 km to the east.
GU1009	Species of concern	Cormorant (unclassified)	Located 17.2 km to the east.
GU1010	Other habitat	Great Blue Heron	Nearest point is 12.2 km to the southeast.
GU1011	Species of concern	Tern (unclassified)	Located 13.8 km to the southeast.
GU1012	Species of concern	Tern (unclassified)	Located 15.9 km to the south.
GU1013	Species of concern	Tern (unclassified)	Located 16.3 km to the south.
GU1014	Other habitat	Great Blue Heron	Nearest point is 16.5 km to the south.
RI735	Species of concern	Tern (unclassified)	Across Chedabucto Bay, approximately 19 km to the northeast.

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- Centre of Site
- Site
- 20 km Radius
- 100 km Radius

Significant Habitats

- Deer Wintering
- Migratory Bird
- Areas of concern
- Other Habitat
- Species at Risk

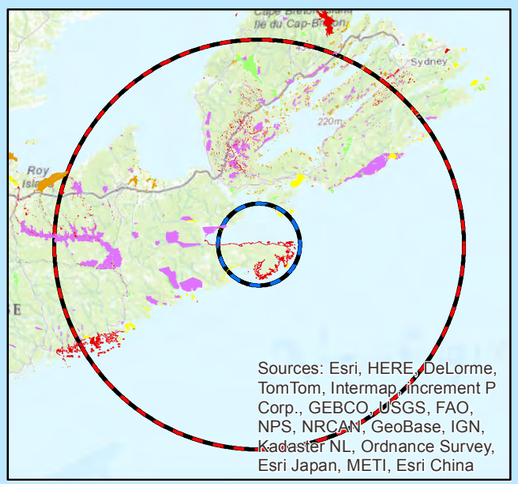
Important Bird Areas

- Country Island Complex
- Roads
- River / Stream
- Waterbody

RI360 RI358 RI708 RI735 RI323 RI707 RI324 RI706 RI705 RI367 GU995 GU988 GU855 GU1005 GU992 GU1006 GU992 GU994 GU858 GU991 GU991 GU1007 GU991 GU1007 GU1007 GU1008 GU985 GU1009 GU1010 GU991 GU915 GU1011 GU871 GU938 GU1004 GU875 GU940 GU876 GU873 GU1014 GU872 GU990 GU1012 GU990 GU877

Chedabucto Bay

Atlantic Ocean



0 12.5 25 50 Kilometers

SCALE: 1:169,301
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

SIGNIFICANT HABITATS
AND IMPORTANT BIRD AREAS

September 23, 2014	Rev 1.0	Figure No. 6.4-3
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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One significant habitat was located along the northern coast of the Project footprint, Site # GU992 - SAR (Harlequin Duck). Harlequin Duck (NSESA: Endangered; SARA: Special Concern) are most often found along the coast of NS from November to April, where they congregate in coastal waters along turbulent rocky shores to feed (EC 2007).

Areas of particular importance to the survival of bird species may be given the designation of Important Bird Area (IBA). The IBA program is coordinated by BirdLife International, and administered in Canada by the Canadian Nature Federation and Bird Studies Canada (IBA 2014). The criteria used to identify important habitat are internationally standardized, and are based on the presence of species at risk, species with restricted range, habitats holding representative species assemblages, or a congregation of a significant proportion of a species' population during one or more season. These criteria are used to identify sites of national and international importance.

There is only one IBA located within 25 km of the Project area, the Country Island Complex (NS028), located in Country Harbour and Tor Bay. The Country Island Complex includes Country Island, Goose Island, an unnamed island off Charlos Cove, a peninsula at Fisherman's Harbour, Inner West Bird Island, and three sites in Tor Bay (Cooks, Dorts, and Hog Islands), and its nearest point is approximately 13 km from the Project area to the southwest. Each of these sites supports or has previously supported nesting Roseate Terns, with the largest number found on Country Island (IBA 2014). In 2000, 54 nests were recorded in the Country Island Complex (IBA 2014), although in 2014, just 15 pairs were reported (J. Rock, pers. comm. 2014). The complex also supports a globally significant colony of Leach's Storm-petrel (*Oceanodroma leucorhoa*) (IBA 2014).

Marine traffic associated with the quarry involves at maximum about two bulk carriers visiting the site per week. These vessels will travel within existing commercial shipping lanes, which pass to the south of the South Shore (Port Joli sector) IBA (NS004) near the town of Liverpool. This IBA includes four designated Migratory Bird Sanctuaries (Port Joli, Port Hebert, Sable River and Haley Lake) and provides a variety of coastal habitats including tidal rivers and estuaries, mud or sand flats, open seas, inlets, coastal cliffs and rocky shores (IBA 2014). Nationally significant numbers of Piping Plover (*SARA* and *NSESA*: Endangered) have nested in this IBA, and during fall migration, large numbers of shorebirds including Black-bellied Plover, Willet, Least Sandpiper, Semipalmated Sandpiper, and Pectoral Sandpiper, feed on the tidal flats. In the winter months, large numbers of waterfowl including Canada Goose, American Black Duck, and Harlequin Duck are present (IBA 2014).

Vertebrates

Birds

Most birds are protected under the MBCA, while others (including raptors, non-migratory game birds, and kingfishers) are regulated under the NSWA. In order to obtain site-specific information on bird species in the Project area, avian field surveys were conducted at the site in 2010 and 2011, and supplemental avian observations on the Project site were made during the September 2014 moose survey.

Field surveys for birds were carried out at those times of the year when birds make the most intensive use of the area; details of the survey methodologies can be found in **Appendix E** (AMEC 2010 surveys) and **Appendix G** (AECOM 2011 winter bird surveys). Survey times were

chosen based on known breeding and migration periods, and all habitats used by the targeted birds were surveyed at appropriate times of the year to maximize the quality and quantity of data obtained. Surveys were conducted at the time of day with the highest likelihood of detecting the target species (e.g., early morning for breeding passerines, and during the appropriate parts of the tidal cycle for shorebirds), and in favourable conditions to maximize detection probability (low winds, no precipitation). Survey dates and primary targets were as follows, and the survey locations are provided in Figure 6.4-4.

- April 14th, 2010: year-round residents and early breeders, including owls;
- May 18th and 19th, 2010: main passerine migration and early breeders;
- June 22nd and 23rd, 2010: main passerine breeding;
- August 25th, 2010: shorebird migration;
- September 23rd, 2010: late shorebird migration; and
- January 18th and 19th, 2011: winter bird species.

Results were obtained for the Second Maritimes Breeding Bird Atlas for the 10 km by 10 km Atlas square which includes the Project area (MBBA 2014). Breeding evidence was recorded for 43 species in Square 20PR42, including four confirmed breeding and 12 considered to be probably breeding based on observed evidence (**Appendix E**). Data were obtained for the Audubon Christmas Bird Count (CBC) in the Strait of Canso, which is the count location nearest the Project area, centred approximately 30 km to the northwest (National Audubon Society 2014). A total of 116 species have been identified in the 17 years of Christmas Bird Counts for which data were available (1995 - 2012; see **Appendix E**). Additional information on bird species in the general Project area was obtained from the ACCDC, Important Bird Areas (IBA) of Canada website, and through information requests from EC-CWS and NatureCounts.

Species Protected under *Nova Scotia Wildlife Act* (NSWA)

Raptor and owl species reported during 2010 and 2011 field surveys of the Project site include Barred Owl, Northern Saw-whet Owl, Bald Eagle, American Kestrel, Merlin, Northern Harrier, Red-tailed Hawk, Sharp-shinned Hawk, and an Osprey was observed in the Project area in 2014. In addition to owls and raptors, Belted Kingfisher, Spruce Grouse and Ruffed Grouse were observed during the 2010-2011 field surveys (**Appendix E**). All of these species are considered possibly breeding in the Project area.

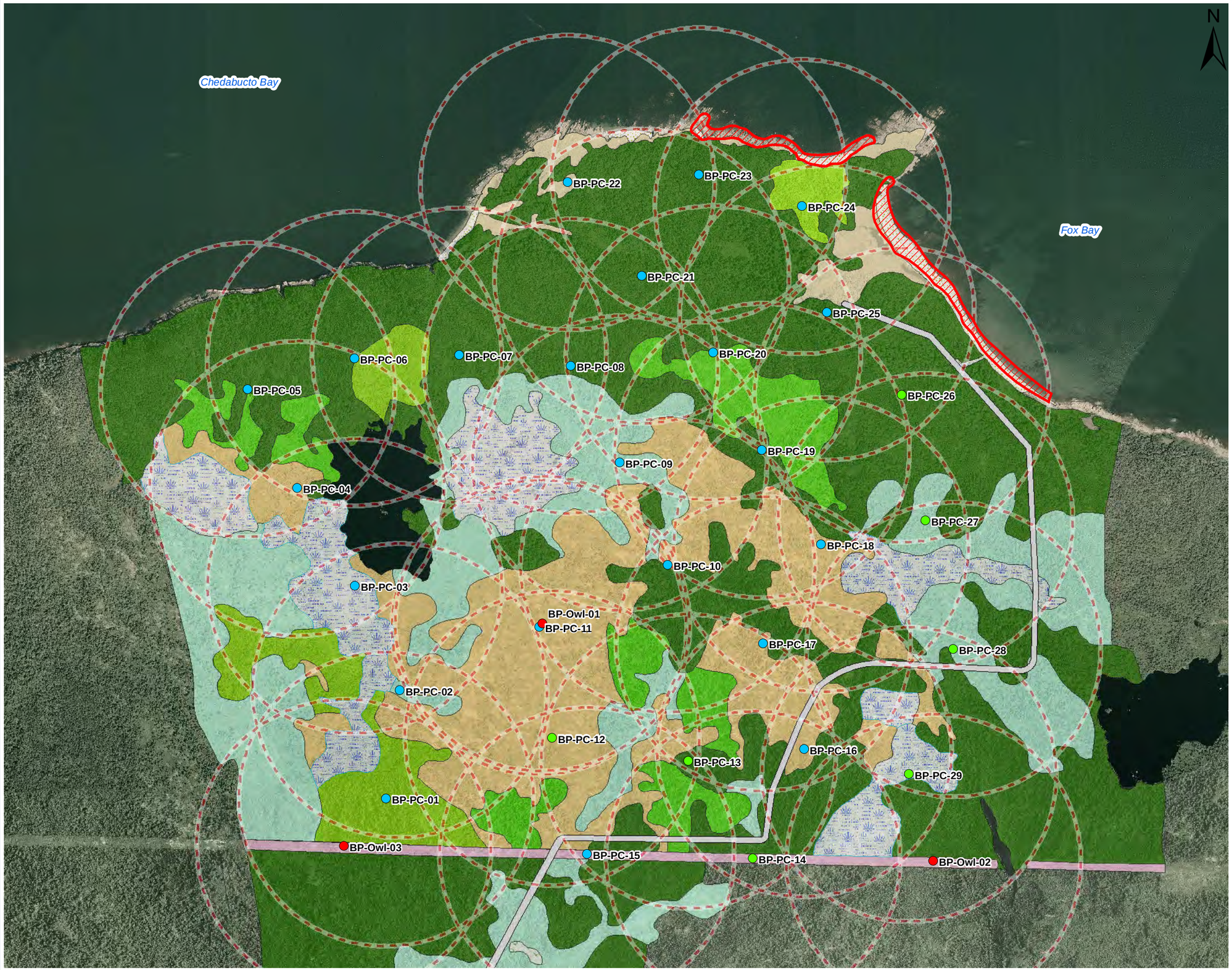
Short-eared Owl and Long-eared Owl were both reported within 100 km of the Project area according to ACCDC (2010), although only the former has potential to breed in the Project area based on available habitat. Broad-winged Hawk, Rough-legged Hawk and Northern Goshawk have each been reported on one occasion in the Strait of Canso Christmas Bird Count (**Appendix E**). NSDNR reports a significant habitat for Bald Eagle 13.8 km east of the Project area (Table 6.4-5).

Migratory Birds Protected under the MBCA

Most species of migratory birds, including passerines, waterfowl, shorebirds and seabirds, are protected under the MBCA. These groups are discussed in turn below.

Landbirds

During June 2010 breeding bird surveys conducted in the Project area, a total of 39 species of migratory landbirds (including passerines, woodpeckers and unclassified species such as hummingbirds) were observed to be possibly breeding in the Project area, including sparrows, finches, thrushes, kinglets, vireos, and numerous warbler species (Table B.1-2 in **Appendix E**). An additional 11 confirmed or potentially breeding species were not observed in the Project area during the breeding season, but reported in the MBBA square in which the Project is located (MBBA 2014); these include Tree Swallow, Bank Swallow, Barn Swallow, Blue Jay, Common Grackle, Ceder Waxwing, European Starling, Fox Sparrow, Mourning Dove, Red-eyed Vireo and Tennesee Warbler (**Appendix E**) The Common Nighthawk was not observed.



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2010 Bird Survey Locations

- Early Morning Point Count
- Late Morning/Mid Afternoon Point Count
- Owl Survey
- Shorebird Survey Area
- 400m Buffer (2010 Bird Survey Locations)

Terrestrial Habitats

- Wetland
- Coniferous Forest
- Open Coniferous Forest
- Open Mixed Forest
- Regenerating Coniferous Forest
- Regenerating Forest
- Bog
- Coastal Barren
- Open Barren
- Shrub Barren
- Sand Gravel Beach
- Powerline Transmission Corridor

0 125 250 500 Meters

SCALE: 1:10,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

2010 BIRD SURVEY LOCATIONS

September 24, 2014	Rev 1.0	Figure No. 6.4-4
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

In May 2010, 39 species of migrating passerines were observed, while in fall (August and September) 2010, 15 passerine species were noted (Table B.1-1 and Table 3.3 in **Appendix E**).

In the Project area, early spring 2010 and winter 2011 surveys yielded a few common resident landbird species (Table 3.1 in **Appendix E**). Other potential wintering landbird species in the area may be found in the Strait of Canso CBC results (**Appendix E**).

Shorebirds

Overall, the eastern shore of NS does not support large numbers of migrating shorebirds, and only small numbers of shorebirds were observed during the fall surveys at the Project area. A total of five species of shorebirds were found during the 2010 field surveys, all along the sand/gravel beach during the fall migration period (**Appendix E**). Two of those species, the Greater Yellowlegs and Spotted Sandpiper, have potential to breed in the project area, although no evidence of breeding was noted. Fogherty Lake does not appear to provide good breeding habitat for these species, as the bank vegetation is dense and shrubby, and there are no shallow areas for wading.

The barrens habitat present on the Project site provides potential stopover habitat for species such as Whimbrel. In September 2014, two days of surveys were conducted, primarily in the open barrens and wetland habitats, for Mainland Moose (see Appendix N Attachment F for geographical coverage). These surveys included recording of any shorebird sightings. However, no Whimbrel was observed; the timing of these surveys was not optimal for Whimbrel, which is most abundant in the area in July and August, but is known to occur as late as October. In the August 2010 shorebird surveys, observations along the coastline as well as on the site (primarily around Fogherty Lake) were conducted, and again, no Whimbrel were observed; nonetheless, it is possible that they are present at and near the Project site in the late summer and early fall.

The Atlantic Canada Shorebird Survey (ACSS) database provides records of 7 shorebird species from a single survey on 15 August 1979 of several beaches between Port Shoreham and Hadleyville, west of Boyleston and across Chedabucto Bay from the Project area. A total of 4 Black-bellied Plovers, 14 Semipalmated Plovers, 1 Greater Yellowlegs, 1 Willet, 2 Least Sandpipers, 16 Ruddy Turnstones and 17 Spotted Sandpipers were reported (Bird Studies Canada 2015).

No shorebirds were observed in the MBBA in Square 20PR42, which includes the Project Site. The American Oystercatcher nests on Grassy Island, approximately 12 km east of the Project area near the town of Canso; this is one of only two known nesting sites in Canada for the American Oystercatcher, a species that suffered large declines in the early 20th century (EC-CWS pers. comm. 2014). . Purple Sandpiper has been reported in the general area in the Strait of Canso CBC (**Appendix E**) as well as during winter waterfowl surveys conducted by EC-CWS (A. Hicks, pers. comm. 2014); this species breeds in the Arctic, but regularly occurs in NS in the winter months, when it feeds along rocky coastlines.

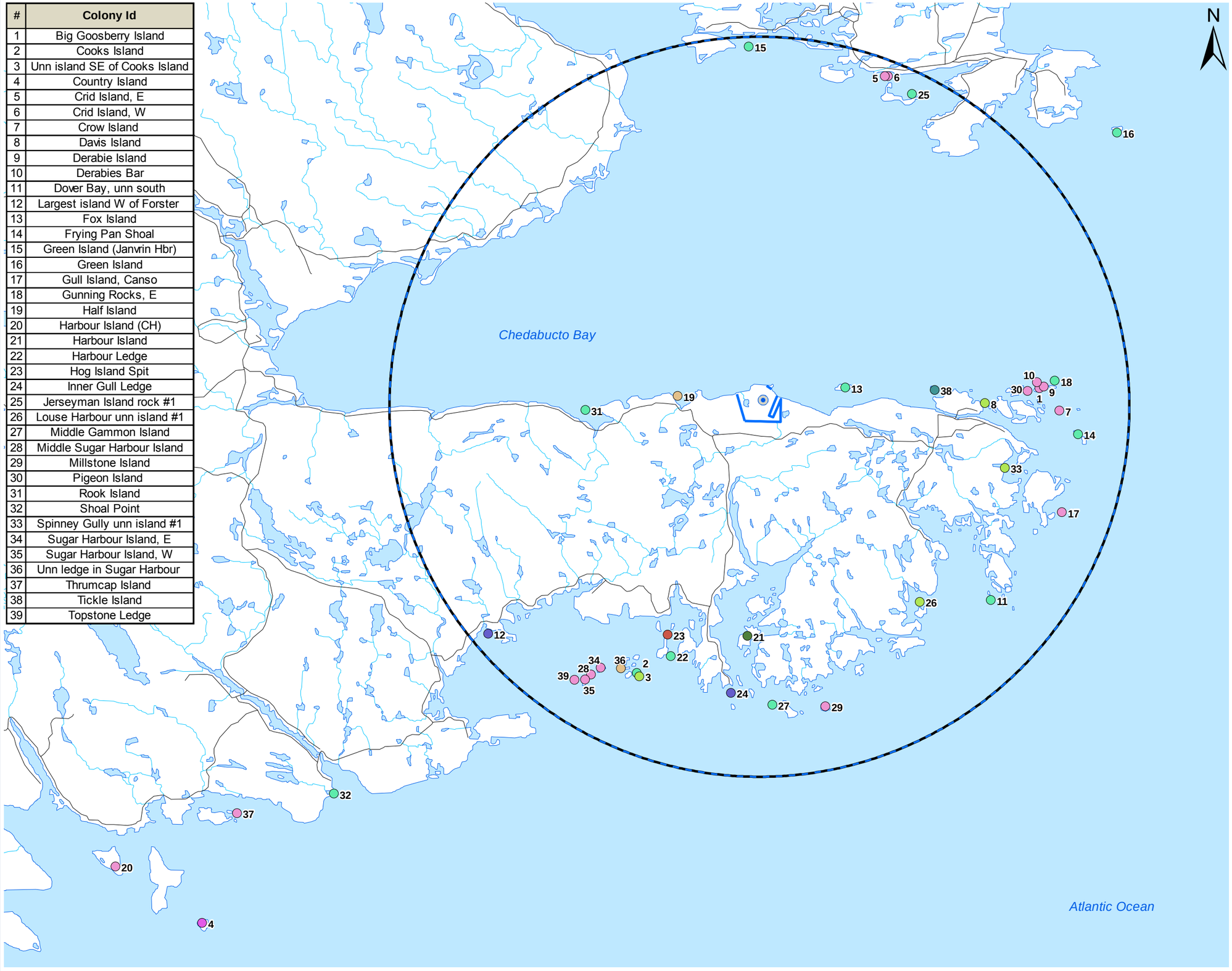
Seabirds and Waterfowl

During field surveys conducted at the site, a total of 12 species of seabirds and waterfowl were observed in coastal environments at or near the Project area, including three gull species, two

cormorant species, four ducks, Common Loon, Northern Gannet and Horned Grebe (**Appendix E**). No breeding evidence for any of these species was observed.

In the MBBA, confirmed breeding was reported in Square 20PR42 for Common Eider and Great Black-backed Gull, and evidence of breeding was reported for Black Guillemot, Common Tern, Herring Gull, Red-breasted Merganser and Common Loon (**Appendix E**). A total of 39 seabird colonies have been identified in the vicinity of the Project area (EC-CWS 2014); these are illustrated on **Figure 6.4-5**. The largest, Country Island, is situated approximately 40 km southwest of the Project sites and supports approximately 1500 nesting pairs of terns including Common, Arctic and Roseate Tern, as well as a large colony of Leach's Storm Petrels (approximately 12,000 pairs). Black Guillemot and Common Eider also nest on Country Island, although numbers of breeding pairs are not provided (Rock and Shervill 2012). The other colonies support large gulls (Herring and Great Black-backed), Common Terns and Arctic Terns; the nearest such colonies are Half Island to the west and Fox Island to the east, each approximately 3 km from the Site.

#	Colony Id
1	Big Goosberry Island
2	Cooks Island
3	Unn island SE of Cooks Island
4	Country Island
5	Crid Island, E
6	Crid Island, W
7	Crow Island
8	Davis Island
9	Derabie Island
10	Derabies Bar
11	Dover Bay, unn south
12	Largest island W of Forster
13	Fox Island
14	Frying Pan Shoal
15	Green Island (Janvrin Hbr)
16	Green Island
17	Gull Island, Canso
18	Gunning Rocks, E
19	Half Island
20	Harbour Island (CH)
21	Harbour Island
22	Harbour Ledge
23	Hog Island Spit
24	Inner Gull Ledge
25	Jerseyman Island rock #1
26	Louse Harbour unn island #1
27	Middle Gammon Island
28	Middle Sugar Harbour Island
29	Millstone Island
30	Pigeon Island
31	Rook Island
32	Shoal Point
33	Spinney Gully unn island #1
34	Sugar Harbour Island, E
35	Sugar Harbour Island, W
36	Unn ledge in Sugar Harbour
37	Thrumcap Island
38	Tickle Island
39	Topstone Ledge



LEGEND

- Centre of Site
- 20 km Radius
- Site

Seabird Colonies In Proximity to Project Area

- Common Tern
- Common Tern and Arctic Tern
- Common Tern and Great Black-backed Gull
- Common Tern, Arctic Tern, Great Black-backed Gull
- Common Tern, Arctic Tern, Herring Gull
- Great Black-backed Gull
- Herring Gull
- Herring Gull and Great Black-backed Gull
- Roseate Tern, Common Tern, Arctic Tern, Leach's Storm Petrel
- Roads
- River / Stream
- Waterbody

0 2.5 5 10 Kilometers

SCALE: 1:199,005
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES CORP.

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

SEABIRD COLONIES IN PROXIMITY TO PROJECT AREA

September 23, 2014 | Rev 1.0 | Figure No. 6.4-5

Project No. 210.05913.00000

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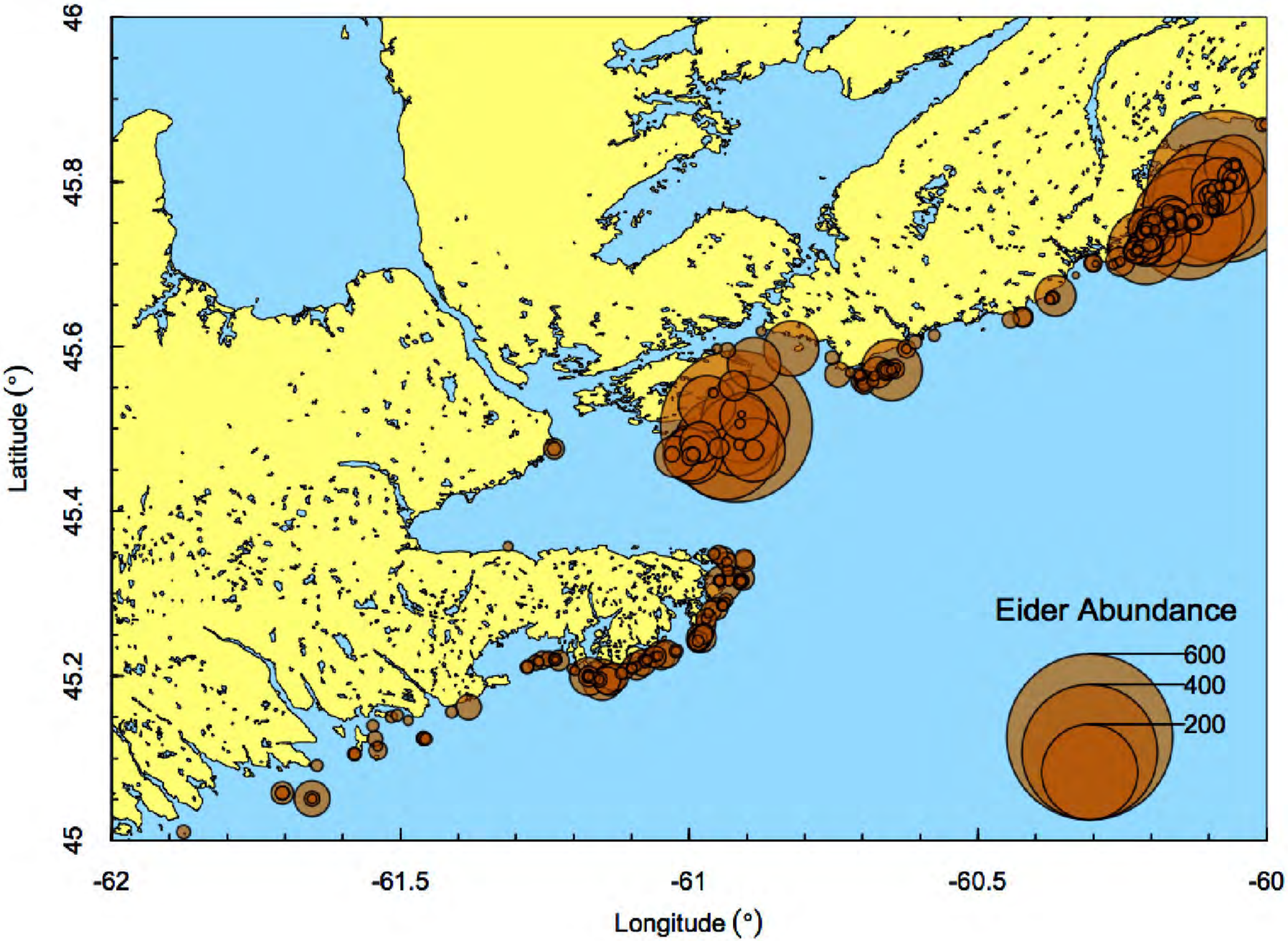
Results of winter surveys for waterfowl conducted by NSDNR and EC-CWS between 1992 and 2011 were obtained from EC-CWS. In Survey Block 226, which extends from approximately the mouth of Guysborough Harbour to the town of Canso and encompasses Black Point, Common Eider, American Black Duck, Common Goldeneye, Long-tailed Duck, Common Loon, mergansers, and scoters are observed most years. Canada lies at the northern edge of the wintering ranges for Surf Scoter, Black Scoter and White-winged Scoter, and while little information exists on the winter distributions of these species, it is likely that most individuals overwintering in Canada likely do so along the eastern shore of Nova Scotia (EC-CWS pers. comm. 2014). Unidentified cormorants, Bufflehead and Mallard have occasionally been observed; the cormorants are likely to be Great Cormorant, which is more abundant in the area during the winter months. Brant and Harlequin Duck were each reported on a single occasion. "Unidentified Goldeneye" has been reported in some survey years; these are likely to be Common Goldeneye but could potentially include Barrow's Goldeneye as well. Waterfowl density in Block 226 is relatively low compared to the adjacent Block 225 that extends from Canso to Dover Island and includes numerous small offshore islands off Canso at the mouth of Chedabucto Bay where thousands of Common Eiders are regularly seen in the winter surveys (A. Hicks, pers. comm. 2014). Other potential wintering seabird species in the area may be found in the Strait of Canso CBC results (**Appendix E**).

EC-CWS (pers. comm. 2014) provided further information on distribution and abundance of Common Eiders along eastern Nova Scotia during winter of 2012 (**Figure 6.4-6**), and stated that significant numbers of eiders are also known to moult along the east coast of Nova Scotia. During this moulting period, which occurs in late August to September for breeding females and June to July for immature, adult males and non-breeders (Goudie *et al*. 2000), birds are flightless and are highly vulnerable to oiling and very sensitive to disturbance. It is not known whether eiders moult in the Project study area.

The main overwintering site for the estimated 1100 to 1200 Harlequin Ducks that overwinter in Nova Scotia is located more than 100 km southeast of the Project site within the Eastern Shore Islands Wildlife Management Unit, but some Harlequin Ducks do winter in and near Chedabucto Bay (Soulliere and Thomas 2009). Little information exists on Harlequin Duck spring and fall use of the eastern shore of Nova Scotia, but large numbers of birds have been detected at times, which are assumed to be migrants (Soulliere and Thomas 2009). In the Chedabucto Bay area, Harlequin Ducks have been reported during fall migration, but not during spring migration (Soulliere and Thomas 2009). However, surveys conducted in May and early June of 2014 have detected significant numbers of Harlequin Ducks among offshore islands of the Eastern Shore in the Bay of Islands (Simon 2014), and it is believed that similar searches would likely detect spring migrants within the Project study area (EC-CWS pers. comm. 2014).

EC-CWS initiated the Eastern Canadian Seabirds at Sea (ECSAS) program in 2006 to monitor seabird species at sea. Available data from between 44°N and 46°N and 59°W and 62°W were obtained from EC-CWS; with only three ECSAS surveys conducted in this general area (in early July of 2007, 2008 and 2011), data are relatively scant (C. Gjerdrum, pers. comm. 2014). Nonetheless, they provide some general information on species presence in the area. Sightings in this broad area of interest included Great Shearwater and Sooty Shearwater, Black-legged Kittiwake, Northern Fulmar, Northern Gannet and Wilson's Storm-petrel (ECSAS 2014). None of these species nest in or near the Project area (EC-CWS 2014), and they are highly pelagic outside of the breeding season, and so are highly unlikely to occur in the Project area, other than possibly along shipping routes.

Common Eiders 3 March 2012



N

LEGEND

NOTES
This map is for conceptual purposes only and should not be used for navigational purposes.

Source: EC-CWS (pers. comm. 2014).

MORIEN RESOURCES CORP.

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

COMMON EIDER ABUNDANCE
WINTER 2012

January 20, 2015	Rev 1.0	Figure No. 6.4-6
Project No. 210.05913.00000		

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Mammals

Throughout the field surveys conducted in the site in 2010 and 2014 by AMEC, and in 2011 by AECOM, evidence of mammal species presence such as sightings, tracks, vocalizations, tufts of hair, scat, and skeletal remains was recorded. Eleven terrestrial mammal species were observed by sight or sign in the Project area during the field surveys; a list of these species including one non-terrestrial species (the Gray Seal) is presented in Table 6.4-8. In addition to these, an unidentified vole was observed during the January 2011 AECOM surveys.

Table 6.4-6:
Terrestrial Mammal Species Identified in Project Area

Common Name	Scientific Name	Evidence
Red Squirrel	*Tamiasciurus hudsonicus*	Sighting, vocalizations
Eastern Chipmunk	*Tamias striatus*	Vocalizations
American Beaver	*Castor canadensis*	Dams, lodges
North American Porcupine	*Erethizon dorsatum*	Sighting
Bobcat	*Lynx rufus*	Tracks
Coyote	*Canis latrans*	Scat, tracks
Black Bear	*Ursus americanus*	Sighting, scat
Short-tailed Weasel	*Mustela erminea*	Sighting
Snowshoe Hare	*Lepus americanus*	Sighting, scat
White-tailed Deer	*Odocoileus virginianus*	Tracks, scat
Moose	*Alces alces*	Tracks, scat
Gray Seal	*Halichoerus grypus*	Sighting (offshore)

In addition to the above-noted species observed on the Site, suitable habitat exists for other mammals such Raccoon (*Procycon lotor*), and Red Fox (*Vulpes vulpes*), and small mammal species including shrews, voles, and mice are assumed to be present.

The NSDNR Hunter and Trapper Harvest website (NSDNR 2014a) was consulted in order to obtain information on species presence and harvest numbers for furbearer species, as well as White-tailed Deer and Snowshoe Hare, in Guysborough County from 2012-2013 (Table 6.4-9).

Table 6.4-7:
Hunter and Trapper Harvest in Guysborough County, 2012-2013

Common Name	Scientific Name	Number Harvested
Common Muskrat	*Ondatra zibethicus*	136
Fisher	*Martes pennanti*	7
American Beaver	*Castor canadensis*	207
North American River Otter	*Lontra canadensis*	72
American Mink	*Neovison vison*	27
Short-tailed Weasel	*Mustela erminea*	64
Bobcat	*Lynx rufus*	41
Canada Lynx	*Lynx canadensis*	1
Red Fox	*Vulpes vulpes*	14
Raccoon	*Procycon lotor*	15
Striped Skunk	*Mephitis mephitis*	3
Red Squirrel	*Tamiasciurus hudsonicus*	39
Coyote	*Canis latrans*	65
Snowshoe Hare	*Lepus americanus*	7,209

Common Name	Scientific Name	Number Harvested
White-tailed Deer	*Odocoileus virginianus*	325

The range of Canada Lynx (NSESA - Endangered) is largely restricted to Cape Breton Island (Nova Scotia Lynx Recovery Team (NSLRT) 2006), so their presence in the Project area is considered unlikely. Eastern Cougar (*Felis concolor*) (COSEWIC - Data Deficient) has been reported in NS, but with little substantial evidence corroborating its presence.

While the Project area is not located within the core habitat for mainland moose (NSESA - Endangered) as identified in the species' recovery plan (NSDNR 2007a), moose sightings have been documented in and around the Project area (M. Pulsifer, pers. comm.) and moose scat and tracks were noted by AMEC in July 2014. In September, a targeted field survey was conducted on the site, with the purpose of confirming presence of moose on the site and developing an understanding of the numbers and sex of moose using the site during the fall season and which areas and habitats they may be using. It is intended to supplement this survey data with winter track surveys and spring pellet surveys, to be conducted in early 2015. Results of the moose survey are discussed in Section 6.7, and details are provided in **Appendix H**.

Bats may be present in the Project area, and in fact, bat sightings have been reported within five km of the site in 2013 and 2014 (Nova Scotia Bat Conservation (NSBC) 2014). The town of Canso, located 12 km to the east of the site, reportedly supports a large concentration of bats (NSBC 2014). Bats in Nova Scotia commonly over-winter in abandoned mine workings; however, a search of the Nova Scotia Abandoned Mine Openings database (NSDNR 2014b) revealed no openings within 20 km of the site, and there are no documented caves or mines used by bats within 75 km (Moseley 2007). There are seven species of bats known to occur in Nova Scotia, four of which are migratory: Eastern Red Bat (*Lasuirus borealis*), Hoary Bat (*L. cinereus*), Big Brown Bat (*Eptesicus fuscus*), and Silver-haired Bat (*Lasionycteris noctivagans*). The three year-round resident species, the Little Brown Myotis (*Myotis lucifugus*), Northern Long-eared Myotis (*M. septentrionalis*) and Tri-coloured Bat (*Perimyotis subflavus*), are listed as Endangered by SARA, COSEWIC and NSESA, primarily due to the effects of the devastating fungal disease, White-nose Syndrome. Of these species, only the Little Brown Myotis and Northern Long-eared Myotis are likely to be present in the Project area; the four migratory species are irregular visitors to NS, and the Tri-coloured Bat is generally restricted to the southwestern part of the province (Broders *et al.* 2003).

Herpetiles

During terrestrial wildlife and freshwater field surveys conducted on the Project site in 2010 and 2014, reptile and amphibian observations were recorded during surveys for other taxonomic groups. Any evidence of herpetile species, including sightings, vocalizations, cast skins (snakes), skeletal remains, egg masses or presence of larvae, was recorded. Ponds and watercourses and their banks were scanned using binoculars during the day to detect presence of turtles, either in the water or basking, night-time field work included listening for vocalizations of frogs and toads, and coarse woody debris such as fallen logs and branches was overturned to look for salamanders and newts.

A list of herpetile species determined to be utilizing habitats on the proposed Project site is provided in Table 6.4-10.

Table 6.4-8:
Reptile and Amphibian Species Identified in Project Area

Common Name	Scientific Name	Evidence
Maritime Garter Snake	*Thamnophis sirtalis*	Sighting
Yellow Spotted Salamander	*Ambystoma maculatum*	Sighting of larvae
American Toad	*Bufo americanus americanus*	Sighting of adults, vocalizations
Spring Peeper	*Pseudacaris crucifer crucifer*	Sighting of adults, vocalizations
Green Frog	*Rana clamitans melanota*	Sighting of adults, vocalizations
Northern Leopard Frog	*Rana pipiens*	Sighting
Bullfrog	*Rana catesbieana*	Sighting of adults and larvae

Other herpetile species could be present based on habitat and range, including Eastern Smooth Green Snake (*Opheodrys vernalis*), Red-bellied Snake (*Storeria occipitomaculata*), Ring-necked Snake (*Diadophis punctatus*), Snapping Turtle (*Chelydra serpentina*), Painted Turtle (*Chrysemys picta*), Wood Turtle (*Glyptemys insculpta*), Wood Frog (*Lithobates sylvaticus*), Mink Frog (*L. septentrionalis*), Leopard Frog (*L. pipiens*), Blue-spotted Salamander (*Ambystoma laterale*), Spotted Salamander (*A. maculatum*), Eastern Red-backed Salamander (*Plethodon cinereus*), Four-toed Salamander (*Hemidactylium scutatum*), and Eastern Newt (*Notophthalmus viridescens*) (Gilhen 1984).

Snapping turtles (SARA: Special Concern; NSESA: Vulnerable) are not considered likely on the site based on the quality of available freshwater habitat. Wood Turtle (SARA and NSESA: Threatened), the most terrestrial of the three turtle species in NS, is considered to be possibly present although has not been observed in any surveys to date.

Invertebrates

Odonates (dragonflies and damselflies) were surveyed on the site in June and July 2010 by local odonate expert Mr. Paul Brunelle, assisted by AMEC staff. Additional specimens were collected during August and September 2010 by AMEC staff, and added to Brunelle's report. The complete odonate report, including details on the approach and methodology, is provided in **Appendix E**, Attachment B2. Odonates require wet areas for breeding, and the ponds, wetlands and watercourses in the Project area provide suitable habitat for these species. During the June and July surveys, the greatest odonate abundance was observed at Wetland 12 and at Wetland 2, Ponds 1 and 2; abundance was observed to be lower than expected at some other parts of the Project area (Fogherty Lake and Wetlands 17 and 19), although that may have been due in part to poor weather conditions at the time these location were surveyed. In all, 47 records of 25 species were documented during the June and July surveys (22% of the species known to occur in mainland NS), and an additional 18 records of 8 species (including 3 species not found in the earlier surveys) were collected in the August and September surveys **(Appendix E**). This was considered by Mr. Brunelle to be a moderate diversity. One species, the Spot-winged Glider (*Pantala hymenaea*) has a General Status rank of Sensitive.

Butterflies are expected to be present at the Project site, particularly in the central part, the wetlands and the coast, where suitable herbaceous vegetation exists. Butterfly observations were conducted by an experienced Maritimes Butterfly Atlas participant during the 2010 field

surveys; however, just one species, the Red Admiral (*Vanessa atalanta*), was identified in the Project footprint. According to the Maritimes Butterfly Atlas, there have been no observations to date in the 10 km by 10 km atlas square (20PR42) in which the Project area is situated (ACCDC: Maritimes Butterfly Atlas 2014). However, there have been a total of 10 records of 6 species in the two squares adjacent to 20PR42 for which observations were reported (20PR52 and 20PR41), all of which have a Canadian General Status rank of Secure in NS:

- Least Skipper (*Ancyloxypha numitor*);
- Peck's Skipper (*Polites peckius*);
- Tawny-edged Skipper (*Polites themistocles*);
- Long Dash Skipper (*Polites mystic*);
- Clouded Sulphur (*Colias philodice*); and
- Northern Blue (*Plebejus idas*).

6.5 Freshwater Environment

6.5.1 Methodology

This section summarizes the different freshwater environments located in the Project Area, including fish habitat. This information was gathered through desktop analysis, consultation with resource agencies, and on-site investigations in 2010 and 2014. **Appendix I** contains supporting field documentation for this subject. Freshwater fish and fish habitat baseline conditions were classified as lakes and watercourses based on size, depth, and percent of in-water vegetation.

The boundaries for aquatic assessment were based on the potential influence from the Project footprint, and the availability and accuracy of existing data. Efforts were made to sample all representative habitat types at each waterbody and watercourse location.

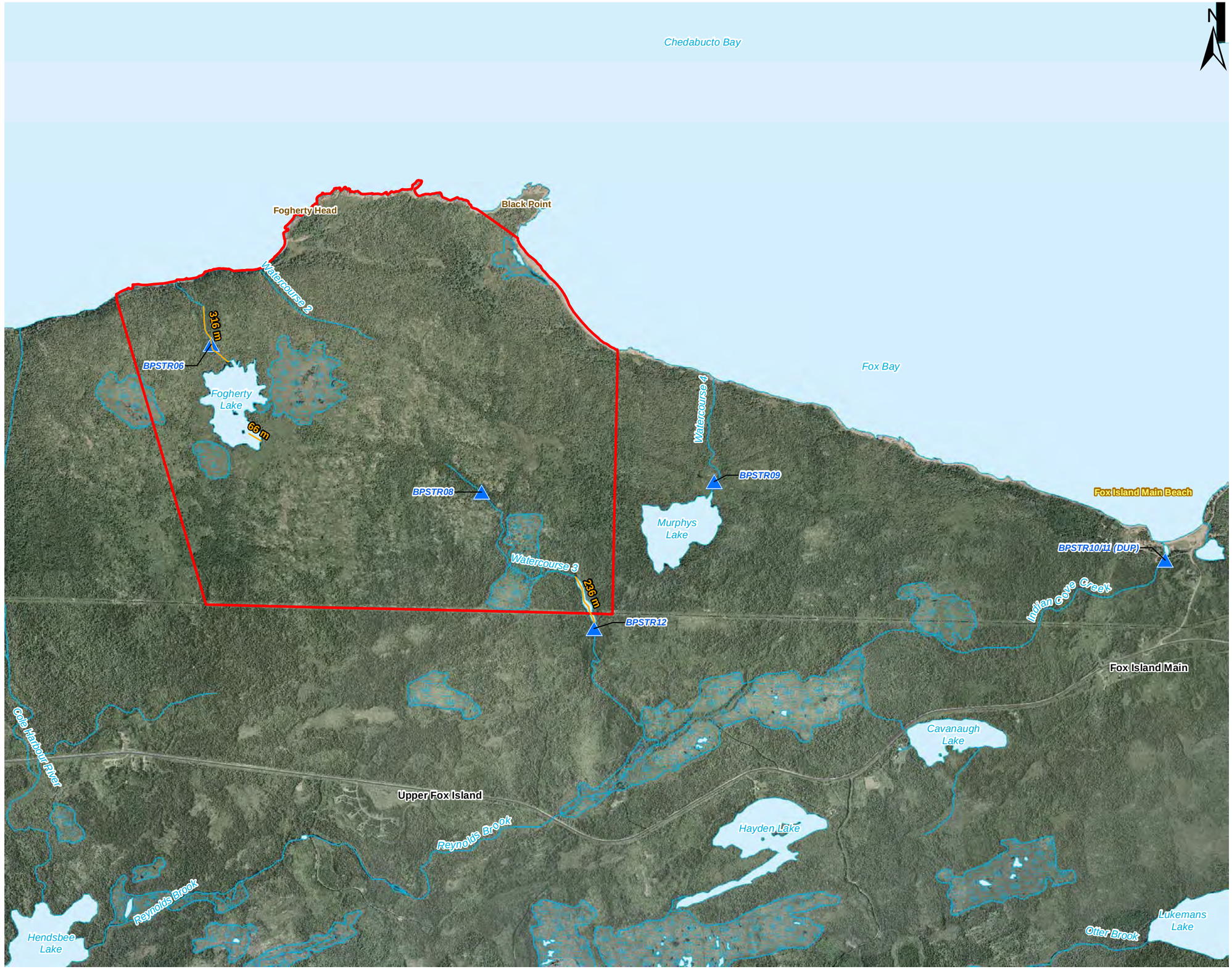
Ultimately this information was used to identify fish and fish habitat that are part of or support recreational, commercial, or Mi'kmaq fisheries.

6.5.1.1 *Field Investigations*

Aquatic field investigations were completed August 24th to 26th and September 20th to 22nd, 2010 by AMEC (**Appendix E**). Additional field data were collected on July 24th, 25th and 31st, 2014 by SLR. One water body and four unnamed watercourses were identified within the Project Area (**Figure 6.5-1**). The timing of the sampling events is summarized in the Table 6.5-1. Field investigations were completed in accordance with NBDNR/DFO New Brunswick Stream Survey and Habitat Assessment Protocol (Hooper *et al.* 1995).

Field investigations included fish community sampling, water quality samples and fish habitat mapping. The sampling program was designed to determine the presence or absence of fish within the Project Area. Fish collection methods were chosen to provide representative data for a broad range of species and size classes. Selection of sampling gear was based on waterbody size, depth and flow.

Prior to commencing fish community investigations, a Scientific Fish Collection Permit was obtained (License No. 323774) in accordance with Section 52 under the *Fisheries Act*.



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LEGEND

- Stream Sample
- Property Boundary
- Gillnetting and Electrofishing Location
- Waterbody
- Wetland
- Watercourse
- Utility Line

0 250 500 1,000 Meters

SCALE: 1:17,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

AQUATIC FIELD INVESTIGATION

October 23, 2014	Rev 1.0	Figure No. 6.5-1
Project No. 210.05913.00000		

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6.5.1.2 *Habitat Assessment*

Habitat assessments characterized water body type, stream morphology, water chemistry, bank habitat, in-water habitat, and noted migratory obstructions and potential enhancement opportunities. Each distinct habitat type within the identified watercourses and water bodies were sampled. Observations were recorded on habitat assessment forms to limit variability of observations among field staff and to assure consistent observations throughout the Project Area. Representative photographs of water bodies were taken and catalogued.

Measured field parameters included conductivity (µS/cm), water depth (m), pH, water and air temperatures (ºC) and dissolved oxygen (mg/L).

Substrate classification was based on particle diameter and grouped into six substrate categories: Boulder (>461 mm); Rock (180-460 mm); Rubble (54-179 mm); Gravel (2.6-53 mm); Sand (0.06-2.5 mm); and Fines (0.5^{-3}-0.05 mm).

Vegetation was visually assessed by estimating percent cover. Dominant aquatic plants were identified and percent cover was estimated for each species present. Riparian vegetation was also assessed for density and species.

6.5.1.3 *Fish Collection*

Fish community data were collected using gillnets, baited minnow traps, and a backpack electrofisher: gillnets in deep water environments; minnow traps in shallow near shore areas; and backpack electrofishing in shallow stream environments.

Two of the four watercourses were fished using a five minute “spot sampling” electrofishing technique. In the south end of Fogherty Lake, two multi-panel gillnets (2.5 cm to 10 cm mesh size) were deployed for two hours, and four minnow traps (baited with cat food) were set for four hours.

6.5.1.4 *Water Quality*

Surface water samples from designated locations (**Figure 6.5-1**, Table 6.5-1) were collected in laboratory bottles, placed on ice and sent for analysis to AGAT Laboratories in Dartmouth, NS. Water samples analyzed for general chemistry, total metals (including mercury), total suspended solids, and low-level phosphorus.

Table 6.5-1:
Summary of Field Investigations, 2010 and 2014

	Fogherty Lake			Watercourse 1			Watercourse 2			Watercourse 3			Watercourse 4		
	Aug 2010	Sep 2010	Jul 2014	Aug 2010	Sep 2010	Jul 2014	Aug 2010	Sep 2010	Jul 2014	Aug 2010	Sep2 010	Jul 2014	Aug 2010	Sep 2010	Jul 2014
Habitat Survey	X			X			X			X					
Backpack electrofishing	X			X			X			X					
Minnow Traps	X			X			X			X					
Gill Nets	X			X			X			X					
Water Quality	X	X	X	X	X	X	X	X	X	X	X	X		X	X

Surface water quality data were compared to the most recent version of Canadian Council of the Ministers of the Environment (CCME) Canadian Water Quality Guidelines (CWQGs) for the protection of aquatic life (CCME 2012).

The CWQGs are numerical limits or narrative statements based on the most current, scientifically defensible toxicological data available for the parameter of interest, and are meant to protect all forms of aquatic life and all aspects of the aquatic life cycles, including the most sensitive life stage of the most sensitive species over the long term. Ambient water quality guidelines developed for the protection of aquatic life provide the science-based benchmark for a nationally consistent level of protection for aquatic life in Canada (CCME 2012). Water Quality Guidelines are provided in Table 6.5-2.

Table 6.5-2:
Surface Water Quality Guidelines

Parameter	Units	CWQG
Aluminium	ug/L	5
Ammonia (total)	mg/L	0
Antimony	ug/L	NV
Arsenic	ug/L	5
Barium	ug/L	NV
Bicarbonate alkalinity	mg/L	NV
Boron	ug/L	NV
Cadmium	ug/L	0.017
Calcium	ug/L	NV
Chloride	mg/L	120
Chromium	ug/L	NV
Colour	TCU	NV
Iron	ug/L	300
Lead	ug/L	1
Magnesium	ug/L	NV
Manganese	ug/L	NV
Molybdenum	ug/L	73
Nickel	ug/L	25
Nitrate (as N)	mg/L	3
Nitrite (as N)	mg/L	0.06
Potassium	ug/L	NV
pH	pH	6.5-9
Selenium	ug/L	1
Silver	ug/L	0.1
Sodium	ug/L	NV
Sulphate	mg/L	NV
Thallium	ug/L	0.8
Total dissolved solids (TDS calculated)	mg/L	NV
Turbidity	NTU	NV
Uranium	ug/L	NV
Zinc	ug/L	30

Note: CWQGs = Canadian Water Quality Guidelines (CCME 2012); NV = no value (no established guideline value)

6.5.2 Waterbodies and Watercourses

This section summarizes the key aquatic features within the Project Area. All of the data collected in the desktop analysis and field investigations are used to provide a description of the fish and fish habitat associated within the freshwater systems. The Project site includes one waterbody (Fogherty Lake) and three watercourses. A fourth watercourse (the outlet to Murphys Lake), is located immediately east of the Property boundary. These features were identified using topographic mapping and aerial photography followed by confirmatory field investigations.

6.5.2.1 *Fogherty Lake*

Fogherty Lake is situated approximately 420 m from Chedabucto Bay, where its flow ultimately outlets. This 6.8 ha lake is shallow and surrounded by trees, barrens and exposed rock. The lake is acidic (pH 3) and tea colored. Substrate within the lake comprises coarse materials such as bedrock and boulder, with an overlaying thin organic layer.

Vegetation surrounding the lake includes leather leaf (*Chaemodaphne calyculata*), sheep laurel (*Kalmia angustifolia*), possum-haw viburnum (*Viburnum nudum*), rhodora (*Rhododendron canadense*), chokeberry (*Photina* sp.) Labrador tea (*Ledum groenlandicum*), bunchberry (*Cornus canadensis*), black spruce (*Picea mariana*) and tamarack (*Larix laricina*). Yellow water lily (*Nuphar lutea*) was observed growing in the lake.

6.5.2.2 *Watercourses*

Watercourse 1 is the outflow of Fogherty Lake located to the north of the lake and the watercourse outlets into Chedabucto Bay. This watercourse has a well-defined channel with deep water and its substrate is dominated by fine grained materials. A beaver dam is located near the upstream extent of the watercourse. Upstream of the dam, the channel is deep and wide and the substrate largely consists of fines; downstream, the channel is a relatively narrow and shallow with one area of no visible flow. The northernmost 150 m of this watercourse were not surveyed in detail, as the watercourse flows down a steep drop off into Chedabucto Bay; however, the dimensions and substrate of the downstream reaches appeared similar to the observed run portions of the channel (AMEC 2011, **Appendix E**).

Watercourse 2 originates in a gully located within the north central portion of the Project site, and flows in a northwesterly direction to discharge into Chedabucto Bay. There was a great deal of deadfall in the channel valley when it was first surveyed in 2011. The upstream reaches were dry at the time of the survey, and further downstream the stream was very shallow; this watercourse is probably intermittent. No flow was observed in 2014. The last 220 m of this watercourse was inaccessible, as it flows down a steep slope to the ocean, as does Watercourse 1. However, the dimensions and substrate of the downstream reaches appeared similar to the rest of the channel (AMEC 2011, **Appendix E**).

Watercourse 3 originates in the southeast portion of the Project site, flows south through softwood forest, riparian shrub, and bog habitat (Wetland 1), and ultimately discharges into Reynolds Brooks and then Hendsbee Lake, south of the Project site. The downstream portion of the assessed section comprises a large pool resulting from a beaver dam on the watercourse just south of the property line.

Watercourse 4 is the outlet of Murphys Lake, located outside (east of) the Property boundary. The pH values measured at this location were on the order of 2.65. Due to the pH, fish habitat was not assessed in Watercourse 4.

Indian Cove Creek, which discharges into Indian Cove at Fox Island Main, was also sampled in 2014 to provide water quality data for comparison to the Project site (Section 6.2). This creek is also referred to as Fox Island Main Creek.

6.5.3 Fish and Fish Habitat

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 are not likely to support fish species. Partial or complete barriers to Chedabucto Bay exist at outflow locations of all watercourses.

Inland freshwater fish species common to Guysborough and Canso include Speckled, Brown, and Rainbow Trout, Yellow and White Perch, Brown Bullhead, Shad, Gaspereau, Smelt, American Eel, Shiners, Sticklebacks, White Sucker, and Creek Chub. Creek Chub and Stickleback have been observed in systems with pH levels as low as 5.4 and 3.7, respectively (USGS 1982). Sensitivity of other freshwater fish to pH is as follows (Robertson & Bryan 2004):

- pH range tolerated by Trout, including Speckled Trout: 4.1 to 9.5
- Toxic limits for Perch: <4.6 to >9.5
- Toxic limits for Sticklebacks: ≤5
- Fish avoidance beyond range 5.4 to 11.4

In summary, most freshwater fish populations begin to disappear as pH approaches 5 and at pH of 4.5 most freshwaters are devoid of fish. Given the observed pH in study area waters, and the sensitivity of freshwater fish to pH, fish are not likely to persist in the study area. It should be noted that fish habitat was not assessed in Reynolds Brook, located 1.0 south of the Black Point site. For the purposes of the EIS, Reynolds Brook is assumed to support fish at some point between the wetland to the east that forms its headwaters and downstream Hendsbee Lake located approximately 3.0 km to the west.

A complete summary of freshwater habitat located within the study area is detailed in Table 6.5-3.

Table 6.5-3:
Existing Fish and Fish Habitat Summary

Waterbody	Flow	Thermal Regime	Substrate Type	Vegetation	Supports Fishery
Fogherty Lake	Permanent	Warmwater	bedrock and boulder thin organic layer	Moderate density and diversity	No
Watercourse 1	Permanent	Warmwater	fine substrate materials	Moderate density and diversity	No
Watercourse 2	Ephemeral	Warmwater	fine substrate	Moderate density and	No

			materials	diversity	
Watercourse 3	Permanent	Permanent	fine substrate materials	Moderate density and diversity	No
Watercourse 4	Permanent	Permanent	NC*	NC	No

NC* = not characterised; lack of fishery conclusion based on low pH measurements in 2014.

6.5.4 Water Quality

6.5.4.1 *Field Parameters*

In Fogherty Lake, surface water temperature was measured at 22.7ºC in August 2010. The lake had acidic pH levels of 2.94. Conductivity was very low, 43 µS/cm. The water was well oxygenated, with surface dissolved oxygen (DO) content of 8.67 mg/L in August, 2010.

Surface temperatures in the watercourses ranged from 21.4^{0}C to 14.9^{0}C, pH ranged from 3.41 to 2.94, conductivity ranged from 91.0 to 43.0 µS/cm, and DO ranged from 4.52 to 8.47 mg/L in August and September 2010 respectively (Table 6.5-4). These parameters are indicative of acidic conditions with low conductivity and DO levels.

Table 6.5-4:
Summary of Field Parameters, August 2010 Sampling Event

Parameters	Fogherty Lake	Watercourse 1	Watercourse 2	Watercourse 3
Conductivity (µS/cm)	43	62	91	53
Water Temperature	22.7	21.4	14.9	16
pH (CCME Guideline 6.5-9)	2.9	3.4	3.2	2.9
Dissolved Oxygen (mg/L)	8.7	6.7	8.5	4.5

6.5.4.2 *Conventional Parameters*

In Fogherty Lake, laboratory measured pH was 4.3, indicating acidic conditions. Conductivity was measured at 52 µS/cm, and calculated TDS was 19 mg/L. The lake is relatively soft (hardness 3.2 mg/L), with an average surface conductivity of 52 µS/cm. Average turbidity values were low (mg/L and 0.7 NTU) indicating clear waters.

The laboratory pH results for water samples from the watercourses ranged from 3.9 to 4.3 indicating acidic conditions. Conductivity ranged from 59 to 102 µS/cm, and calculated TDS ranged from 22 to 33 mg/L. The watercourses are soft (hardness 3.5 to 5.8 mg/L), and turbidity values are low (0.7 to 2.8 NTU) indicating clear waters.

6.5.4.3 *Nutrients*

Total ammonia exceeded CWQGs in Fogherty Lake (0.03 mg/L) and all four watercourses, 0.09 mg/L in watercourse 1, <0.05 mg/L in Watercourse 2 and 3, and 0.08 mg/L in Watercourse 4.

Total phosphorus was 0.035 mg/L in Fogherty Lake and ranged from 0.03 mg/L to 0.16 mg/L in the watercourses. Nitrite and nitrate were below CWQG during sampling events in Fogherty Lake and the watercourses.

6.5.4.4 *Metals*

In Fogherty Lake, several metals exceeded their guideline values and this is likely related to the acidity of the water, which promotes mineral dissolution and metal mobility. Total aluminium and cadmium were above CWQGs at 335 ug/L and 0.023 ug/L, respectively. Iron (319 ug/L), lead (2.6 ug/L), manganese (16 ug/L), and zinc (26 ug/L) all exceeded their guideline values.

Aluminium and iron exceeded guidelines in all watercourses. Cadmium and lead concentrations also exceeded guidelines at 0.019 ug/L and 1.2 ug/L, respectively in Watercourse 3.

6.6 Marine Environment

6.6.1 Physical Oceanography

6.6.1.1 *Overview*

Chedabucto Bay is approximately 45 km long from Canso to Guysborough (east to west) and approximately 20 km wide at its widest from West Arichat to Fox Island Main (north to south). The south shore of Chedabucto Bay between Canso and Guysborough is a relatively straight, steep coast with a narrow offshore shelf (CHS Chart 4335; Owens 1971). This is a shoreline resistant to wave erosion composed largely of rock platforms and low cliffs with pocket beaches of shingle and coarse sand. The amount of sediment in the littoral zone increases from east to west as indicated by the presence of spits and bars in the Salmon River - Guysborough area (Owens 1971).

This Project site is located within the Canso Ledges Ecologically and Biologically Significant Area (EBSA - **Figure 6.6-1**). This area extends from the mainland adjacent to White Head Island to Queensport along the coast of Chedabucto Bay and wraps around the Canso Peninsula. The Ledges extend approximately 10 km seaward in most areas (Hastings *et al.* 2014).

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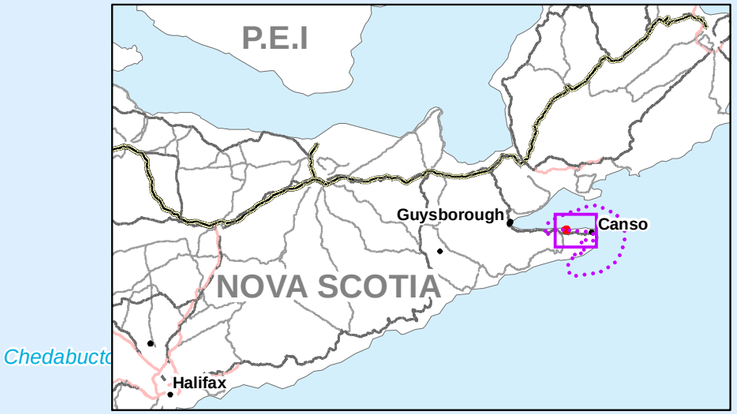

Chedabucto

Canso Islands National Historic Site of Canada

Half Island Cover Beach
Huss Head
Gaulman Point
Lower Half Island Cover Beach
Fogherty Head
Black Point
Fox Bay
Fox Island
Tickle Island
Half Island
Yellow Rocks
Fogherty Lake
Lazy Head
French Point
Durells Island
Long Point
Davis Island
Fox Island Main Beach
Indian Cove
Murphys Lake
Piscatiqui Island
Tickle Road
Union Street
Main Street
Grassy Island
Lumsdens Lake
Three Mile Lake
Highway 16
Upper Fox Island
Cavanaugh Lake
Fogartys Lake
Whistlehouse Lake
Dobsons Lake
Hayden Lake
Ice Lake
Southwest Lake
Hendsbee Lake
Lukemans Lake
Hazel Hill Lake
Trout Lake
Eastern Lookout Lake
Blowdown Lake
Walshs Lake
Charles Lake
Lookout Hill
Muskrat Lake
Spinney Gully
Swaines Lake
Young Lake
Snows Island
White Lake
Western Lookout Lake
Allens Lake
Basin Lake
Lookout Hill Rocky Lake
Eastern Lake
Third Lake
Smelt Lake
Publicover Lake
Dover Lake
Seven Island Lake
Cooeycoff Lake
Dover Road
Canso Coastal Barrens Wilderness Area
Dover Basin
Mud Lake
Big Branch Lake
St. Andrews Island
Dover Lane
Kavanaughs Lake
Mahons Lake
Grassy Lake
Highway 316
Little Branch Lake
Negrowac Lake
Little Mud Lake
Dover Harbour
Gun Cove Island
Dans Lake
Warrens Lake
Gull Lake
Valentines Lake
Round Lake
Moose Lake
Snyders Lake
Maguire Lake
Black Duck Cove
Andrews Lake
Bonnett Lake Barrens Wilderness Area

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LEGEND

- Building
- Property Boundary
- Wilderness Area
- NSDNR Wetland
- Waterbody
- Watercourse
- Contour (5m)
- Utility Line
- Designated Water Supply Area
- Natural Watershed Municipal Surface Water Supply
- Operational Non-Designated Parks and Reserves
- Canso Ledges (Ecologically and Biologically Significant Area)

0 0.5 1 2 3 Kilometers

SCALE: 1:60,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

CANSO LEDGES EBSA

October 23, 2014	Rev 1.0	Figure No. 6.6-1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

The Canso Ledges EBSA is an area of high productivity for cod, wolffish, lobster, snow crab, and historically for cod spawning. A steep seabed close to shore results in relatively high diversity of species in a relatively narrow nearshore band (e.g., lobsters, snow crab, shrimp) that are normally more dispersed when depth gradients are shallower.

Extensive and diverse marine algae contribute to the primary productivity of the area. There are fewer eelgrass beds and salt marshes in this area compared to other parts of the Nova Scotia coast due to the rocky shores which better support kelp (algae) growth (Gromack *et al*. 2010).

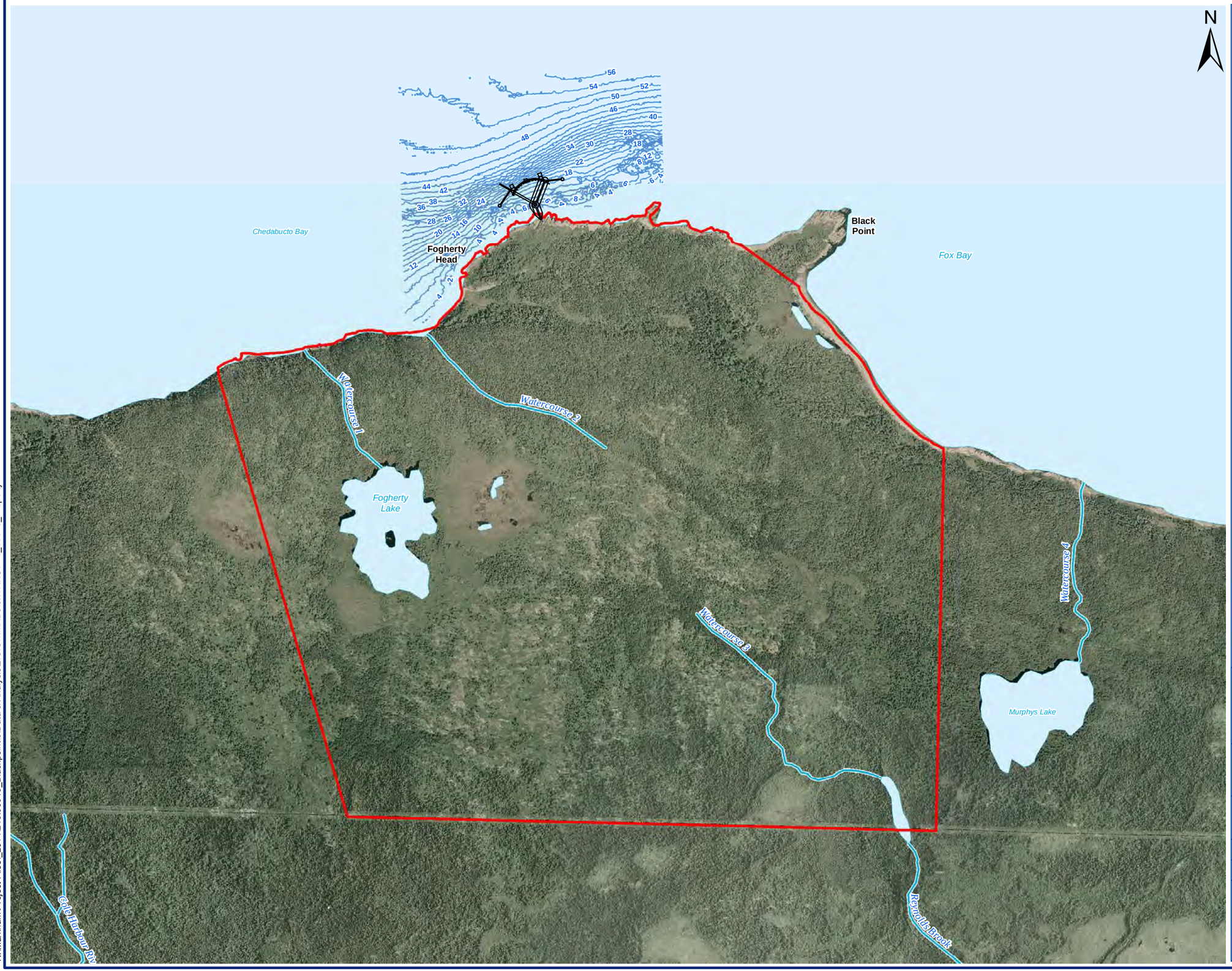
In the past Fin Whales aggregated in the Canso Ledges area in winter but whether they still use the area is unknown. Dolphins likely congregate in the area in summer. Migrating waterfowl, particularly Common Eider, use the area for spring staging (late March-April). Colonies of Great Blue Heron, Common Eider and Double-crested Cormorant breed in the area (April to late August), and probably Common and Arctic Terns as well. Deep areas off the Canso Ledges referred to as the Deep Holes of Canso serve as a deep water reserve for lobster, supporting some of the largest lobsters along the Eastern Shore (Doherty and Horsman 2007). The ecologically significant features of Chedabucto Bay as described by Hastings *et al.* (2014) are summarized at the end of this section.

6.6.1.2 *Bathymetry*

Chedabucto Bay borders the Project site to the north. Chedabucto Bay is 107.9 m deep at the mouth near Canso and has a maximum depth of 146 m at the seaward extent of the Project Area (Canadian Hydrographic Service Charts 4013 and 4321). The area is tidally dominated with a high tidal to freshwater ratio of approximately 487:1 (Gromack *et al.* 2010). Chedabucto Bay has a flushing time of 295.3 hours (DFO 2008a) and has been classified as an intermediate pelagic bay (Greenlaw 2009). Chedabucto Bay has a watershed drainage area of 2,148.4 km^2 (DFO 2008a).

The seabed descends to a depth of 30 m within approximately 300 m from the shoreline where the marine terminal is proposed (**Figure 6.6-2)**. Along the south shore of Chedabucto Bay, the coastline forms a relatively straight fault line-scarp with low, resistant rock cliffs and intertidal platforms. There is an extensive bed of *Ascophylum nodosum* (a common brown alga sometimes referred to as Rockweed) in the area.

Water depth ranges from 0 to approximately 15 m in the area proposed for the rubble mound structure and ranges from approximately 16 m to 22 m deep where the mooring and berthing structures will be located.



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LEGEND

- Property Boundary
- Waterbody
- Watercourse
- Utility Line
- Bathymetry (2m)

0 100 200 400 Meters

SCALE: 1:12,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT QUARRY

PROPERTY BOUNDARY AND TERMINAL LOCATION

October 23, 2014	Rev 1.0	Figure No. 6.6-2
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

6.6.1.3 *Hydrography*

Currents

Dominant currents in the Study Area originate in St Lawrence River and the Gulf of St Lawrence (**Figure 6.6-3**). The Nova Scotia Current is the primary inflow, originating in the Gulf of St. Lawrence and entering the region through Cabot Strait. This current has a general south-westward drift over the Scotian Shelf, passing across the mouth of Chedabucto Bay and continuing into the Gulf of Maine (Herbert *et al.* 2012). Tidal currents in Chedabucto Bay off the Project Area are approximately 2.6 knots (0.51 m/s).

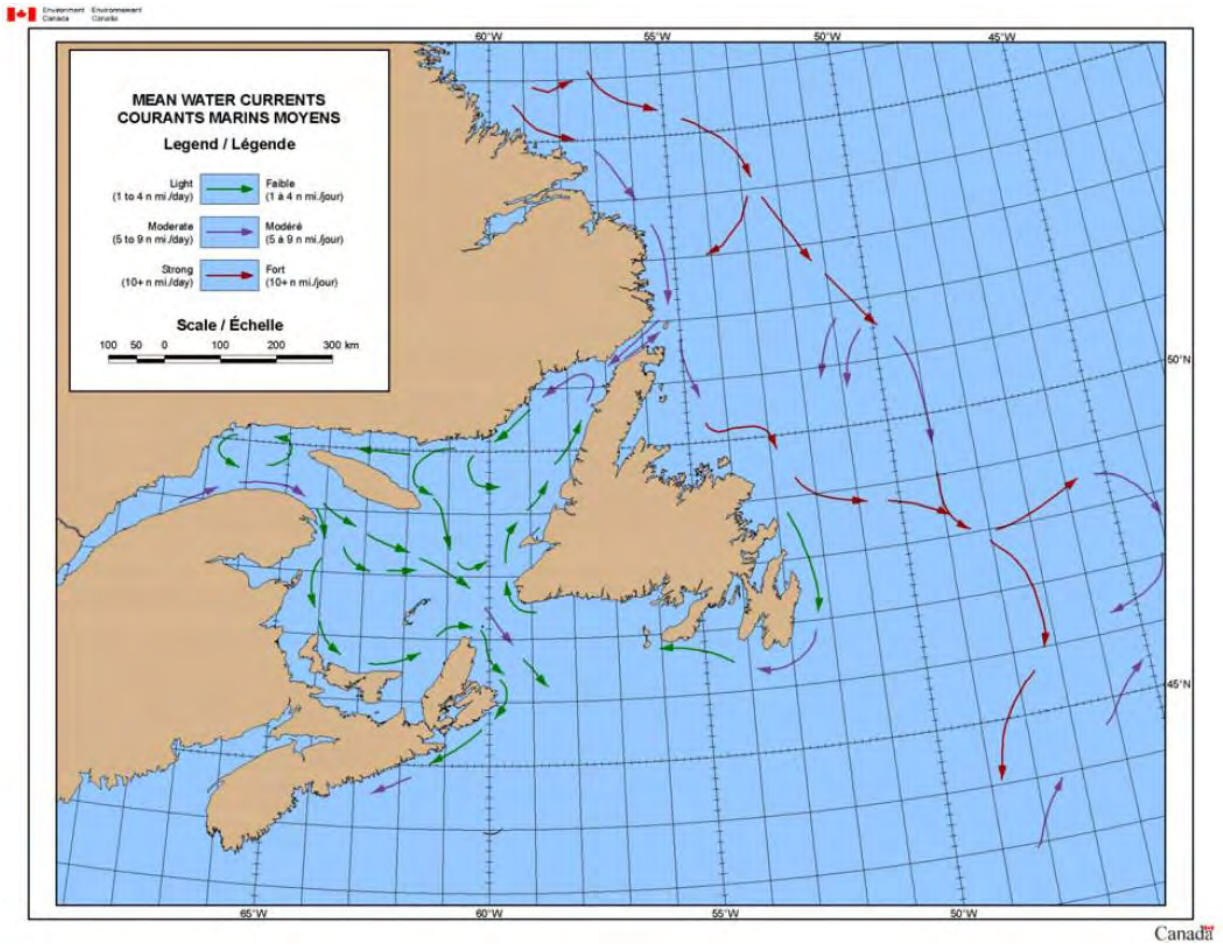


Figure 6.6-3:
Surface Currents on the East Coast

Source: CCG 2012.

Tides

Chedabucto Bay experiences semi-diurnal tides with mean tidal ranges of 1.28 m (Canso) to 1.37 m (Guysborough). The highest tides are about 2.0 m at Canso and slightly less (1.95 m) at Guysborough (Owens 1971).

Wind and Waves

Wind data summarized from a meteorological station at Canso from 1964 to 1970 show that the highest wind speeds are mainly from the north-west (see also Figure 6.3-1) and occur from December to February (Owens 1971). Table 6.6-1 summarizes average and maximum winds recorded at Canso from 1964 to 1970[4]. Anemometer data collected at Canso (for a recording period of less than 10 years) indicates a maximum hourly wind speed from the northwest of about 97 kph and 80 kph from the east (CCG 1981); these values are higher than those reported in Table 6.6-1.

Table 6.6-1:
Average and Maximum Winds (Canso 1964 – 1970)

Month	Average of the Monthly Mean Speeds (kph)	Prevailing Direction	Average of the Monthly Maximum Recorded Speed (kph)	Direction Dominant
Jan.	23.01	NW	67.59	NW/NW
Feb.	23.82	NW	64.37	NW
Mar.	22.21	NW	56.33	NE
Apr.	21.57	NW	53.11	NW/SW
May	20.44	SW	53.11	SW
June	18.67	SW	46.67	SW
July	17.06	SW	43.45	SW
Aug.	19.15	SW	46.67	SW
Sept.	18.34	SW	48.28	SW
Oct.	20.92	SW	54.72	SE
Nov.	22.05	NW/SW	57.94	NE
Dec.	23.82	NW	61.15	SE

Source: Owens 1971

[4] Owens (1971) does not specify whether these are annual hourly maximum winds or hourly maximums over the entire data set.

Table 6.6-2:
Return Periods for Winds at Canso, NS

Return Period (years)	2	5	10	15	20	25	50	100
Wind Speed (knots/kph)	46/85	51/94	55/102	58/107	59/109	60/111	64/119	68/126

Source: CCG 1981.

Table 6.6-3 provides more recent wind data collected at Hart Island and Eddy Point, NS. The table lists the maximum wind gusts recorded each month over the course of several years.

Table 6.6-3:
Maximum Wind Speeds, Hart Island and Eddy Point, NS

Hart Island (2005-2014) Station 820318, Elevation 8.20 m

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	2014			2013	
Jan	32	102	Jan	20	93
Feb	22	107	Feb	21	106
Mar	8	95	Mar	28	115
Apr	5	83	Apr	22	70
May	19	67	May	22	74
June	31	67	June	22	74
July	21	83	July	22	69
Aug	23	72	Aug	31	89
Sept	16	89	Sept	20	63
Oct	30	78	Oct	31	74
Nov	18	102	Nov	32	102
Dec	20	85	Dec	10	107
	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	2012			2011	
Jan	29	93	Jan	23	95

Feb	22	100	Feb	30	109
Mar	20	89	Mar	30	91
Apr	14	89	Apr	21	93
May	22	72	May	3	74
June	14	69	June	19	78
July	23	69	July	21	76
Aug	22	70	Aug	19	89
Sept	13	82	Sept	34	85
Oct	26	82	Oct	32	104
Nov	29	80	Nov	19	89
Dec	27	95	Dec	22	119

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	2010			2009	
Jan	8	96	Jan	31	120
Feb	31	80	Feb	31	95
Mar	31	70	Mar	1	80
Apr	32	74	Apr	22	74
May	23	82	May	30	95
June	31	95	June	24	96
July	19	63	July	15	85
Aug	21	57	Aug	29	93
Sept	16	109	Sept	2	70
Oct	12	98	Oct	1	83
Nov	29	82	Nov	36	96
Dec	14	117	Dec	11	95

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	2008			2007	
Jan	13	87	Jan	N/A	N/A
Feb	17	91	Feb	N/A	N/A
Mar	29	106	Mar	N/A	N/A
Apr	28	76	Apr	N/A	N/A
May	19	82	May	N/A	N/A
June	32	72	June	N/A	N/A
July	17	56	July	N/A	N/A
Aug	36	80	Aug	N/A	N/A
Sept	31	56	Sept	30	72
Oct	1	76	Oct	32	74
Nov	11	106	Nov	19	124
Dec	12	132	Dec	31	102

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	2006			2005	
Jan	N/A	N/A	Jan	28	113
Feb	N/A	N/A	Feb	32	76
Mar	N/A	N/A	Mar	34	80
Apr	N/A	N/A	Apr	22	70
May	N/A	N/A	May	34	98
June	N/A	N/A	June	20	69
July	N/A	N/A	July	22	74
Aug	N/A	N/A	Aug	20	82
Sept	N/A	N/A	Sept	31	82

Oct	N/A	N/A	Oct	9	85
Nov	N/A	N/A	Nov	N/A	N/A
Dec	N/A	N/A	Dec	N/A	N/A

Eddy Point (1977-1984) Station 8201716 Elevation 66.10

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	1984			1983	
Jan	32	76	Jan	15	81
Feb	31	74	Feb	32	100
Mar	32	93	Mar	33	87
Apr	8	65	Apr	8	69
May	20	61	May	21	72
June	33	69	June	18	46
July	18	50	July	8	57
Aug	N/A	N/A	Aug	31	67
Sept	N/A	N/A	Sept	18	52
Oct	27	46	Oct	1	61
Nov	32	70	Nov	15	80
Dec	13	74	Dec	32	93

	Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)		Direction of Max. Gust (10's Degrees)	Max. Gust (km/h)
	1982			1981	
Jan	12	81	Jan	21	102
Feb	32	83	Feb	16	83
Mar	17	70	Mar	12	74

Apr	21	67	Apr	22	74
May	22	56	May	32	70
June	20	57	June	18	56
July	32	52	July	33	56
Aug	32	74	Aug	21	54
Sept	33	54	Sept	4	59
Oct	35	63	Oct	19	65
Nov	31	78	Nov	15	74
Dec	32	93	Dec	21	80

	Direction of Max. Gust (10's Degrees)	**Max. Gust (km/h)**		**Direction of Max. Gust (10's Degrees)**	**Max. Gust (km/h)**
	1980			**1979**	
Jan	16	83	Jan	32	83
Feb	31	78	Feb	30	106
Mar	15	81	Mar	17	93
Apr	9	78	Apr	15	70
May	32	76	May	31	67
June	19	65	June	22	56
July	33	65	July	27	59
Aug	31	65	Aug	18	57
Sept	22	63	Sept	20	83
Oct	16	65	Oct	21	93
Nov	32	91	Nov	22	52
Dec	29	72	Dec	29	85

	Direction of Max. Gust (10's Degrees)	**Max. Gust (km/h)**		**Direction of Max. Gust (10's Degrees)**	**Max. Gust (km/h)**
	1978			**1977**	

Jan	15	94	Jan	14	89
Feb	7	74	Feb	18	78
Mar	29	80	Mar	33	93
Apr	33	74	Apr	28	80
May	18	85	May	32	67
June	19	59	June	21	56
July	21	48	July	17	59
Aug	34	50	Aug	17	56
Sept	30	67	Sept	33	74
Oct	16	85	Oct	15	69
Nov	22	78	Nov	18	85
Dec	29	83	Dec	15	85

Source: GC 2015.

As noted in Section 6.3.2, wave heights at the MSC50 grid point near the Project (45.4N, 61.1W, approximately 5 km northeast of the site) were less than 2 metres in height 92.77% of the time whereas waves from 2 to 3 metres and 3 to 4 metres were present 5.96% and 1.02% of the time, respectively. Waves in excess of 4 metres were relatively minor and only present over 0.25% of the year on average. The annual wave rose in presented in **Figure 6.6-4** while wave direction and intensity is compiled in Table 6.3.6.

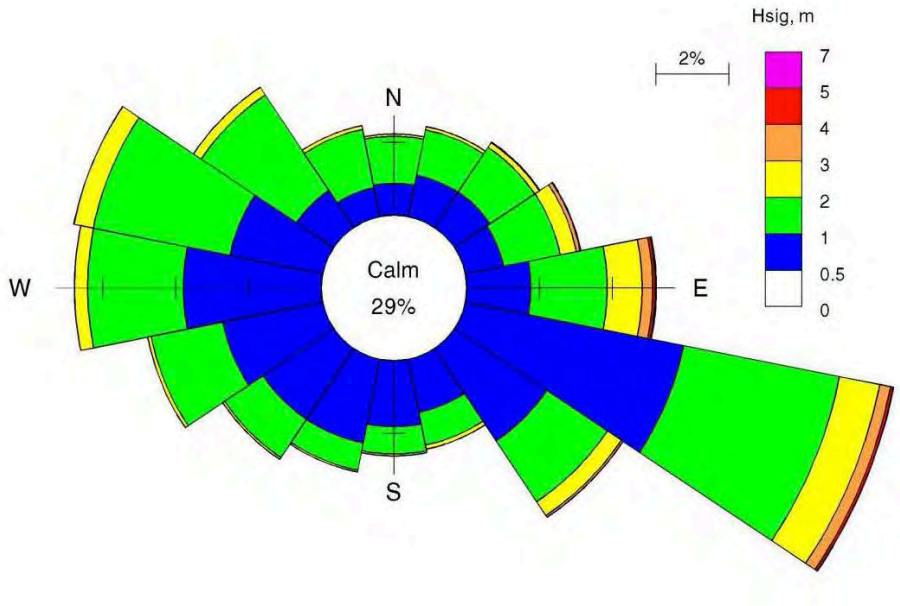


Figure 6.6-4:
Annual Wave Rose (45.4N, 61.1W)

Source: MSC50 Environment Canada data in CBCL 2004

Chedabucto Bay has a broad opening the east and the bathymetry at the mouth of the Bay permits ocean waves to penetrate deep into the Bay. This suggests that the most severe conditions within Chedabucto Bay will be comparable to those for the Scotian Shelf area off Chedabucto Bay. Using 10 years of ship-observed wave data for the Scotian Shelf Neu (1980, reported in CCG 1981) found the largest significant wave height for a one-year period to be 8.6 m and for 10 years, 11.7 m. The significant wave height is taken to be the average of the highest one-third of all the wave heights present. The maximum wave height is much higher than the significant height; in the open ocean the ratio of maximum wave height to significant wave height ranges from about 1.8 to 2.0.

Storm surge is described in Section 8.0 Effect of the Environment on the Project.

Ice

Ice typically forms around Prince Edward Island, along the north shore of Nova Scotia and along the western shore of Cape Breton in January and persists until early April (CCG 2012). In these areas, ice ridging can be extensive but seldom exceeds 2 m in height. Typically the southern and eastern shores of Nova Scotia and Cape Breton, including Chedabucto Bay, remain ice free over the winter although ice may in fact form or move into the Bay on occasion (**Figure 6.6-4**; CCG 2012).

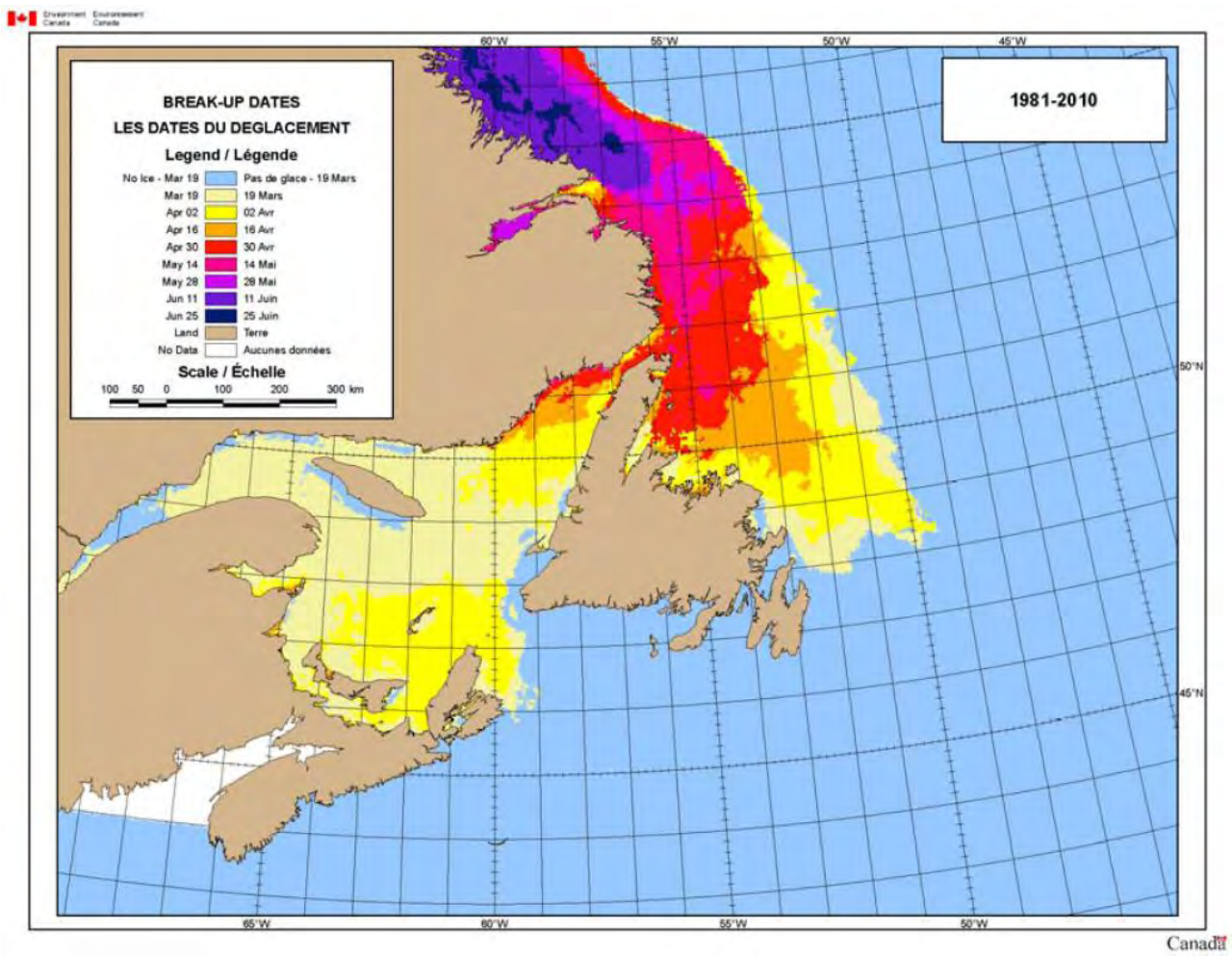


Figure 6.6-5:
Variability of Ice Extent on the East Coast

Source: CCG 2012.

There has been essentially no ice on the Scotian Shelf from April 2009 until the end of the season in May 2012. The ice volume during 2012 was the fourth lowest in the 51 year record. Only 1969, 2010 and 2011 had lower coverage and volume. The periods 1987-1993 and 2003-2004 were predominantly colder than normal, and 1999-2000 and 2010-2012 were warmer than normal (Hebert *et al*. 2012). The ice coverage varies considerably from year to year but in general, there were normal to above normal conditions from 1980/81 to 1994/95 then below normal conditions from 1995/96 to 2009/10 (CCG 2012).

6.6.2 Marine Biology

6.6.2.1 *Methodology*

Available reports and maps, consultation with resource agencies, and on-site investigations form the basis of information for characterizing existing conditions for key fish and fish habitat features in the marine environment in the Project Area as defined in Section 5.0. **Appendix J**

presents supporting field notes and other documentation that helps to characterise the marine biological environment.

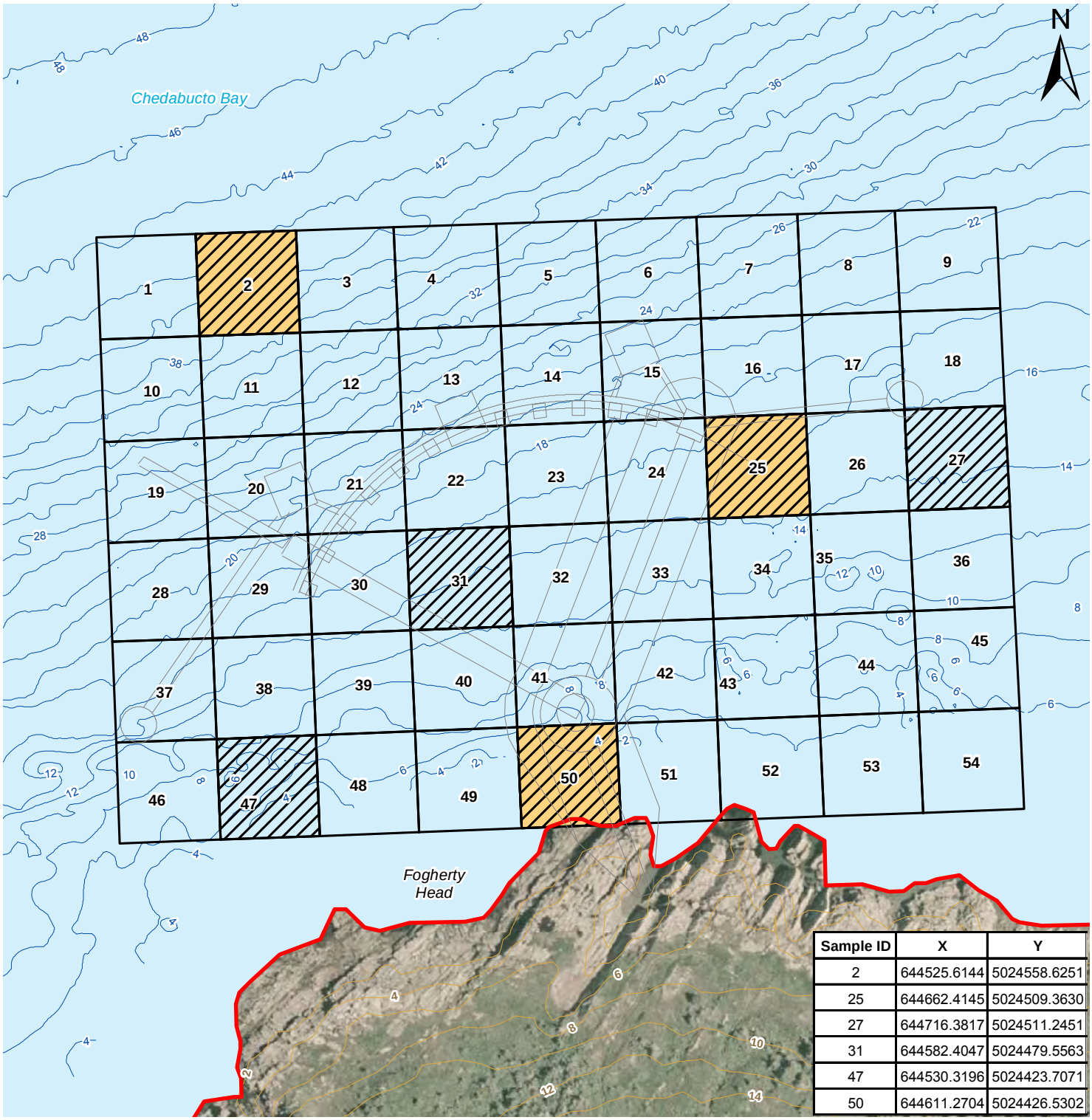
Information on fish and fish habitat collected for the marine environment will be used to:

- Characterize habitat type, function and fish presence;
- Form the knowledge base to assess project impacts;
- Inform and recommend mitigation strategies;
- Form the basis upon which to characterize residual effects; and
- Form the basis upon which to identify a suite of measures to offset serious harm to fish and fish habitat.

The Study Area has been defined by considering Project-environment interactions and includes the Project Area (i.e., the Property boundary including the seabed Crown lease), Adjacent Areas and Chedabucto Bay. The most detailed studies occurred within the Project Area. Efforts were made to characterize representative habitat types in the Adjacent Areas and Chedabucto Bay. Ultimately this information was used to identify fish and fish habitat that are part of or support recreational, commercial, or Mi'kmaq fisheries.

Field Investigations

The area of detailed aquatic investigation included the zone proposed for installation of the marine terminal. The zone extended 240 m along the shoreline and 165 m seaward, perpendicular to the shore, for a total area of 39,600 m^2. For comparison, the marine terminal rubble mound is expected to occupy about 11,000 m^2 of the seabed. This larger area was characterized by underwater video surveys. Video recordings of approximately 1200 meters of sea floor was compiled along 6 transects and reviewed to characterize the existing seabed. **Figure 6.6-6** presents the video transect locations. Transect 1 (T1), T2, and T3 each measured 250 m and were oriented parallel to the shoreline while T4, T5, and T6 each measured 150 m and extended perpendicular from the shoreline. Waypoints for the start and finish of each transect were measured and recorded using a handheld GPS. The underwater observations extend approximately 1 m on either side of the transect line.



Sample ID	X	Y
2	644525.6144	5024558.6251
25	644662.4145	5024509.3630
27	644716.3817	5024511.2451
31	644582.4047	5024479.5563
47	644530.3196	5024423.7071
50	644611.2704	5024426.5302

LEGEND

- Property Boundary
- Benthic Invertebrate Sampling Location
- Marine Sediment Sampling Location
- Sampling Location Grid
- Waterbody
- Bathymetry (2m)
- LIDAR Contour (2m)

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014;

0 12.5 25 50 Meters

SCALE: 1:1,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT SURFACE WATER ASSESSMENT

MARINE SEDIMENT AND BENTHIC INVERTEBRATE SAMPLING LOCATIONS

October 23, 2014 | Rev 0.0 | Figure No. 6.6-6

Project No. 210.05913.00000

SLR global environmental solutions

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Marine field investigations were completed between August 31 and September 3, 2010 within the proposed footprint of the marine infrastructure. The underwater surveys captured information relating to the presence and absence of benthic invertebrates, macrofaunal and macrofloral species. Substrate characteristics, algae cover, and incidental fish were also documented. Observations along the video transects were made for each 5 m segment.

The following observations were made for each 5 m increment along each transect:

- Visual estimate of substrate grain size distribution (in order of dominance);
- Identification and abundance of macrofaunal species; and
- Identification and percent coverage of macrofloral species.

In order to review the 5 m transects and assess species presence and abundance, four categories were developed as described by AMEC in **Appendix J** (Table 6.6-3).

Table 6.6-4:
Field Investigation Methodology

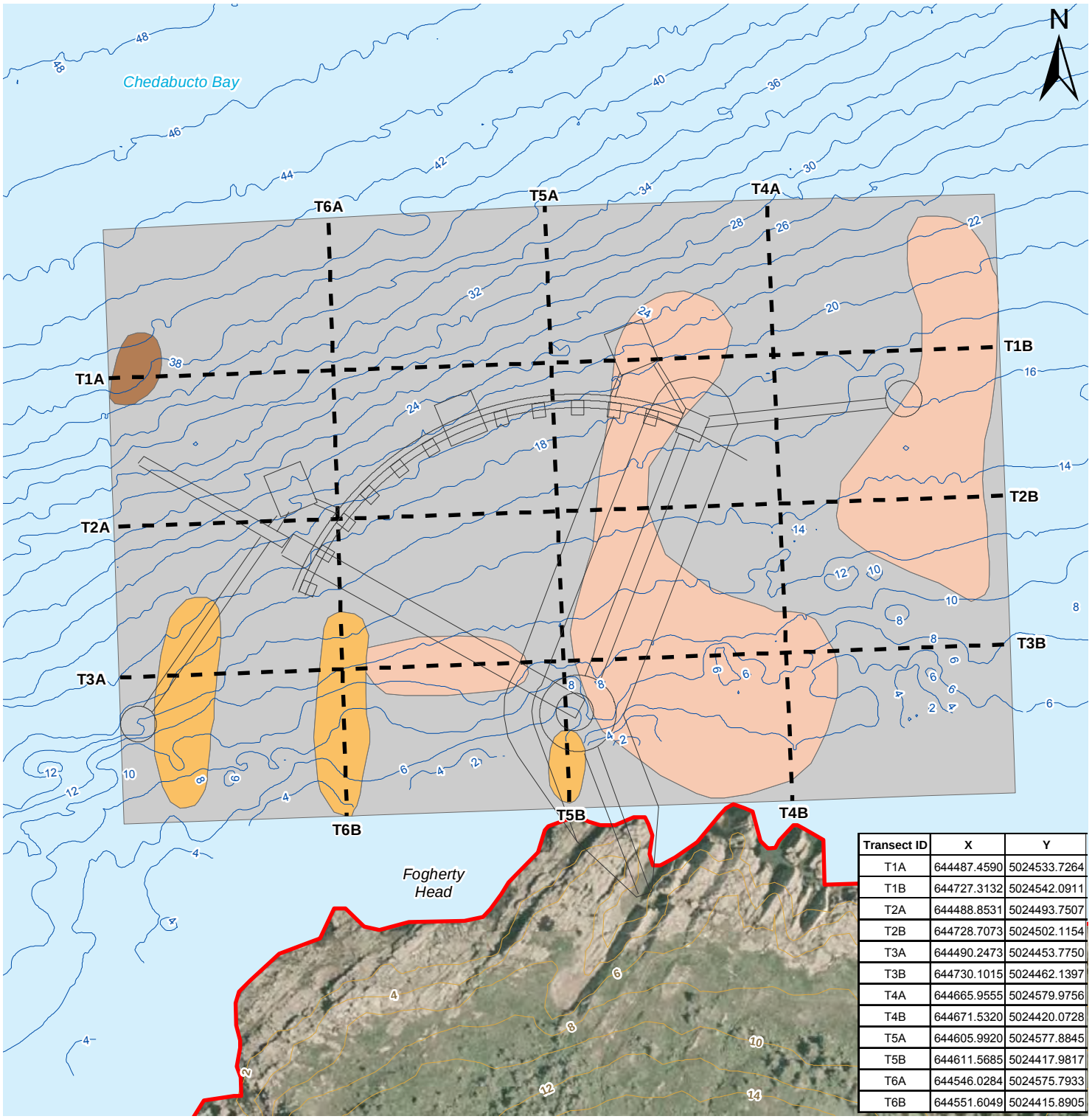
Category		Description
A	Abundant	Numerous (not quantitative) observations made throughout the entire 5 m segment.
C	Common	Numerous (not quantitative) observations made intermittently along the 5 m segment.
O	Occasional	Quantifiable observations made intermittently along the 5 m segment.
U	Uncommon	Quantifiable observations made infrequently along the 5 m segment.

Marine Invertebrate Community Survey

Benthic invertebrates are animals that colonize on or near the sea bottom in aquatic environments. Benthic invertebrates are considered effective indicators of ecosystem conditions because

a. they have limited mobility and are therefore constantly exposed to the effects of pollution;
b. they are reasonably long-lived so the effects of environmental stressors can be quantified;
c. short-term changes in environmental conditions do not dictate sampling results; and
d. they are a well-documented, aquatic ecological indicator with various tolerance levels.

To facilitate the collection of benthic invertebrates, a sampling grid was plotted over a map of the marine terminal footprint, and sampling locations within the footprint were selected randomly using a random number generator (**Figure 6.6-7**). In total, six benthic invertebrate sampling stations were used to characterize existing conditions and inform assessment of effects.



Transect ID	X	Y
T1A	644487.4590	5024533.7264
T1B	644727.3132	5024542.0911
T2A	644488.8531	5024493.7507
T2B	644728.7073	5024502.1154
T3A	644490.2473	5024453.7750
T3B	644730.1015	5024462.1397
T4A	644665.9555	5024579.9756
T4B	644671.5320	5024420.0728
T5A	644605.9920	5024577.8845
T5B	644611.5685	5024417.9817
T6A	644546.0284	5024575.7933
T6B	644551.6049	5024415.8905

LEGEND

- Property Boundary
- LIDAR Contour (2m)
- Transect Location
- Bathymetry (2m)
- Waterbody

Substrate

- Boulder
- Cobble
- Rock
- Sand

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.
Basedata: Nova Scotia Natural Resources, downloaded, June 2014;

0 12.5 25 50 Meters

SCALE: 1:1,500
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

MORIEN RESOURCES AND VULCAN MATERIALS

BLACK POINT SURFACE WATER ASSESSMENT

BENTHIC HABITAT VIDEO SURVEY
TRANSECT LOCATIONS AND SUBSTRATE

October 23, 2014 | Rev 0.0 | Figure No. 6.6-7

Project No. 210.05913.00000

SLR global environmental solutions

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On September 1, 2010 Connors Diving Services performed the sample collection. The diver placed a 0.25 m^2 quadrate on the substrate surface and used a small container to penetrate the substrate, to a minimum depth of 5 cm. Several litres of sediment were collected at each of the six sampling locations. The sediment was placed in a clean 20 L bucket, brought to surface, and thoroughly mixed. Four litres of each sample was measured for the benthic invertebrate sample.

The samples were sieved though a 1.0 mm screen using filtered seawater to remove the risk of osmotic shock to any organisms. The samples were preserved with 70% isopropanol in 1 L glass Mason jars. Each jar was inverted several times to insure proper mixing and preservation.

Samples were analyzed by BioTech Inc. (Smithtown, NB) for benthic invertebrate identification and enumeration.

Statistical analysis of the benthic invertebrates' samples included:

- Benthic invertebrate identification and enumeration for each station;
- Number of species and number of individuals per species for each station;
- Number of species per station by major taxonomic group; and
- Density (number of organisms/m^3) and biomass (g/m^2 wet weight) for each station.

Marine Sediment Sampling Program

The sediment sampling program and analysis was completed in accordance with Environment Canada's publication *Guidance Document on Collection and Preparation of Sediments for Physiochemical Characterization and Biological Testing* (December 1994).

In order to assess disposal options for sediment potentially removed during the construction of the Project, the analytical sample results were compared to the following:

- Canadian Environmental Protection Act (CEPA) Disposal at Sea Regulations (formerly the Ocean Dumping Control Act);
- Canadian Council of Ministers of the Environment (CCME) Probable Effects Levels (PELs) for marine/estuarine sediment;
- CCME Soil Quality Guidelines (SQGs) for the Protection of Environment and Human Health in agricultural, residential/parkland, and commercial/industrial applications; and
- Atlantic Risk-Based Corrective Action (RBCA) Tier 1 Version 2.0 Risk-Based Screening Levels (RBSLs).

The sediment samples were collected concurrently with the benthic invertebrate sampling program. On September 1, 2010, a total of six marine sediment samples were collected from the same well-mixed benthic invertebrate samples within the proposed footprint of the marine terminal.

Two 250 ml jars of sediment were collected at each station. A duplicate jar of sediment was collected for each of the stations to safeguard against loss or damage during transport. All samples were sent to Maxxam Analytics Inc. for chemical analysis. Maxxam is accredited with the Standards Council of Canada. Three of the six samples (GQ 02, GQ 25, and GQ 50; **Figure 6.6-7**) were analyzed for parameters listed in **Appendix J**.

6.6.2.2 *Results*

This section summarizes key aquatic features within the Project Area. All data collected in the desktop analysis and field investigations are used to provide a description of marine ecosystems.

Marine Environment

The marine environment is characterized using information from existing reports and supplemented by field investigations. As noted water depth in Chedabucto Bay is approximately 108 m at the mouth near Canso. Chedabucto Bay is classified as an intermediate pelagic bay with a drainage area of 2,148 km^2. The intertidal and adjacent sublittoral areas are subject to the effects of scouring by winter ice and shifting cobblestone material. Chedabucto Bay supports productive and diverse fisheries (Gromack *et al.* 2010).

Substrate type and vegetative cover are key components that contribute to the ecological structure of the marine environment. Substrate type and percentage of cover facilitate development and growth and thus influence the diversity and abundance of floral and faunal species. Within the area of potential Project impact, the marine substrate is dominated by coarse materials including cobble, rock, and large boulders (**Figure 6.6-7)**. Small areas of finer grained substrates consisting primarily of sand were documented along certain transects.

Within the Project Area, algal cover was sparse (0-10%) in deeper waters and increased to 50-90% cover in the near shore areas. The algal canopy is dominated by the brown algal species black whip weed (*Chordaria flagelliformis*), bladderwrack (*Fucus sp.*), and sea colander (*Agarum clathratum*). Other species present in lesser densities included sugar kelp (*Laminaria saccharina*), tube weed (Polysiphonia lanosa), an encrusting red alga (*Leptophyllum sp.*), Irish moss (*Chondrus crispus*), a brown alga (*Pilayella littoralis*), a green alga (*Acrosiphonia arcta*), and a red alga (*Plumaria plumosa*). Of note, green fleece (*Codium fragile*), an invasive species in Nova Scotia (Invasive Species Alliance of Nova Scotia, 2011), was noted along T2. This species has been previously reported around the Canso area (Watanabe *et al.* 2010).

6.6.2.3 *Benthic Habitat and Communities*

The results of the six benthic samples reflect a benthic community dominated by annelid worms (polychaetes) and mollusks (gastropods). The most common identified polychaetes include the worm *Aricidea* (syn. *Acmira*) catherinae, sinistral spiral tubeworm (*Spirobis borealis*) and cirratulids (*Tharyx spp.*). The dominant bivalves included the common tortoiseshell limpet (*Tectura testudinalis*) and interrupted turbonille (*Turbonilla interrupta*). A complete list of identified species at the six sampled locations is included in **Appendix J**.

The benthic invertebrate assemblage was highest at Station 2 (GQ 25) and lowest at Station 4 (GQ 31): 318 and 109 individuals respectively. The benthic invertebrate assemblage at Station 1 (GQ 02) contained the greatest number of taxa and Station 4 contained the lowest number of taxa (GQ31); 47 and 17 taxa respectively. Station 2 is the deepest of the 6 Stations. Due to the presence of a diverse community assemblage collected at this site, dissolved oxygen content and food sources are likely not limiting factors.

6.6.2.4 *Marine Sediment Quality*

As noted above, results of sediment quality data collections were compared against the relevant CEPA, CCME, SQGs, RBCA sediment quality guidelines. Three of six collected sediment samples were analyzed. The results of the analysis are summarized in **Appendix J**. The complete set of analytical results, including laboratory Quality Assurance/Quality Control and Certificates of Analyses for all parameters tested are provided in **Appendix J**.

No exceedance was noted for any of the above mentioned guidelines for any parameters in the three samples. Two samples (GQ 25 and GQ 50) were predominantly gravel (76-82%) with lesser amounts of sand (16-19%), silt (1-3%), and clay (<1-1%). Sample GQ 02 was a mix of gravel (51%) and sand (42%) with lesser amounts of silt (5%) and clay (3%). Total carbon content in the three samples collected and analyzed ranged from 0.6 to 1.62 g/kg (AMEC 2011 in **Appendix J**).

6.6.2.5 *Fish Community*

Chedabucto Bay is a cool water marine environment which supports a diverse fish community. 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 spawn. The fish and fish habitat within Chedabucto Bay are valued for their ecological services as well as economic benefits. Fishing is regulated to fixed gear only in Chedabucto Bay (except for scallops) in order to preserve the high marine diversity and productivity. A number of species listed under SARA

and assessed by COSEWIC are found in the Bay (Gromack *et al.* 2010). Please see Section 6.7 for a description of marine Species at Risk.

Chedabucto bay supports shellfish, demersal fish, and pelagic fish populations (**Appendix J**). Demersal fish are those that occupy habitat near the sea bottom, while pelagic fish are associated with habitat within the water column and closer to the surface. The Bay supports more than 50 fish species, however only two fish species were noted along the transects during field investigations. Species present in the Project Area included Cunner (*Tautogolabrus adspersus*) and Shorthorn Sculpin (*Myoxocephalus scorpius*). Cunner and Sculpin are demersal fish and often congregate around wharves. Neither of these species are part of a recreational, commercial or Mi'kmaq fishery. Fox Island Beach, located several kilometers east of the Project area, was sampled in 2005 and 2006 for fish abundance and diversity of juvenile fish. This sampling resulted in the capture of Sand Lace, Hake species, and Grubby. These species are typically associated with sand substrates, which are more or less absent from the immediate Project Area location. For a complete list of species found in the Bay, please refer to **Appendix J**.

The hard bottom and algal cover present within the Project Area provides habitat for many invertebrate species (Table 6.6-4). The most common species noted from the video transects include deep sea scallop (*Placopecten magellanicus*), blue mussel (*Mytilus edulis*), green sea urchin (*Strongylocentrotus droebachiensis*), and American lobster (*Homarus americanus*). Other invertebrate species observed along the transects included American oyster (*Crassostrea virginica*), northern rock barnacle (*Semibalanus balanoides*), Bowerbank's halichonidria (*Halichondria bowerbanki*), frilled anemone (*Metridium senile*), periwinkle (*Littorina sp.*), sea cucumber (*Cucumaria frondosa*), sea peach (*Holacynthia pyriformis*), sea star (*Asterias sp.*), and waved whelk (*Buccinum undatum*). Due to the depths of the surveyed areas divers had to move at speed greater than optimal for characterization. The combination of the speed of the diver's movement and a cobble bottom resulted in difficulty discerning the presence of small invertebrates such as periwinkles.

Table 6.6-5:
Invertebrate Occurrence in Strait of Canso – Inhabitants Bay – Chedabucto Bay Area

Common Name	*Scientific Name*	Present During Field Investigations (AMEC 2011)
American Lobster	*Homarus americanus*	✓
Sea Scallop	*Placopecten magellanicus*	
Snow Crab	*Chionoecetes opilio*	
Rock Crab	*Cancer irroratus*	
Hermit Crab	*Pagurus bernhardus*	
Green Crab	*Carcius maenas*	
Pink Shrimp	*Penaeus duorarum*	
Northern Shrimp	*Pandulus borealis*	
American Oyster	*Crassostrea virginica*	✓
Soft shell clams	*Mya arenaria*	
Bar clams	*Spisula solidissima*	
Blue mussel	*Mytilus edulis*	✓

Horse mussel	*Modiolus modiolus*	
Green Sea Urchin	*Strongylocentrotus droebachiensis*	
Northern Rock Barnacle	*Balanus balanoides*	
Bowerbank's Halichonidria	*Halichondria bowerbanki*	✓
Frilled Anemone	*Metridium senile*	✓
Periwinkle	*Littorina sp.*	✓
Sea Cucumber	*Cucumaria frondosa*	✓
Sea Peach	*Holacynthia pyriformis*	✓
Sea Star	*Asterias sp.*	✓
Waved Whelk	*Buccinum undatum*	✓

6.6.2.6 *Species at Risk*

No freshwater fish Species at Risk were encountered within the Project area during field investigations. Marine Species at Risk including fish and marine mammals are described in full in Section 6.7.

6.6.3 Ecological Summary

Hastings *et al.* (2014) summarize the ecologically and biologically significant attributes of the Canso Ledges ESBA. Although the ESBA wraps around the Canso peninsula and thus includes areas along the south shore of the peninsula that are outside of the area potentially impacted by the Project, many of these attributes specifically reference Chedabucto Bay. The attributes below are extracted from Hastings *et al.* (2014):

<u>Uniqueness</u>

- Chedabucto Bay is unique in its size and depth.
- A tongue of deep water is present on northern shore of the peninsula.
- The Bay supports rare coastal habitat for Northern Shrimp.

<u>Aggregation</u>

- The mouth of Chedabucto Bay has been noted for its abundance and diversity of fish.
- Historic importance for Atlantic Cod (Endangered – COSEWIC). May still be important area for this species.
- Aggregations of Atlantic Wolffish (Special Concern – SARA), Thorny Skate (Special Concern – COSEWIC), and Winter Skate (Threatened – COSEWIC).
- Inshore concentration of Fin Whale (Special Concern – SARA).
- Significant aggregations of scoter spp., merganser spp., American Black Duck, Common Eider, and Purple Sandpiper.
- High concentrations of the rockweed *Fucus* spp around the Canso peninsula and into Chedabucto Bay.
- Because of its strong depth gradient, the Bay is a hotspot for invertebrate diversity.

<u>Fitness Consequences</u>

- The Bay is potentially important juvenile areas for sand lance spp., hake spp., and Grubby.

- Formerly a significant spring and fall spawning area for Atlantic Herring.
- Overwintering area for Atlantic Herring.

6.7 Species at Risk and Species of Conservation Concern

Under the federal *Species at Risk Act (SARA)*, the COSEWIC determines whether a species is at risk. Following a period of public and stakeholder review, the Governor in Council may recommend to the Minister of Environment whether the species will be protected under *SARA*. Species at Risk (SAR) are those classified as Extirpated, Endangered, Threatened, or Special Concern in SARA Schedule 1. Once listed, measures for protection and recovery of the species are implemented. Under *SARA* (*SARA* section 32 and 33), prohibitions apply to species listed in Schedule 1 except for the species of Special Concern. As of September 1 2014, there were 42 species listed under SARA (Schedule 1) for NS (www.sararegistry.gc.ca).

On the provincial level, species listed as Endangered, Threatened, or Vulnerable under the *Nova Scotia Endangered Species Act* (*NSESA*) are also considered to be SAR. Since the latest amendment to the list of protected species in July 2013, there are 51 species listed as SAR under the *NSESA*.

Other organizations apply their own criteria to species considered threatened by human activity. These include species which are ranked in the General Status of Wild Species in Canada for Nova Scotia (GSWSC-NS, www.wildspecies.ca) as 1 (At-Risk), 2 (May be at Risk) or 3 (Vulnerable). Such species are often referred to as Species of Conservation Concern (SOCC), not SAR, since they may be at risk but are not yet legally protected federally or provincially. The Atlantic Canada Conservation Data Centre (ACCDC) also provides ranks (known as S-ranks) for species occurring in the Atlantic Provinces.

Descriptions of the ranking systems used by COSEWIC, *SARA*, NSESA, the GSWSC, and ACCDC are provided in **Appendix N** (Attachment A).

SAR and SOCC belong to numerous taxonomic groups, including lichens, vascular plants, fish, amphibians, reptiles, mammals, birds, molluscs, odonates, and butterflies. To obtain data on SOCC potentially occurring in the area, data requests were submitted to the ACCDC and the Nova Scotia Museum of Natural History (NSMNH). Data provided in 2010 for a standard 100 km radius around Black Point by the ACCDC indicated the potential for occurrence of a number of SAR and numerous SOCC in the region (**Appendix N** Attachment B) though few have actually been observed in the Project area (Section 6.4- **Appendix E**). An updated data request in 2014, using the new five km radius as required by NSDNR, resulted in only 4 SOCC from the area (**Appendix N** Attachment C**)**. Data requests to the NSMNH resulted in reports of two plant and 21 bird species of conservation concern in the area around the Black Point site (**Appendix N** Attachment D).

To examine the potential for SAR and SOCC species in the area encompassing the Black Point site, species listed as SAR or SOCC in NS under *SARA*, COSEWIC, *NSESA*, or the GSWSC for Nova Scotia or the Atlantic Ocean (marine species) were summarized by taxonomic group in a "Priority Species List" (Step 1, NSE 2009). Note that the General Status of Wild Species in Canada for Nova Scotia list has replaced the NSDNR colour ranking system, and is to be used in its stead (M. Elderkin, NSDNR 2013, pers. comm.). Also, while the ACCDC determines status rankings for species in the Atlantic Canadian provinces, these ranks are not considered when preparing the Priority List, as directed by NSE (2009). Instead, ACCDC data is used late in this process as a source of information on uncommon or rare species reported from the area.

In order to determine the potential for occurrence of these species in the Project area, a two-step evaluation process according to NSE (2009) including habitat modelling was carried out as described below.

Species Distribution

Priority species were evaluated concerning their presence in the broad geographic area of the proposed Project (Step 2, NSE 2009), using information on previously recorded sightings obtained from COSEWIC, NSMNH, ACCDC, and NBSDNR's Significant Habitats (SigHab) databases (when applicable). Sources also included previously completed reports that summarized published and unpublished listings of occurrences of rare species and distribution maps from a variety of literary sources such as *Roland's Flora of Nova Scotia* (Zinck 1998). Data received from ACCDC for a five km radius in 2014 and a 100 km radius in 2010 is provided in (**Appendix N** Attachments B and C**)**, and data received from the NSMNH for the area of the Black Point site in (**Appendix N** Attachment D**)**.

All data was then used to compile a Short List of Priority Species that occurs in the general geographical area of the Project, i.e., Eastern NS (**Appendix N** Attachment E**)**. Species whose known distribution range does not include eastern NS were excluded from the short list.

Habitat Preferences

The species listed in the Short List of Priority Species were then reviewed with respect to their habitat requirements (Step 3, NSE 2009). Those species which exist in, or utilize habitat types found within the Project footprint or immediate surrounding areas, were summarized by taxonomic group as "species with potential to be present at the Project site" (see below). Suitable habitat was scanned for indications of the presence of these priority species during field surveys as indicated below. Results of the priority species evaluation process are provided in the following sections.

It should be noted that it is possible that other species of concern exist within the area without previously recorded sightings. Therefore, the potential presence of other priority species for which suitable habitat occurred within the Project area was considered during field surveys.

6.7.1 Terrestrial SAR and SOCC

Terrestrial species groups assessed within this document include vascular plant, lichens, terrestrial mammals, reptiles, amphibians, birds, and select invertebrates (Lepidopterans and Odonates). Each of these groups is discussed in the following subsections.

The ACCDC was consulted for records species of conservation concern from the area encompassing the project sites. In 2010, when the initial field work for this project was done, NSDNR required all such databases searches utilize a 100 km radius around the Project site. In 2014, however, when an updated ACCDC search was requested, this requirement had been reduced to only a 5.0 km radius, and therefore the more recent list is much shorter.

6.7.1.1 *Vascular Plant SAR and SOCC*

A total of 295 species, subspecies and varieties of vascular plants are considered to be SAR in NS (i.e., listed under *SARA*, COSEWIC (2013) or the *NSESA*), or are listed as SOCC (i.e.,

ranked as 1, 2, or 3 in the GSWSC for Nova Scotia). For definitions of the conservation rankings, see **Appendix N** Attachment A**)**.

A short-list of Priority Flora Species (SARA, COSEWIC, NSESA, and Canada General Status List for Nova Scotia) was assembled based on known geographic distribution of priority species in the geographic region around the Project area, using data received from ACCDC, the NSMNH and distribution maps in Zinck's *Flora of Nova Scotia* (1998). The NSDNR Significant Habitats database no longer contains information on vascular plant and lichen SAR and SOCC within NS any longer (NSDNR 2012), so this was not consulted.

A total of 80 vascular plant priority species, subspecies and varieties were identified as having potential to occur in the region of eastern NS (Step 2, NSE (2009b)) (**Appendix N** Attachment E**)**. The 2014 ACCDC database search provided no records of any vascular plant species of conservation concern for a radius of five km around the Project site (**Appendix N** Attachment C).

6.7.1.1.1 Vascular Plant SAR and SOCC Potentially Occurring on the Black Point Site

Habitat modelling was applied in order to estimate the potential presence of the 80 short-listed vascular plants in the Project footprint or immediate surrounding areas (Step 3, NSE (2009); see **Appendix E**). Based on information in Zinck (1998) and Hinds (2000), suitable habitat appears to be available on the Black Point site for over half (48 of 80) of the short-listed vascular plant species.

No priority species were reported by ACCDC within five km of the Black Point site in 2014 (**Appendix N** Attachment C**)**. The NSMNH provided records of two vascular plant SOCC for the area around the Project footprint (**Appendix N,** Attachment D**)**.

Priority species with habitat requirements which may be met by habitats on the Project site are listed in Table 6.7.1.

Table 6.7-1:
Priority Vascular Plant Species Potentially Present

	SCIENTIFIC NAME	COMMON NAME	STATUS LISTS	HABITAT[1]
1	*Ageratina altissima*	White Snakeroot	GSWSC-NS= 2 (May Be At Risk)	Clearings, thickets, and moist woods.
2	*Betula michauxii*	Newfoundland Dwarf Birch	GSWSC-NS= 3 (Sensitive)	Peat and sphagnous bogs.
3	*Botrychium simplex*	Least Moonwort	GSWSC-NS= 3 (Sensitive)	Lakeshores, or mossy edges of streams or waterfalls.
4	*Cardamine pratensis*	Cuckoo Flower	GSWSC-NS= 2 (May Be At Risk)	Meadows, low fields and moist areas.
5	*Carex adusta*	Lesser Brown Sedge	GSWSC-NS= 3 (Sensitive)	Dry open woods, gravels, rocks, and clearings. Also in acidic soils.
6	*Carex alopecoidea*	Foxtail Sedge	GSWSC-NS= 2 (May Be At Risk)	Moist, overgrown, clear-cut woods near coast
7	*Carex castanea*	Chestnut Sedge	GSWSC-NS= 2 (May Be At Risk)	Swamps and wet meadows, cliff crevices and ledges.
8	*Carex comosa*	Bearded Sedge	GSWSC-NS= 3 (Sensitive)	Rich marshes
9	*Carex haydenii*	Hayden's Sedge	GSWSC-NS= 2 (May Be At Risk)	Wet Meadows and rocky shores.

	SCIENTIFIC NAME	COMMON NAME	STATUS LISTS	HABITAT[1]
10	*Carex peckii*	Peck's Sedge	GSWSC-NS= 2 (May Be At Risk)	Uncommon on rocky slopes, clearing and dry woods, often on calcareous soils.
11	*Carex rostrata*	Narrow-leaved Beaked Sedge	GSWSC-NS= 2 (May Be At Risk)	Wet meadows, swales and around boggy pond margins.
12	*Carex tenera*	Tender Sedge	GSWSC-NS= 3 (Sensitive)	Meadows, woodlands, moist or dry openings.
13	*Comandra umbellata*	Bastard's Toadflax	GSWSC-NS= 2 (May Be At Risk)	Damp, sandy areas, dunes and exposed headlands; Open coniferous woods.
14	*Cornus suecica*	Swedish Bunchberry	GSWSC-NS= 3 (Sensitive)	Sphagnous depressions in barrens, gravelly shores, and dry exposed headlands.
15	*Crassula aquatic*	Water Pygmyweed	GSWSC-NS= 3 (Sensitive)	Brackish, muddy shore and muddy flats and borders of muddy ponds near the coast.
16	*Eleocharis flavescens*	Yellow Spikerush	GSWSC-NS= 3 (Sensitive)	Bogs, cold springs, dry stream banks, lake and pond margins, maritime mud flats, marshes, moist meadows, swamps;
17	*Eleocharis ovate*	Ovate Spikerush	GSWSC-NS= 3 (Sensitive)	Fresh, often drying shores, lake and stream beds, bogs, tidal estuaries, disturbed places;
18	*Empetrum eamesii*	Pink Crowberry	GSWSC-NS= 3 (Sensitive)	Exposed headlands on top of lichen-bearing rocks with thin soil.
19	*Epilobium coloratum*	Purple-veined Willowherb	GSWSC-NS= 3 (Sensitive)	Low-lying ground, springy slopes, and similar locations.
20	*Eriophorum gracile*	Slender Cottongrass	GSWSC-NS= 3 (Sensitive)	Wet peat and inundated shores.
21	*Fallopia scandens (syn. Polygonum scandens)*	Climbing False Buckwheat	GSWSC-NS= 3 (Sensitive)	Low habitats
22	*Fraxinus nigra*	Black Ash	GSWSC-NS= 3 (Sensitive), NSESA= Threatened	Low ground, damp woods, and swamps.
23	*Fraxinus pennsylvanica*	Red Ash	GSWSC-NS= 2 (May Be At Risk)	Near lakes and pond or in other low lying areas.
24	*Goodyera repens*	Lesser Rattlesnake-plantain	GSWSC-NS= 3 (Sensitive)	Under conifers, typically occurring singly.
25	*Hypericum dissimulatum*	Disguised St John's-wort	GSWSC-NS= 3 (Sensitive)	On shores and in damp open areas (Hinds, 2000); mostly shores.
26	*Hypericum majus*	Large St. John's-wort	GSWSC-NS= 2 (May Be At Risk)	Wet or dry open soil. (Hinds 2000: damp open areas)
27	*Iris prismatica*	Slender Blue Flag	GSWSC-NS= 2 (May Be At Risk)	Wet ground near the coast.
28	*Isoetes acadiensis*	Acadian Quillwort	GSWSC-NS= 3 (Sensitive)	Water up to 1 m deep, bordering lakes or ponds, and occasionally along rivers.
29	*Juncus alpinoarticulatus*	Alpine Rush	GSWSC-NS= 2 (May Be At Risk)	Wet meadows, sandy and gravelly, often calcareous shores, fens, and clayey pools over rock
30	*Listera australis*	Southern Twayblade	GSWSC-NS= 2 (May Be At Risk)	Sphagnum moss bogs or damp woods. Always near small spruce or tamarack.
31	*Malaxis monophyllos*	White Adder's-mouth	GSWSC-NS= 2 (May Be At Risk)	Moss cushions and wet, mossy cliff edges, where there is little competition from other plant species
32	*Pedicularis palustris*	Marsh Lousewort	GSWSC-NS= 2 (May Be At Risk)	Marshes and meadows.
33	*Platanthera macrophylla (syn. Platanthera orbiculata var, macrophylla)*	Large Round-leaved Orchid	GSWSC-NS= 3 (Sensitive)	Damp woods in deep shade

	SCIENTIFIC NAME	COMMON NAME	STATUS LISTS	HABITAT[1]
34	*Potamogeton nodosus*	Long-leaved Pondweed	GSWSC-NS= 2 (May Be At Risk)	Pond and streams
35	*Proserpinaca pectinata*	Comb-leaved Mermaidweed	GSWSC-NS= 3 (Sensitive)	Wet savannahs, sphagnous swales, and the sandy, gravelly, or muddy borders of lakes or ponds
36	*Ranunculus pensylvanicus*	Pennsylvania Buttercup	GSWSC-NS= 2 (May Be At Risk)	Muddy shores and moist meadows (Hinds 2000). Richer moist shores and sometimes disturbed ground.
37	*Rudbeckia laciniata*	Cut-leaved Coneflower	GSWSC-NS= 3 (Sensitive)	Swales, the edges of swamps or in gullies, in small colonies.
38	*Salix pedicellaris*	Bog Willow	GSWSC-NS= 3 (Sensitive)	Swampy thickets, poorly drained soils, bogs, and heavy soils.
39	*Schoenoplectus americanus (SYN. Scirpus americanus)*	Olney's Bulrush	GSWSC-NS= 3 (Sensitive)	Brackish marshes, and sometime in bogs near the coast. Forms colonies on wet sand around depressions were sand is rather salty.
40	*Senecio pseudoarnica*	Seabeach Ragwort	GSWSC-NS= 3 (Sensitive)	Gravelly seashores.
41	*Sparganium hyperboreum*	Northern Burreed	GSWSC-NS= 3 (Sensitive)	Peaty pools.
42	*Symphyotrichum boreale*	Boreal Aster	GSWSC-NS= 3 (Sensitive)	Gravelly soil and lake beaches, along streams and the edges of bogs.
43	*Teucrium canadense*	Canada Germander	GSWSC-NS= 3 (Sensitive)	Gravel seacoasts, the crest of the beach, beyond the reach of the tide.
44	*Vaccinium boreale*	Northern Blueberry	GSWSC-NS= 2 (May Be At Risk)	Exposed headlands and barrens.
45	*Vaccinium caespitosum*	Dwarf Bilberry	GSWSC-NS= 3 (Sensitive)	Rocky cliffs and crevices. Dry or wet acidic sites from sea level to 3800 m.
46	*Vaccinium avolifolium*	Oval-leaved Bilberry	GSWSC-NS= 2 (May Be At Risk)	Moist coniferous woods to an elevation of 2100 m.
47	*Vaccinium uliginosum*	Alpine Bilberry	GSWSC-NS= 3 (Sensitive)	Dry or wet, organic or inorganic acid soils. Tolerant of high copper concentrations.
48	*Viola nephrophylla*	Northern Bog Violet	GSWSC-NS= 3 (Sensitive)	Cool mossy bogs. Borders of streams, and damp woods.

[1] Sources are Zinck (1998), Hinds (2000) and personal communications (2013) from Sean Blaney, ACCDC

6.7.1.1.2 Vascular Plant SAR and SOCC Confirmed to Occur on the Black Point Site

Field surveys of a variety of habitats in the Project area were carried out in 2010 and 2014 in order to identify vascular plant SAR and SOCC with early and late phenology. A vascular plant inventory based on those surveys amended by current (2014) conservation ranks is provided in Section 6.4, **Appendix E**. During the field surveys, only two vascular plant SOCC were found (Table 6.7.2).

Table 6.7-2:
Vascular Plant SOCC Confirmed to Occur on the Site

	Common Name	Scientific Name	Status	Habitat Preferences[1]
1	Northern Commandra	*Geocaulon lividum*	Canada General Status List of Wild Species= 3 (Sensitive)	Sterile soils and damp sands, in acid or peaty areas.
2	Southern Twayblade	*Listera australis*	Canada General Status List of Wild Species= 2 (May be at Risk)	Sphagnum moss bogs or damp woods. Always near small spruce or tamarack.

[1] Sources are Hinds (2000) and personal communications from Sean Blaney, ACCDC

6.7.1.2 *Lichen (Non-vascular Flora) SAR and SOCC*

According to ACCDC, Southern Twayblade (*Listera australis*) was reported four times within a 100 km radius, with the closest location being 24 +/-10 km away. Note that ACCDC does not provide exact locations in order to protect uncommon species. ACCDC has a single record for Northern Commandra (*Geocaulon lividum*), also 24 +/-10 km from the Black Point site (ACCDC 2010, **Appendix N** Attachment B).

A total of 65 species of lichens are considered to be SAR, *i.e*., listed under SARA, COSEWIC (2013) or the *NSESA*), or listed as SOCC (i.e., ranked 1, 2, or 3 in the Canada General Status List for NS. For definitions of the conservation rankings see **Appendix N** Attachment A.

A short-list of priority species was assembled based on known occurrences of priority species in the geographic region, using data received from ACCDC and the NSMNH and professional knowledge (Step 2, NSE 2009). Lichens are no longer listed in the NSDNR SigHab database (NSDNR 2012c). The resulting table listing the 46 lichen species with potential to occur in eastern Nova Scotia, along with their habitat requirements is provided in **Appendix N** Attachment E. While *Sclerophora peronella* is unlikely to occur in the Project area because its known distribution is limited to Cape Breton Highlands National Park, it was retained in the short-list using a precautionary principle.

ACCDC had no records for any lichen SOCC within a five km radius of the Black Point site (ACCDC 2014, **Appendix N** Attachment C). An earlier ACCDC request conducted in 2010 resulted in 31 records of a single lichen species (Boreal Felt Lichen) considered to be of conservation concern within a radius of 100 km around the Project site (ACCDC 2010, **Appendix N** Attachment B). The NSMNH does not have any records for rare lichens in the Project area (**Appendix N** Attachment D).

6.7.1.2.1 Lichen SAR and SOCC Potentially Occurring on the Black Point Site

Of the 47 lichen priority species identified for the region (Step 2), thirteen have the potential to occur on site (Step 3, NSE 2009) based on their habitat requirements. These are outlined in Table 6.7.3. The lichen priority species encompass ground-dwelling (terricolous), rock-dwelling (saxicolous) and tree-dwelling (corticolous) lichens.

Table 6.7-3:
Priority Lichen Species with Potential to Occur in the Area

	Common Name	Scientific Name	Status	Habitat Preferences[1]
1	*Polychidium muscicola*	Eyed Mossthorns Woollybear Lichen	GSWSC-NS = 2 (May be at Risk)	Among mosses on exposed or shaded rocks. Occasionally on ground or at base of trees
2	*Punctelia appalachensis*	Appalachian Speckleback Lichen	GSWSC-NS = 3 (Vulnerable)	On deciduous trees
3	*Ramalina thrausta*	Angelhair Ramalina Lichen	GSWSC-NS = 3 (Vulnerable)	On trees, rarely rocks
4	*Sticta fuliginosa*	Peppered Moon Lichen	GSWSC-NS = 3 (Vulnerable)	Mossy bark, rarely mossy rock
5	*Sticta limbata*	Powdered Moon Lichen	GSWSC-NS = 2 (May be at Risk)	Mossy bark and rock, especially in coastal forest
6	*Umbilicaria polyphylla*	Petaled Rocktripe Lichen	GSWSC-NS = 3 (Vulnerable)	On nutrient -encrusted siliceous rocks
7	*Usnea ceratina*	Warty Beard Lichen	GSWSC-NS = 3 (Vulnerable)	Usually on trees, occasionally rocks, near moist lakesides, wetlands or coastal habitats
8	*Usnea flammea*	Coastal Bushy Beard Lichen	GSWSC-NS = 3 (Vulnerable)	On trees and rocks
9	*Usnea flavocardia*	Blood-splattered Beard Lichen	GSWSC-NS = 3 (Vulnerable)	On trees, usually in coastal areas
10	*Usnea mutabilis*	Bloody Beard Lichen	GSWSC-NS = 3 (Vulnerable)	On trees in deciduous and pine forests.
11	*Usnea scabrata*	Straw Beard Lichen	GSWSC-NS = 3 (Vulnerable)	On conifers in forests or open habitat
12	*Usnea substerilis*	Embossed Beard Lichen	GSWSC-NS = 2 (May be at Risk)	On trees
13	*Usnocetraria oakesiana (syn. Cetraria/Allocetraria oakesiana)*	Yellow Band Lichen	GSWSC-NS = 2 (May be at Risk)	On both conifers and some hardwoods, occasionally on rocks

[1] Sources are Brodo *et al*. (2001), Hinds and Hinds (2000)

Of the 13 remaining lichen Priority Species, one species, Boreal Felt Lichen (*SARA*, COSEWIC and *NSESA* Endangered, GSWSC= 1 (At Risk)) is considered most likely to occur in the general area, because ACCDC has reported 31 observations within 100 km distance (ACCDC 2010, see **Appendix N** Attachment B).

Boreal Felt Lichen

Boreal Felt Lichen grows on the bark of mature Balsam Fir trees in cool, humid habitats. Wet coniferous forests, usually in or near wetlands, on north to east facing slopes near the coast are preferred (Cameron and Neily 2008). NSE Protected Areas Branch has prepared predictive maps indicating polygons of potential BFL habitat in Nova Scotia based on a heuristic model (NSE 2008). These potential habitats categorize potential Boreal Felt Lichen habitat according to level of suitability (Low, Medium, and High). The maps indicate that there is no potential Boreal Felt Lichen habitat within the footprint of the Black Point site. However, there are nine small polygons of potential Boreal Felt Lichen habitat within a two km radius of the Project site (Figure 6.7.1). One polygon of high suitability (Category 1) habitat is located about 500m south of the Project site. Five areas of Medium suitability and four of low suitability also occur within

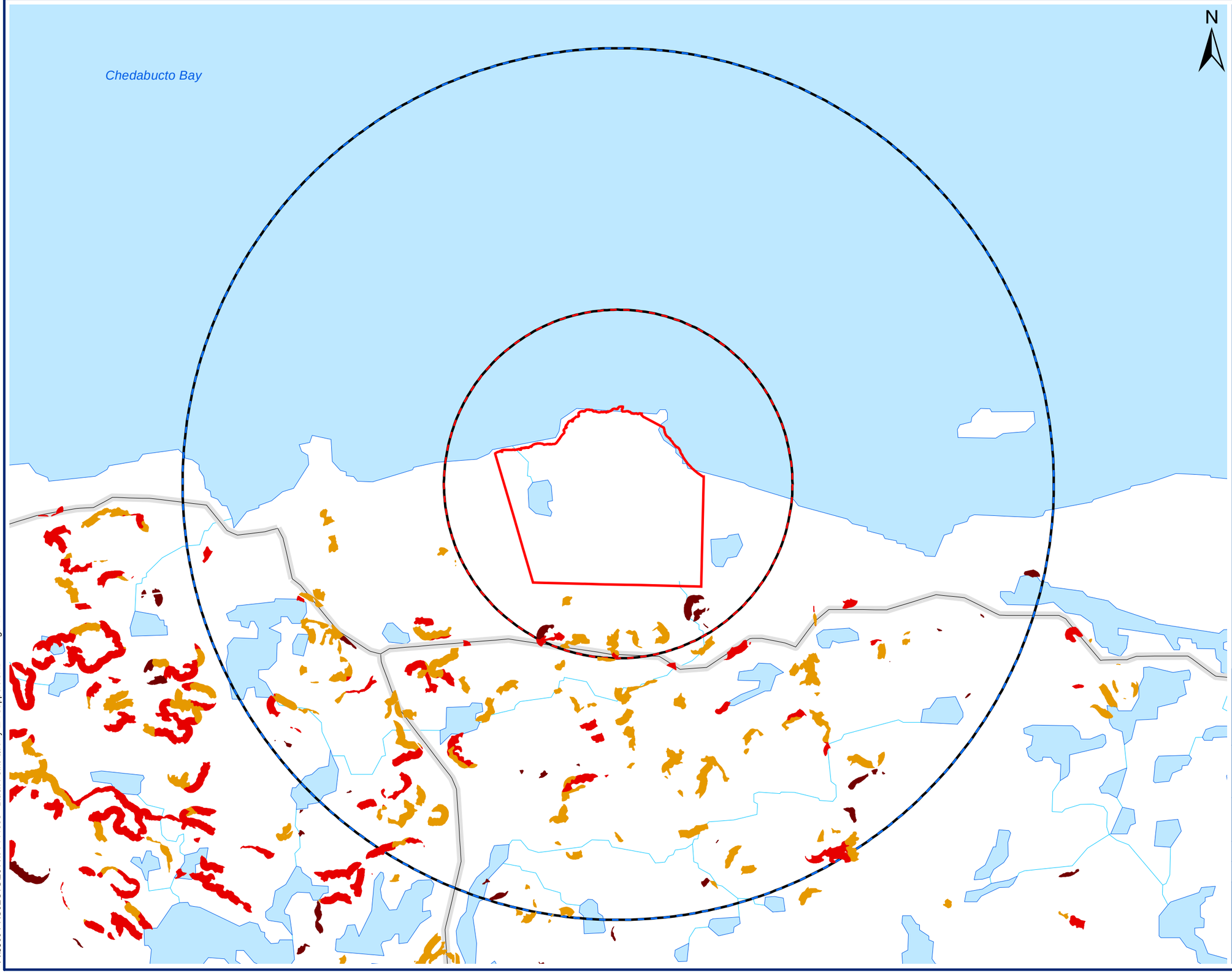
about 700 m of the southern boundary of the Project site. All of these areas are considered to be well out of range of dust or other potential effects of quarry activities.

In addition to looking for Boreal Felt Lichen on the site directly, the available habitat was evaluated concerning suitability as habitat for this species. Balsam fir, the preferred host species for Boreal Felt Lichen occurs on the Project site, however, the microclimatic conditions required by this species apparently were not met at the Black Point site. Wet forests on north to east facing slopes were not encountered. No Boreal Felt Lichen was found on the site during targeted lichen surveys in 2010 or 2014 (Section 6.4 and **Appendix E**).

6.7.1.2.2 Lichen SAR and SOCC Confirmed to Occur on the Black Point Site

A lichen survey of the Black Point site was carried out in August 2010 and again in August 2014 targeting all lichen SAR or SOCC in all potential habitats on the Project site. In addition, indicator species and any cyanolichens were of interest and were included in the surveys, as their habitat requirements are similar to the habitat requirements of the priority species as indicated in **Appendix E**. Survey methods and photos are provided in Section 6.4 and **Appendix E**.

A total of four lichen SOCC were found on the Black Point site in 2010 and 2014. Much of the observed forest habitat is likely not conducive to the presence of rare lichen species due to previous disturbance. The four lichen SOCC occurring on the Project site are outlined in Table 6.7.4.



LEGEND

- Site Boundary

Nova Scotia Boreal Felt Lichen

- Category 1
- Category 2
- Category 3
- 2 km Radius
- 5 km Radius
- Roads
- River / Stream
- Waterbody

0 125250 500 Meters

SCALE: 1:42,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

BOREAL FELT LICHEN PREDICTIVE HABITAT MAPPING

September 23, 2014	Rev **1.0**	Figure No. **6.7-1**
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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Table 6.7-4:
Lichen SOCC Confirmed to Occur on the Site

	Common Name	Scientific Name	General Status of Wild Species in Canada-NS 2010 Rank	Habitat Preferences[1]
1	*Cladonia stygia*	Black-footed Reindeer Lichen	3- Vulnerable	Open bog
2	*Nephroma bellum*	Naked Kidney Lichen	3- Vulnerable	Forested wetlands on Red Maple
3	*Usnea flammea*	Coastal Bushy Beard Lichen	3- Vulnerable	Conifers
4	*Ramalina thrausta*	Angel Hair Ramalina Lichen	3- Vulnerable	On trees, rarely rocks

[1] Sources are Brodo *et al*. (2001), Hinds and Hinds (2000).

Note that the 2010 fieldwork summary report prepared for this Project (**Appendix E**), another lichen species thought to be of conservation concern was reported. However, this species, *Peltigera leucophlebia*, which was yellow listed by the now-discarded NSDNR General Status List, is currently listed as Secure on the Canada General Status of Wild Species List for Nova Scotia, and, as it is not listed on other conservation status lists for NS, is no longer considered a SOCC.

All four lichen SOCC species likely occur within the Project footprint.

6.7.1.3 *Avifauna SAR and SOCC*

A total of 93 species of birds are listed as SAR in NS under *SARA*, COSEWIC, *NSESA*, or listed as SOCC by the GSWSC for NS (updated in 2010). All of these were included in the initial Priority Species List. For definitions of the conservation rankings see **Appendix N** Attachment A. In addition, all raptors are protected under the *Nova Scotia Wildlife Act* (*NSWA*). While a number of the priority species have not been recorded in eastern NS, there is potential for many of the priority species to be found in the Project area based on available habitat, either as breeding birds or during migration. A list of bird species of conservation concern (81 in total) that have potential to occur in the Project area based on habitat requirements and distribution is provided in **Appendix N** Attachment E.

6.7.1.3.1 Avifauna SAR and SOCC Potentially Occurring on the Black Point Site

To gain further information on bird species potentially occurring on the Black Point site, records of bird SAR and SOCC in the Project area were obtained from field surveys conducted in 2010 and from existing databases. Data were obtained from the Maritimes Breeding Bird Atlas and Environment Canada's Canadian Wildlife Service (EC-CWS), while the NatureCounts database was consulted for additional information sightings on rare and colonial species. The NSMNH provided information on twenty-one avifauna priority species reported to occur in the area surrounding the Project site.

ACCDC results for priority species within a five km buffer around the Project area were obtained in 2014, while records for a wider radius (100 km) were obtained in 2010. Records of wintering

waterfowl and seabird colonies were obtained from EC-CWS. EC-CWS also provided information regarding records of American Oystercatcher (*Haematopus palliatus*) breeding on Grassy Island (EC-CWS pers. comm. 2014).

Of the 81 avian SOCC potentially occurring in the Project area (eastern mainland NS), just over half (43) are considered to have suitable habitat available on the Black Point site. These are listed in Table 6.7.5.

Table 6.7-5:
Avian Priority Species Potentially Present in the Area.

	Scientific Name	Common Name	Status Lists	Habitat Preferences[1]
1	*Actitis macularius*	Spotted Sandpiper	GSWSC-NS=3 (Sensitive)	Breeds near water in a variety of habitats, including shorelines, grasslands and forests. Found in both coastal and freshwater habitats during migration.
2	*Asio flammeus*	Short-eared Owl	COSEWIC=Special Concern SARA=Special Concern / Schedule 1 GSWSC-NS=2 (May Be At Risk)	Usually found in open country supporting cyclic small mammals (voles, lemmings), large expanses of grasslands, heathlands, shrub-steppe, tundra or agricultural areas. Nesting: dry sites with enough vegetation to conceal incubating female.
3	*Bucephala islandica*	Barrow's Goldeneye	COSEWIC=Special Concern SARA=Special Concern / Schedule 1 GSWSC-NS=1 (At Risk)	Breeding appear to be restricted to high elevation lakes north of St. Lawrence Estuary and Gulf. Eastern Canada populations have dwindled in recent years as a result of habitat loss due to fish introduction, logging and contamination.
4	*Calidris maritima*	Purple Sandpiper	GSWSC-NS=3 (Sensitive)	Coastal environments.
5	*Calidris pusilla*	Semipalmated Sandpiper	GSWSC-NS=3 (Sensitive)	Breeds in subarctic tundra; found in coastal habitats during migration.
6	*Cardellina (syn. Wilsonia) canadensis*	Canada Warbler	COSEWIC=Threatened SARA=Endangered/ Schedule 1 NSESA=Endangered GSWSC-NS=1 (At Risk)	Most abundant in moist, mixed forests with a well-developed understory, dense nest site cover. Often near open water. Nesting: Typically on or near the ground, often on slopes, knolls, in earthen banks, or rocky areas.
7	*Cathartes aura*	Turkey Vulture	GSWSC-NS=3 (Sensitive)	Preferred habitat includes farmland with pasture and abundant carrion close to undisturbed forested areas for perching, roosting, and nesting. This species nests in dark recesses beneath boulders, on cliff ledges, in hollow trees, logs, and stumps, and in abandoned buildings

	Scientific Name	Common Name	Status Lists	Habitat Preferences[1]
8	*Charadrius vociferus*	Killdeer	GSWSC-NS=3 (Sensitive)	A variety of open habitats, including sandbars, mudflats, heavily grazed pastures, cultivated fields, athletic fields, airports, golf courses, gravelled lots, and gravelled rooftops
9	*Chordeiles minor*	Common Nighthawk	COSEWIC=Threatened SARA=Threatened/ Schedule 1 GSWSC-NS=1 (At Risk)	Coastal sand dunes and beaches, logged or slash-burned areas of forest sites, woodland clearings, grassland habitat, farm fields, open forests, rock outcrops, and flat gravel rooftops. Nesting: Nests in open areas on the ground.
10	*Contopus cooperi*	Olive-sided Flycatcher	COSEWIC=Threatened SARA=Threatened /Schedule 1 NSESA=Threatened GSWSC-NS=1 (At Risk)	Along forest edges and openings with tall snags for foraging and singing. Nesting: generally well out toward tip of horizontal branch in coniferous tree.
11	*Contopus virens*	Eastern Wood Peewee	COSEWIC=Special Concern GSWSC-NS=3 (Sensitive)	Damp boreal forests, spruce bogs, swamps, coniferous forests, wet areas with sphagnum-moss ground cover
12	*Dendroica castanea*	Bay-breasted Warbler	GSWSC-NS=3 (Sensitive)	Spruce-fir forests
13	*Dendroica striata*	Blackpoll Warbler	GSWSC-NS=3 (Sensitive)	Deciduous and mixed forests, damp woodlands
14	*Dendroica tigrina*	Cape May Warbler	GSWSC-NS=3 (Sensitive)	Mixed and deciduous forests with thick undergrowth, rhododendron thickets, beech and maple forests
15	*Dumetella carolinensis*	Gray Catbird	GSWSC-NS=2 (May Be At Risk)	Open woodlands, suburban areas, thickets
16	*Empidonax flaviventris*	Yellow-bellied Flycatcher	GSWSC-NS=3 (Sensitive)	Birch forests, bogs, edges of marshes, damp thickets of alder or willows
17	*Euphagus carolinus*	Rusty Blackbird	COSEWIC=Special Concern SARA=Special Concern /Schedule 1 GSWSC-NS=2 (May Be At Risk)	Frequents cool habitats in forest openings, including spruce bogs, swamps, and damp alder swales. Nesting: In trees and shrubs, 0.5 m to 6 m above ground or over water.
18	*Gallinago delicata (form. G. gallinago)*	Wilson's Snipe	GSWSC-NS=3 (Sensitive)	Sedge bogs, fens, alder or willow swamps, and pond and river edges.
19	*Gavia immer*	Common Loon	GSWSC-NS=2 (May Be At Risk)	Prefers lakes larger than 24 ha with clear water, an abundance of small fish, numerous small islands, and an irregular shoreline. Nesting: ground-nesting; prefers to nest on islands.

	Scientific Name	Common Name	Status Lists	Habitat Preferences[1]
20	*Haematopus palliatus*	American Oystercatcher	GSWSC-NS=5 (Undetermined)[2]	Tied to coastal areas during breeding and non-breeding intervals, bound by prey specialization on shellfish and other marine invertebrates. Nests primarily on sand and shell beaches, dunes, salt marsh, and occasionally rock or other surfaces, in areas with little to no vegetation. Known to breed on Grassy Island in Guysborough County (one of two known nesting areas in Canada)
21	*Histrionicus histrionicus*	Harlequin Duck	COSEWIC=Special Concern SARA=Special Concern / Schedule 1 NSESA=Endangered GSWSC-NS=1 (At Risk)	Favour marine environments, but move inland to breed. In winter, occurs along headlands where surf breaks against rocks. Feed close to rocky shorelines or skerries. Few breeding records in NS
22	*Numenius phaeopus*	Whimbrel	GSWSC-NS=3 (Sensitive)	Arctic tundra, bogs, marshes at edge of boreal forests
23	*Perisoreus canadensis*	Gray Jay	GSWSC-NS=3 (Sensitive)	Nests in often large colonies, under rock ledges, highway culverts, bridges, and buildings
24	*Phalacrocorax carbo*	Great Cormorant	GSWSC-NS=3 (Sensitive)	Rocky islands, cliffs facing water, stands of trees near water
25	*Pheucticus ludovicianus*	Rose-breasted Grosbeak	GSWSC-NS=3 (Sensitive)	Woodland edges, weedy fields, thickets
26	*Picoides arcticus*	Black-backed Woodpecker	GSWSC-NS=3 (Sensitive)	Open woodlands, mature forests
27	*Pinicola enucleator*	Pine Grosbeak	GSWSC-NS=2 (May Be At Risk)	Open woodlands, conifer forests
28	*Poecile hudsonicus*	Boreal Chickadee	GSWSC-NS=3 (Sensitive)	Boreal forests
29	*Riparia riparia*	Bank Swallow	COSEWIC= Threatened GSWSC-NS=2 (May Be At Risk)	Along rivers, streams, lakes, and coasts. Nesting: burrows in banks, cliffs and bluffs; may also use artificial sites such as sand and gravel quarries and road cuts.
30	*Regulus calendula*	Ruby-crowned Kinglet	GSWSC-NS=3 (Sensitive)	Coniferous and mixed forests.

	Scientific Name	Common Name	Status Lists	Habitat Preferences[1]
31	*Regulus satrapa*	Golden-crowned Kinglet	GSWSC-NS=3 (Sensitive)	Coniferous forests during breeding season; in winter, may be found in coniferous, mixed and deciduous forests.
32	*Sayornis phoebe*	Eastern Phoebe	GSWSC-NS=3 (Sensitive)	Open deciduous and coniferous woodlands
33	*Spinus pinus*	Pine Siskin	GSWSC-NS=3 (Sensitive)	Generally inhabits coniferous or mixed coniferous-deciduous forests
34	*Sterna dougallii*	Roseate Tern	COSEWIC=Endangered SARA=Endangered /Schedule 1 NSESA=Endangered GSWSC-NS=1 (At Risk)	Colonies sparsely scattered on southern shore of NS (Brothers Islands, Grassy Island, and Country Island Complex)
35	*Sterna hirundo*	Common Tern	GSWSC-NS=3 (Sensitive)	Throughout NS, particularly the southern coast and Cape Breton.
36	*Sterna paradisaea*	Arctic Tern	GSWSC-NS=2 (May Be At Risk)	Lower Bay of Fundy, south shore of mainland NS, south and east shores of Cape Breton Island
37	*Sturnella magna*	Eastern Meadowlark	COSEWIC=Threatened GSWSC-NS=3 (Sensitive)	Grassland habitats
38	*Tachycineta bicolor*	Tree Swallow	GSWSC-NS=3 (Sensitive)	Open fields, meadows, marshes. Nesting: Typically in standing dead trees, or nest boxes where available.
39	*Tringa melanoleuca*	Greater Yellowlegs	GSWSC-NS=3 (Sensitive)	Breeds in muskeg, wet bogs with small wooded islands, and forests (usually coniferous) with abundant clearings. During migration, uses a variety of coastal habitats and wetlands.
40	*Tringa semipalmata*	Willet	GSWSC-NS=2 (May Be At Risk)	Breeds most commonly on salt marshes, barrier islands, and barrier beaches; also pastures and farmlands in Nova Scotia
41	*Tyrannus tyrannus*	Eastern Kingbird	GSWSC-NS=3 (Sensitive)	Open habitats, frequently along woodland edges.
42	*Vermivora peregrina*	Tennessee Warbler	GSWSC-NS=3 (Sensitive)	Open woodlands, brushy areas, cut-over and burned woods, second-growth woodlands, edges of bogs
43	*Wilsonia pusilla*	Wilson's Warbler	GSWSC-NS=3 (Sensitive)	Undergrowth in moist mature forests, dense woodlands near streams or swamps

[1] Source TBNAO (2014)

[2] Though not technically a SAR or SOCC, American Oystercatcher is included here at the request of EC-CWS, due to the reported presence of breeding individuals on Grassy Island, approximately 12 km east of the Project site off the town of Canso.

Although habitat may be available to these species, many have no suitable breeding or nesting habitat within the Project area; nonetheless, individuals may potentially migrate through or over-winter in the area.

6.7.1.3.2 Avifauna SAR and SOCC Confirmed to Occur on the Black Point Site

A total of 14 avian SAR and SOCC are known to occur on the Project site, having been detected on the site during filed survey by AMEC in 2010 and/or AECOM in 2011. A list of these species is provided in Table 6.7.6, along with the species status and information on known presence in the Project area. A single species, the Rusty Blackbird (*Euphagus carolinus*) is a legally-protected *SAR* species.

Table 6.7-6:
Priority Avian Species Recorded on the Site

Scientific Name	Common Name	Status Lists	Comments
Dendroica castanea	Bay-breasted Warbler	GSWSC-NS=3 (Sensitive)	Possible breeder.
Picoides arcticus	Black-backed Woodpecker	GSWSC-NS=3 (Sensitive)	Confirmed breeding in Project area.
Dendroica striata	Blackpoll Warbler	GSWSC-NS=3 (Sensitive)	Possible breeder.
Poecile hudsonicus	Boreal Chickadee	GSWSC-NS=3 (Sensitive)	Possible breeder, found year-round in Project area.
Gavia immer	Common Loon	GSWSC-NS= 2 (May Be At Risk)	Heard during spring surveys, outside of breeding season.
Regulus satrapa	Golden-crowned Kinglet	GSWSC-NS= 3 (Sensitive)	Possible breeder, found year-round in Project area.
Perisoreus canadensis	Gray Jay	GSWSC-NS= 3 (Sensitive)	Possible breeder; also observed during winter surveys.
Phalacrocorax carbo	Great Cormorant	GSWSC-NS= 3 (Sensitive)	Observed during winter surveys.
Tringa melanoleuca	Greater Yellowlegs	GSWSC-NS= 3 (Sensitive)	Observed in fall surveys along coast.
Regulus calendula	Ruby-crowned Kinglet	GSWSC-NS= 3 (Sensitive)	Possible breeder.
Euphagus carolinus	Rusty Blackbird	*SARA*= Special Concern/ Schedule 1 COSEWIC= Special Concern *NSESA*= Endangered GSWSC-NS= 2 (May Be At Risk	Possible breeder.
Calidris pusilla	Semipalmated Sandpiper	GSWSC-NS= 3 (Sensitive)	Observed in fall surveys

			along coast.
Actitis macularius	Spotted Sandpiper	GSWSC-NS= 3 (Sensitive)	Observed in fall surveys along coast.
Empidonax flaviventris	Yellow-bellied Flycatcher	GSWSC-NS= 3 (Sensitive)	Possible breeder.

Landbirds (Including Raptors and Passerines)

Breeding evidence has been recorded in the Project area for Rusty Blackbird, Boreal Chickadee, Blackpoll Warbler, Bay-breasted Warbler, Black-backed Woodpecker, Gray Jay, Golden-crowned Kinglet, Ruby-crowned Kinglet and Yellow-bellied Flycatcher (Table 6.7.6). Potential breeding habitat exists in the Project area for other landbird species of special status that were not directly observed, including Common Nighthawk, Eastern Phoebe, Pine Grosbeak, Short-eared Owl, Tennessee Warbler, Tree Swallow and Wilson's Warbler. Potentially suitable habitat exists for Black-billed Cuckoo and Willow Flycatcher, although these species are considered unlikely to occur in the Project area due to their geographic distributions.

Shorebirds

Spotted Sandpiper and Greater Yellowlegs have each been observed along the coastline in the Project area during fall migration surveys, and while both of these species may breed in the area, no breeding evidence was observed in field surveys of the Project area or in the MBBA. Fogherty Lake does not appear to provide good breeding habitat for these species, as the bank vegetation is dense and shrubby, and there are no shallow areas for wading.

The Purple Sandpiper has been reported in the general area by ACCDC (2010), the Strait of Canso CBC (National Audubon Society 2014) and during winter waterfowl surveys conducted by EC-CWS (A. Hicks, pers. comm. 2014). Purple Sandpipers breed in the Arctic; however, in the winter months, this species feeds on invertebrates along rocky shorelines throughout the province, and may be found on the coastline of the Project area.

Waterfowl and Seabirds

The Common Loon has potential to breed in freshwater lakes in the Project area; however, because Fogherty Lake is not productive and does not appear to support fish, it is considered unlikely. During the surveys for the Project, Common Loons were heard at a distance, but no breeding evidence was observed. They may utilize marine habitats off the Black Point site in winter.

Common Tern and Arctic Tern nest on coastal islands, the closest colony being on Half Island, located approximately 3 km from the Project area (EC-CWS 2014). A large tern colony supporting a significant number of breeding Roseate Terns exists in the Country Island Complex IBA (IBA 2014); this complex is composed of a number of islands and while the nearest point of this IBA is 13 km away, Country Island itself (which supports the largest number of Roseate Terns) is approximately 40 km away. Rock and Shervill (2012) state that between 18 and 53 pairs of Roseate Terns per year have been reported nesting on Country Island since surveys at this colony began in 1996, although surveys conducted in 2014 indicated that there were just 15 breeding pairs (J. Rock, pers. comm. 2014). While they do not breed in the Project area, there is slight potential for Roseate Terns to forage in the area.

One species of special status was identified during EC-CWS winter waterfowl surveys in Block 226: in 2006, two Harlequin Ducks were observed (A. Hicks, pers. comm. 2014). It is possible that some of the unidentified Goldeneye reported is Barrow's Goldeneye, which winter in small numbers off the coast of NS. The Common and Barrow's Goldeneye are very similar in appearance, and mixed flocks of the two species are known to occur. Both Barrow's Goldeneye and Harlequin Duck have been reported in the Strait of Canso CBC (National Audubon Society 2014), and both species are considered to potentially winter in the waters off the Project area.

To date, a single SAR species, the Rusty Blackbird, has been detected on the Black Point site. Rusty Blackbird was detected during a June breeding survey in 2010 by AMEC.

6.7.1.4 *Mammal SARR and SOCC*

6.7.1.4.1 Mammal SARR and SOCC Potentially Occurring on the Black Point Site

A total of nine terrestrial mammalian SAR or SOCC are listed by *SARA*, COSEWIC, *NSESA*, and GSWSC for NS (**Appendix N** Attachment E), of which four have potential to occur at the Project site, based on known distributions and habitat preferences (Table 6.7.7).

Table 6.7-7:
Priority Mammal Species Potentially Present on/near the Site

	Scientific Name	Common Name	Status	Habitat[1]
1	*Alces alces americana*	Eastern Moose- Mainland NS Population	*NSESA* Endangered GSWSC-NS= 1 (At Risk)	Second-growth forest, openings, swamps, lakes and wetlands
2	*Martes penannti*	Fisher	GSWSC-NS= 3 (Sensitive)	Mixed forests
3	*Myotis lucifugus*	Little Brown Myotis	COSEWIC, SARA, NSESA Endangered GSWSC-NS= 1 (At Risk)	Forests, especially near wetlands. Hibernates in caves in colonies.
4	*Myotis septentrionalis*	Northern Myotis/ Northern Long-eared Myotis	COSEWIC, SARA, NSESA Endangered GSWSC-NS= 1 (At Risk)	Dense forest caves. Hibernates in caves.

[1] Sources are Banfield (1977), Parker (2003), Barbour and Davis (1969)

The 2014 ACCDC database request report had no records of any mammal SOCC occurring within five km of the Project area (**Appendix N** Attachment C). An earlier ACCDC request had records of two mammal SOCC occurring within the formerly required 100 km radius of the Project area (**Appendix N** Attachment B). These were mainland Moose (*Alces americanus*, 11 records within 89 km), and American Marten (*Martes americana,* three records within 92 km). Other data sources indicate that moose or signs of moose have been reported within 5 km of the centre of the Project site on 11 occasions since 1999 (M. Pulsifer, pers. comm. 2014), including visual sightings of multiple moose within the Property boundary in 2004.

The NSMNH does not have any records of mammal species of concern in the general Project area (**Appendix N** Attachment D), although they suggested the surrounding area should be evaluated for potential bat hibernacula. They also suggested that the Proponent consult with NSDNR regarding mainland Moose and Canada Lynx.

Although not reported by ACCDC or the NSMNH for the area, based on its habitat preferences and reported range in the province, the Fisher (*Martes pennanti*) may possibly occur in the region as well.

Moose

As only very low numbers of Moose occur in Eastern mainland NS, many of the Moose sightings recorded within the 100 km radius are likely from the large Cape Breton population, which is a different subspecies from western Canada (*Alces alces andersonii)* and has been introduced by humans (Parker 2003). Only the mainland population of Moose in NS is listed as Endangered by NSESA. Nonetheless, this species was retained in the short-list and subjected to the review of habitat requirements.

Moose inhabit second-growth forest, openings, swamps, lakes and wetlands (NatureServe 2013), and suitable Moose habitat occurs within the Project area. Therefore, this species is considered to have potential for presence within the Project site, and moose tracks and scat have been observed on the Project site as noted below in 6.7.1.3.2.

Fisher

Fisher (*Martes pennanti*) is listed as Vulnerable (3) by the General Status of Wild Species in Canada for NS (2010). Although not reported by ACCDC for the area, a small numbers of fishers were captured by fur harvesters in Guysborough County in 2012-2013, according to NSDNR (2014a). Fishers, though not abundant, are widespread in the province and occur in mixed and coniferous forests, typically in proximity to watercourses (Banfield 1974). Their diet consists primarily of small mammals, and they are one of the few natural predators of porcupines.

No sign of fisher was observed during surveys for this Project in 2010 or 2014. However, because there is suitable fisher habitat and abundant food (including porcupine) within the Project area, the occurrence of fisher is considered possible.

Little Brown Myotis

The Little Brown Myotis, also known as the Little Brown Bat, is a small non-migratory species which is probably the most common bat species in North America, ranging from Alaska to California (Barbour and Davis 1969). Throughout their range, Little Brown Myotis are usually abundant in forested areas, and are often associated with human settlement. In summer, reproductive females may form nursery colonies containing hundreds, sometimes thousands of individuals in buildings, attics, and other man-made structures. In late summer, Little Brown Myotis may travel hundreds of kilometres to swarm around caves and abandoned mines (Fenton and Barclay 1980). In NS, this species is known to hibernate in several caves or abandoned mine openings (AMOs) (Moseley 2007).

This species has been shown to be seriously affected by White-Nose Syndrome in NS and other parts of its range, and may be at risk of rapid extirpation in the Northeast US within 20 years, due to White-Nose Syndrome mortality (Frick *et al.* 2010). Due to this threat, the Little Brown Myotis was recently listed as Endangered under the *NSESA* (*NSESA* 2013). The Little Brown Myotis was also one of three bat species recently listed as Endangered in Canada by COSEWIC, under a rare emergency listing spurred on by the White-Nose Syndrome issue (COSEWIC 2012a), and has subsequently been listed as Endangered under *SARA* (SARA 2014).

The Project site provides much forested and wetland area which may be used as roosting and foraging habitat by Little Brown Myotis. The town of Canso, located 12 km to the east of the site, reportedly supports a large concentration of bats (Nova Scotia Bat Conservation 2014). However, a search of the Nova Scotia Abandoned Mine Openings (AMOs) database NSDNR 2014b revealed no unfilled openings within at least 33 km of the site, and there are no documented caves or mines used by bats within 75 km (Moseley 2007). There is no known hibernating or swarming caves in the vicinity of the Black Point site.

Northern Long-eared Myotis

The Northern Long-eared Myotis, also known as the Northern Myotis, is a small non-migratory forest-interior species of bat (Broders *et al.* 2006; Caceres and Barclay 2000; Henderson and Broders 2008; Sasse and Pekins 1996; Jung *et al.* 1999) which feeds on insects and occurs in both hardwood and softwood forests (Foster and Kurta 1999). Northern Long-eared Myotis are known to forage under the forest canopy (Laval *et al.* 1977; Broders *et al.* 2006) often near vernal pools and forest streams (Brooks and Ford 2005). They roost preferentially in deciduous trees (Sasse and Pekins 1996; Menzel *et al.* 2002; Carter and Feldhamer 2005). This species swarms around mines and caves in the fall, and hibernates in many of these same spaces, although not in large numbers.

Due to the current White-Nose Syndrome epidemic mentioned above, the Northern Long-eared Myotis was recently listed as Endangered under the *NSESA* (NSESA 2013), and was one of three bat species recently listed as Endangered in Canada by COSEWIC, under a rare emergency listing spurred on by the White-Nose Syndrome issue (COSEWIC 2012b), and has subsequently been listed as Endangered under *SARA* (SARA 2014).

The Project site provides much forested and wetland area which may be used as roosting and foraging habitat by Northern Long-Eared Myotis. The town of Canso, located 12 km to the east of the site, reportedly supports a large concentration of bats (Nova Scotia Bat Conservation 2014). However, a search of the Nova Scotia Abandoned Mine Openings (AMOs) database NSDNR 2014b revealed no unfilled openings within at least 33 km of the site, and there are no documented caves or mines used by bats within 75 km (Moseley 2007). There is no known hibernating or swarming caves in the vicinity of the Black Point site.

6.7.1.4.2 Mammal SOCC Confirmed to Occur on the Black Point Site

To date, a single mammal SAR, Mainland Moose, has been confirmed to occur on the Black Point site.

Mainland Moose

As only very low numbers of Moose occur in Eastern mainland NS, many of the Moose sightings recorded within the 100 km radius in 2010 are likely from the large Cape Breton population, which is an introduced Albertan subspecies (Parker 2003). Only the mainland population of Moose, which is the native Atlantic subspecies, is listed as Endangered by the *NSESA,* and as 1 (At Risk) by the General Status of Wild Species in Canada for Nova Scotia (2010).

However, mainland moose inhabit second-growth forest, openings, swamps, lakes and wetlands (NatureServe 2013), and suitable Moose habitat occurs within the Project area.

Evidence of moose presence on the Black Point site was observed during wetland surveys conducted by AMEC staff in August 2014. Field surveys targeting mainland Moose were then conducted by AMEC personnel, accompanied by a Mi'kmaq hunter experienced in tracking Moose and other wildlife, in late September 2014. Results are provided in **Appendix N** Attachment F. A winter survey is also planned for early 2015 (comprising two survey events) in order to build upon existing data regarding the use of the Project Area and Adjacent Areas by Moose and a follow-up pellet grouping study is planned for spring, 2015.

6.7.1.5 *Herpetile SOCC*

The term herpetile refers to an artificial grouping which includes both reptiles and amphibians.

6.7.1.5.1 Herpetile Priority Species Potentially Occurring on the Black Point Site

Four species of reptiles at risk are listed by *SARA*, COSEWIC*, NSESA* and/or GSWSC in NS. There are currently no species of amphibian at risk listed by *SARA*, COSEWIC, *NSESA* and/or GSWSC in NS. Of the four herpetile priority species in NS, only the Wood Turtle and Snapping Turtle (*Chelydra serpentina*) have potential to occur in the Project area, and are included in the Shortlist of Priority Fauna Species (**Appendix N** Attachment E). The other two species, Blanding's Turtle (*Emydoidea blandingii*) and Northern Ribbonsnake (*Thamnophis sauritus septentrionalis*), are restricted to southwestern NS, in the general area of Kejimkujik National Park in Queens and Lunenburg Counties (Gilhen 1984) and are not expected to occur on the Project site.

NSMNH (2014) does not list any terrestrial reptile or amphibian species of concern as occurring with the general area of the Project site, though it does state that marine turtles may occur in nearby marine environments. Marine turtle SAR are discussed further in Section 6.7.3.3.

The two species potentially occurring on the site are discussed below.

Wood Turtle

According to data provided by ACCDC in 2010 the Wood Turtle (COSEWIC and *SARA* Threatened, *NSESA* Threatened, GSWSC-NS 3 (Sensitive) has been recorded within 100 km of the Project area (**Appendix N** Attachment B). The largest known wood turtle population in NS occurs in the St. Mary's River (MacGregor and Elderkin 2003), which is approximately 70 km west of the Project area. For most of the year, Wood Turtles live along permanent streams, but in summer months they roam widely over a large variety of terrestrial habitats adjacent to streams, including deciduous forest, fields, woodland bogs and marshy pastures. For nesting, Wood Turtles require fairly moist but well-drained, unshaded, vegetation-free sites with loose substrate, such as sandy or gravely stream banks or sand-gravel bars in streams (MacGregor and Elderkin 2003, NatureServe 2013). They also use such banks for basking and will utilize clearings created by humans for basking or breeding (NatureServe 2013). They prefer hard-bottomed streams and rivers composed of sand or gravel, and avoid streams with clay or mucky substrate; clear rivers and streams of medium size (between 2 m and 30 m wide) are considered ideal (MacGregor and Elderkin 2003).

All the streams on the Project site are very small, almost ephemeral, and their banks are vegetated, and therefore do not meet the species' nesting habitat requirements. Wood Turtles are not likely to overwinter in the very small, shallow streams in the Project area. Although

there is potential foraging habitat during summer months, Wood Turtles are highly unlikely to nest within the proposed site.

Snapping Turtle

According to data provided by ACCDC (2010), snapping turtles (*SARA* and COSEWIC Special Concern, NSESA Vulnerable, GSWSC= 4 (Secure)) have not been recorded within 100 km of the Project area (**Appendix N** Attachment B). However, Guysborough County is known to be poorly surveyed for many fauna groups, and the lack of snapping turtle reports could be due to a lack of reporting, rather than an actual lack of this species' presence in the region. MacAlpine (2010) states that it is unclear whether snapping turtles inhabit the Atlantic Coast zone in which the Black Point Project site is located. It is reported to occur in the two neighbouring ecozones, the South Central Nova Scotia Uplands and the Nova Scotia Highlands. It is included in this report as a precaution.

Snapping Turtles utilize a wide variety of aquatic habitats, preferring those with a soft muddy or sandy bottom. They are highly aquatic, seldom emerging from the water even to bask, and they are able to tolerate brackish water. Nest sites are often far from water, and may include banks, lawns, gardens, road embankments, or even Muskrat burrows. Snapping Turtles are omnivorous, feeding on invertebrates and plants as well as fish, frogs, and other small vertebrates. They hibernate on the bottom of lakes and rivers. Foraging habitat is marginal for Snapping Turtles on the Project site, though suitable nesting habitat may occur.

Herpetile (reptile and amphibian) surveys were conducted simultaneously with surveys for other taxonomic groups and wetlands on the site throughout the 2010 field season. No evidence of any herpetile SOCC was observed.

No reptile or amphibian SOCC has been confirmed to occur on the Black Point site.

6.7.1.6 *Invertebrate SOCC - Odonates and Lepidopterans*

This section discusses Odonates (dragonflies and damselflies) and Lepidopterans (Butterflies).

The Odonata, or dragonflies and damselflies, are large predatory insects which complete their larval development in aquatic environments before emerging as flying adults. All rely on aquatic habitats for reproduction, and some have very specific habitat requirements. Currently, there are 26 species of odonates listed as 1 (At Risk), 2 (May Be At Risk), or 3 (Sensitive), in the Canadian General Status of Wild Species list for NS. No odonate species are listed under *SARA*, COSEWIC or the *NSESA*. The distribution of odonates in NS has not received much study until the last few decades, and Guysborough County is the least studied county in NS (P. Brunelle, pers. comm. 2010). As there are very few odonate experts in eastern Canada, odonate distribution and populations within the province are not as well documented as for other more-easily identified groups.

6.7.1.6.1 Invertebrate Priority Species Potentially occurring on the Black Point Site

Odonates

A review of the known geographic distributions of these species indicates that 23 species of Odonata of conservation concern have potential to occur in eastern NS, and so are included in

the Shortlist of Priority Fauna Species (**Appendix N** Attachment E). Of these, 20 are considered to have potential to occur on the Project site, based on known habitat preferences. These are outlined in Table 6.7.8.

Table 6.7-8:
Odonate Priority Species with Potential to Occur on the Site

	Scientific Name	Common Name	GSWSC-NS[1]	Habitat[2]
1	*Boyeria grafiana*	Ocellated Darner	3- Sensitive	Lotic obligate; found near rapid forest streams and lakes with rocky substrate. Flight period: early June to late September.
2	*Coenagrion interrogatum*	Subarctic Bluet	2- May Be At Risk	Peatland obligate. Found in open marshes and bogs with cool water, abundant aquatic mosses. Flight period: early June to early August
3	*Coenagrion resolutum*	Taiga Bluet	2- May Be At Risk	Ponds, marshes, sphagnum pools. Flight period: late May to late July.
4	*Enallagma signatum*	Orange Bluet	2- May Be At Risk	Lentic habitats, including ponds and lakes. Flight period: late June to early September.
5	*Enallagma vesperum*	Vesper Bluet	3- Sensitive	Lentic habitat; found in small lakes with lots of floating vegetation and occasionally slow-moving streams.. Flight period: early July to mid August.
6	*Gomphaeschna furcillata*	Harlequin Darner	3- Sensitive	Found in bogs and swamps, including alder swamps. Flight period: mid May to late July.
7	*Gomphus descriptus*	Harpoon Clubtail	3- Sensitive	Breeds in clear, rapid rocky streams with sandy or silty bottoms. Feeds in clearings and along forest edges. Flight period: early June to mid July.
8	*Leucorrhinia patricia*	Canada Whiteface	2- May Be At Risk	Peatland obligate. Found in bogs, fens, and lakes with mats of floating moss or shallow pools. Flight period: early June to mid July.
9	*Pantala hymenaea*	Spot-winged Glider	3- Sensitive	Peatland obligate; found in fresh and brackish temporary pools and ponds. Flight period: late June to mid August.
10	*Somatochlora brevicincta*	Quebec Emerald	2- May Be At Risk	Peatland obligate; found in grassy bogs, poor fens and acid fens. Flight period: late June to mid September.
11	*Somatochlora forcipata*	Forcipate Emerald	2- May Be At Risk	Lentic habitat; found in small spring-fed streams and alder swamps. Flight period: early June to mid August.
12	*Somatochlora franklini*	Delicate Emerald	3- Sensitive	Peatland obligate; found in shallow, mossy bogs and fens with short sedges or horsetails. Flight period: early June to early August.
13	*Somatochlora*	Kennedy's Emerald	2- May Be At Risk	Slow open streams in wetlands, boreal swamps, and

	Scientific Name	Common Name	GSWSC-NS[1]	Habitat[2]
	kennedyi			cool, shady bog ponds. Feeds over roads and streams. Flight period: late May to early September.
14	*Somatochlora williamsoni*	Williamson's Emerald	2- May Be At Risk	Slow streams and lakes including bog lakes, usually with clear water. Flight period: mid June to mid September.
15	*Ophiogomphus mainensis*	Maine Snaketail	2- May Be At Risk	Feeds in fields, and breeds in clear, moderately rapid rocky forest streams, often draining lakes or swamps. Flight period: late May to early August.
16	*Ophiogomphus aspersus*	Brook Snaketail	2- May Be At Risk	Feeds in fields and along forest trails, and near water. Breeds in clear open streams with brushy banks and sand, gravel or rock riffles. Flight period: early June to early September.
17	*Stylurus scudderi*	Zebra Clubtail	2- May Be At Risk	Clear forest streams, small rivers. Forages along forest edges and in clearings. Flight period: late June to early October.
18	*Sympetrum danae*	Black Meadowhawk	3- Sensitive	Bogs, fens and marshes; occasionally saline or moving water. Flight period: late July to late October
19	*Tramea lacerata*	Black Saddlebags	2- May Be At Risk	Ponds (including temporary ponds), lakes and ditches without fish. Flight period: mid May to mid October.
20	*Williamsonia fletcheri*	Ebony Boghaunter	2- May Be At Risk	Bog pools and forest fens. Flight period: late May to early July.

1= General Status of Wild Species in Canada- Nova Scotia rank; 2= Sources are Dunkle (2000) and BugGuide (2014)

See Section 6.4.3.3 for a description of the odonate surveys conducted on the Project site in 2010; odonate surveys were conducted by Mr. Paul Brunelle, a well-known expert of Odonata of the Maritimes. He conducted his initial surveys in June and July of 2010, and AMEC staff collected additional specimens in August and September of 2010, in order to accurately characterize the odonate fauna of the site. Mr. Brunelle's report is provided in Section 6.4-**Appendix E**.

According to ACCDC (2010), six odonate priority species have been reported within a 100 km radius around the Project area (Appendix N2). These were Williamson's Emerald, Maine Snaketail, Brook Snaketail, Black Meadowhawk, Harlequin Darner, and Ocellated Darner. No odonates were listed within five km of Black Point in the 2014 ACCDC report (**Appendix N** Attachment C).

The NSMNH does not have any records of odonate species of concern in the general Project area (**Appendix N** Attachment D), and no Significant Habitat areas for odonates are listed by NSDNR within 20 km of the Project site (NSDNR 2012).

The Project area contains several types of aquatic habitats which are potential breeding sites for odonates such as streams, bogs, ponds, and marshes. Based on habitat requirements

(**Appendix N** Attachment E), potential breeding habitat exists for most odonate priority species on the short-list.

Lepidopterans

Ten butterfly and moth species are listed as SAR or SOCC in NS by *SARA*, COSEWIC, *NSESA*, and/or the General Status of Wild Species in Canada, and are known to occur in NS. Of these, nine are considered to have potential to occur on the Project site based on known habitat preferences (**Appendix N** Attachment E). These are listed in Table 6.7.9.

Table 6.7-9:
Lepidopteran Priority Species with Potential to Occur on the Site

	Scientific Name	Common Name	GSWSC-NS Status	Habitat[1]
1	*Boloria chariclea*	Arctic Fritillary	3- Sensitive	Boreal forest clearings and transmission lines; bogs and boggy trails. Frequently visits flowers including daisies and spreading dogbane. Host plant: Various willows; possibly violets.
2	*Callophrys lanoraieensis*	Bog Elfin	2- May Be At Risk	Bogs, wood roads and sandy pine forests with black spruce. Host plant: Black spruce.
3	*Danaus plexippus*	Monarch	3- Sensitive	Found in a variety of open habitats; in late summer, congregates in coastal areas to feed on thistle and prepare for migration to Mexico. Host plant: Swamp milkweed and Kansas milkweed.
4	*Oeneis jutta*	Jutta Arctic	2- May Be At Risk	Colonial, found in bogs and fens. Host plant: Various sedges, including *Carex* spp. and tussock cotton-grass.
5	*Papilio brevicauda*	Short-tailed Swallowtail	3- Sensitive	Found on coastal marshes, dunes and headlands. Usually seen within 100 m of the ocean. Host plant: Scotch lovage and other members of the Carrot family.
6	*Pieris oleracea*	Mustard White	3- Sensitive	Along roadsides and in open spaces in forested areas. Host plant: Various members of the Mustard family, particularly rock cresses and toothworts.
7	*Polygonia gracilis*	Hoary Comma	3- Sensitive	Often seen visiting flowers (such as Pearly Everlasting), unlike most Commas. Host plant: Various currants (*Ribes* spp.)
8	*Polygonia satyrus*	Satyr Comma	3- Sensitive	Woodland species often seen sitting on roads and trails; like most Commas, attracted to animal droppings, carrion, sap and fermented fruit. Host plant: Stinging nettle.
9	*Thorybes pylades*	Northern Cloudywing	3- Sensitive	Inhabits a variety of open forest and meadow habitats. Host plants: Various legumes, including vetch and beach pea.

[1]= Source= Maritime Butterfly Atlas 2014

Three of these priority species have known occurrences within 100 km of the Project area (**Appendix N** Attachment B): Monarch, Short-tailed Swallowtail, and Hoary Comma. No lepidopteran SOCC were listed within five km of Black Point in the 2014 ACCDC report (**Appendix N** Attachment C), and none were observed during the field surveys conducted at the Site. To date, no butterfly Priority Species have been reported to the Maritimes Butterfly Atlas in the 10 km by 10 km atlas square in which the Project area is situated or in any of the adjacent atlas squares (Maritimes Butterfly Atlas 2014).

According to the Maritimes Butterfly Atlas, Hoary Comma has only been reported in northern NB, and the only NS sighting of Short-tailed Swallowtail was at St. Paul Island, off the northern tip of Cape Breton (Maritimes Butterfly Atlas 2014). Jutta Arctic, which had not been recorded in mainland NS prior to initiation of the ongoing Maritimes Butterfly Atlas, has since been reported in Guysborough County (Maritimes Butterfly Atlas 2014). Monarch, Northern Cloudywing and Mustard White have also been recorded in Guysborough County (Maritimes Butterfly Atlas 2014). Based on known distributions and habitat preferences, Monarch, Northern Cloudywing, Mustard White and Jutta Arctic have been retained in the short list of priority species (**Appendix N** Attachment E).

A review of habitat requirements for the butterfly species includes the consideration of larval food-plants. Butterflies depend on plants as a food source for the juvenile stage, the caterpillar. Many species are very specialized on one or a few plant species. Adults are mobile and are expected to be able to search for nectar producing plants in larger, though somewhat limited areas, thus avoiding areas unsuitable due to Project activities. However, presence or absence of larval food-plants ultimately determines the potential for presence of these species in the Project area, as well as the possibility of negative impacts caused by Project activities.

During the breeding season, Monarch butterflies (*SARA* and COSEWIC: Special Concern; GSWSC-NS = 3 Sensitive) utilize habitats such as meadows, weedy fields and watercourses, where milkweed, the larval food plant, is present. Monarchs can occur almost anywhere in NS during spring migration, and in the breeding season near the food plants. Monarchs are common to abundant during the fall migration, particularly along the Atlantic coast; however, most of these fall migrants are thought to originate from outside the province. Small numbers are resident. During the field surveys, no milkweed plants were found. Therefore, breeding Monarchs are unlikely to be present on the Project site.

Jutta Arctic, though relatively widespread in New Brunswick is uncommon in NS (GSWSC-NS = 2 May Be At Risk). This species is typically observed around margins of bogs and fens. Host plants include a variety of sedges, including *Carex* spp. and Tussock Cotton Grass. As suitable habitat and host plants occur in the Project area, breeding Jutta Arctic may be present.

Northern Cloudywing (GSWSC-NS = 3 Sensitive) utilizes a variety of open forest and meadow habitats where it is frequently observed visiting flowers. This species is highly colonial, and may be locally common. All but one of the Atlas records for the province all are from Guysborough and Antigonish Counties. Suitable habitat exists and at least one of the host plant species, Beach Pea, has been found in the Project area; therefore, it is possible that Northern Cloudywing may breed in the Project area, although none were observed during field surveys.

Mustard White (GSWSC-NS=3 Sensitive) is found in forest openings and along roadsides, and utilizes a variety of members of the mustard family (Brassicaceae), such as rock cresses and toothworts, as its host plants. The species is uncommon but widespread in the Maritimes. Suitable habitat for the Mustard White is present in the Project area, and so it is considered to possibly breed there, although none were observed during field surveys on the Site.

6.7.1.6.2 Invertebrate SOCC Confirmed to Occur on the Black Point Site

Only one priority species of invertebrate has been detected on the site to date, the Spot-winged Glider (*Pantala hymenaea*).

The spot-winged glider is a large dragonfly species which is migratory in north-eastern North America (Paul Brunelle, pers. comm. 2010). It is listed as 3 (Sensitive) by GSWSC-NS, meaning it is not believed to be at risk of immediate extirpation or extinction within the province but may require special attention or protection to prevent it from becoming at risk. A specimen was observed near shallow bog pools in Wetland 11, engaging in mating behaviour. However, it is not known if such bog pools are suitable for larval development of the fast-growing larvae of this genus (Paul Brunelle, pers. Comm. 2010.) See the Odonate report in Section 6.4, **Appendix E** for further details.

No SOCC butterfly species have been detected on the Black Point site to date.

6.7.2 Freshwater SAR and SOCC

6.7.2.1 *Freshwater Fish SAR and SOCC*

A total of 10 species, representing 17 populations of freshwater and/or anadramous fish species are listed as SAR/SOCC by *NSESA, SARA*, COSEWIC, and GSWSC-NS. Note that different populations of a species are often treated separately due to differing environments and threats, a good example being the various Salmon populations in NS.

Fish species which spend portions of their life histories in both fresh and salt water will be discussed in both of these sections, and impacts to either one of these environments can have impacts on these species.

6.7.2.1.1 Freshwater Fish SOCC Potentially Occurring on the Black Point Site

A review of the known geographic distributions of these freshwater fish species and populations of concern in NS indicates that nine species of freshwater, anadromous, or catadromous fish species of conservation concern have potential to occur in eastern NS, and so are included in the Short-list of Priority Fauna Species (**Appendix N** Attachment E). These are listed in Table 6.7.10.

Table 6.7-10:
Freshwater Fish SOCC and their Potential to Occur on the Site

Scientific Name	Common Name	GSWSC-NS Status	COSEWIC/ SARA Status	Potential in Region	Potential in Freshwater Habitats on Project Site
Salmo salar	Atlantic Salmon (NS Southern Upland Population)	2-May Be At Risk	Endangered /No status	YES	Unlikely*
Acipenser oxyrhynchus	Atlantic Sturgeon	2-May Be At Risk	Threatened /No status	YES	Unlikely*
Alosa pseudoharengus	Gaspereau (Alewife)	3-Sensitive		YES	Unlikely*
Salvelinus fontinalis	Brook Trout (Char)	3-Sensitive		YES	Unlikely
Margariscus margarita	Pearl Dace	3-Sensitive		YES	Unlikely
Culaea inconstans	Brook Stickleback	3-Sensitive		YES	Unlikely
Anguilla rostrata	American Eel	2-May Be At Risk	Threatened /No status	YES	Unlikely*
Morone saxatilis - Southern Gulf of St. Lawrence population	Striped Bass	1-At Risk	Special Concern/No Status	YES	Unlikely*
Salvelinus namaycush	Lake Trout	3-Sensitive		YES	Unlikely

Note:

*See discussion in Marine Fish SAR section

None of these species are expected to utilize any of the freshwater habitats on the Project site. While one small lake (Foghertys Lake) and three small unnamed watercourses are present, none of these are considered suitable fish habitat, as the pH is very low (<3). Gillnetting and electrofishing surveys conducted on the site in 2010 found no evidence of any fish species. No suitable habitat for any of the freshwater fish SOCC occurs on the Project site.

6.7.2.2 *Freshwater Invertebrate SOCC*

Freshwater invertebrates assessed for this document include the freshwater mussels. Currently, six species of freshwater mussels are considered to be SAR or SOCC in Nova Scotia by SARA, COSEWIC, NSESA, and/or GSWSC for Nova Scotia.

6.7.2.2.1 Freshwater Mussel SOCC Potentially Occurring on the Black Point Site

Six species of freshwater mussel SOCC occur in Nova Scotia. Five of these six Priority species are included in the Shortlist of Priority Fauna Species based on known occurrences (**Appendix N** Attachment E) and are listed in Table 6.7.11. The sixth species, the Yellow Lampmussel

(*Lampsilis cariosa)*, occurs in only a single NS location, the Sydney River system on Cape Breton Island. Therefore, this species is not expected to be present within the Project area, and is not included in the habitat evaluation.

Table 6.7-11:
Freshwater Mussel SOCC Occurring in Nova Scotia

	Common Name	Scientific Name	*SARA* Status & Schedule	*NSESA*	COSEWIC Status	GSWSC-NS
1	Creeper	*Strophitus undulatus*				2- May Be At Risk
2	Delicate Lampmussel (Tidewater Mucket)	*Leptodea ochracea* (formerly *Lampsilis ochracea)*				3- Sensitive
3	Yellow Lampmussel	*Lampsilis cariosa*	Special Concern / Schedule 1	Threatened	Special Concern	2- May Be At Risk
4	Brook Floater (Swollen Wedge Mussel)	*Alasmidonta varicosa*	Special Concern / Schedule 1	Threatened	Special Concern	3- Sensitive
5	Eastern Lampmussel	*Lampsilis radiata*				3- Sensitive
6	Eastern Pearlshell	*Margaritifera margaritifera*				3- Sensitive

No freshwater mussel SOCC was listed in the 2014 ACCDC database search within a five km radius of the Black Point Site (**Appendix N** Attachment B). The 2010 ACCDC report listed three species of concern within a 100 km radius from the Project area (Triangle Floater *Alismadonta undulata* (4 records); Brook Floater *A. varicosa* (6 records), and Eastern Lampmussel Lampsilis *radiata* (15 records)). None were within a 20 km radius of the proposed Project footprint. Distribution maps show that the Triangle Floater, Brook Floater and Delicate Lamp Mussel have occurrences in Guysborough County (Clarke 1981). In addition to these three species, Martel *et al.* (2010), in their summary of the known distributions of freshwater mussel species within Atlantic Maritime Ecozone, state that an additional freshwater mussel SOCC, the Eastern Pearlshell *Margaritifera* m*argaritifera*, also occurs in the drainage system encompassing the Black Point site.

None of these species are expected to occur on the Black Point site, as the water in the aquatic habitats present is too acidic to support fish, which several of these species depend upon as hosts in the larval stage. Some studies have also shown dissolution of the shell periostracum layer in freshwater mussels at pH levels below 3.9 (Mäkelä and Oikari 1992).

No freshwater mussel shells were noted during field surveys in 2010 and 2014 by AMEC staff.

6.7.3 Marine SAR and SOCC

A review of the COSEWIC database, the SARA public Registry listings, and the Canada General Status of Wild Species for NS and the Atlantic Ocean found a total of 39 marine SAR or SOCC (29 fish, 7 mammals, 2 reptiles, 1 mollusc) which are known to occur in the northwestern Atlantic Ocean around Nova Scotia (**Appendix E**; **Appendix N,** Attachment E). This includes species that are fully marine, such as whales, as well as species which rely on marine habitats for only a portion of their life cycle, such as anadramous fishes. Note that marine birds are not included within this section, see Section 6.7.1.3 for a discussion of coastal and seabird species**.** The habitat preferences of the listed marine SOCC were compared with the known habitats occurring within the planned Black Point footprint to determine the likelihood of their occurrence. Of the 39 SAR or SOCC occurring in this region, 17 are known to occur or have potential to occur within the area encompassing the Project site. These species are discussed in detail in the following subsections.

The single marine mollusc SOCC, the Atlantic Mud-piddock (*Barnea truncata,* COSEWIC Threatened), is a sedentary boring species which occurs only within a specific geological formation in the Minas Basin (COSEWIC 2009a). It is not expected to occur in eastern mainland Nova Scotia, and so is not discussed further in this document.

Note that there is little information available on marine species' distribution in some cases.

6.7.3.1 *Marine Fish SOCC*

A review of the COSEWIC database and the SARA Public Registry listings for NS and the Atlantic Ocean found a total of 29 marine or diadromous fish SOCC which occur in the northwestern Atlantic Ocean (full list provided in **Appendix N** Attachment E). Distribution ranges and habitat preferences of these species were compared to the site location and the habitat types known to occur off the Black Point site to determine species with potential to occur in the waters at and near the Project site. The species considered to have potential to occur in the region are outlined in Table 6.7.12. Note that a few species occur in both freshwater and marine environments, and so, for the sake of completeness, are discussed in both the Freshwater and Marine SAR sections.

6.7.3.1.1 Marine Fish SOCC Potentially Occurring on the Black Point Site

A total of 15 marine fish SAR or SOCC which utilize marine habitats are deemed to have potential to occur in the waters at and near the Project site. A brief description of the habitat and life history of each of these fish species, along with its current designation under COSEWIC and/or SARA is provided below in Table 6.7.12.

Table 6.7-12:
Marine Fish SOCC with the Potential to Occur at/near the Site

	SCIENTIFIC NAME	COMMON NAME	STATUS LISTS	POSSIBLE OCCURRENCE IN HABITATS AT/NEAR SITE
1	*Acipenser oxyrinchus*	Atlantic Sturgeon	COSEWIC= Threatened GSWSC-NS=2 (May Be At Risk)	Possible
2	*Anguilla rostrata*	American Eel	COSEWIC= Threatened GSWSC-NS=2 (May Be At Risk)	YES
3	*Gadus morhua*	Atlantic Cod-Southern population	COSEWIC =Endangered, GSWSC-NS=3 (Sensitive)	YES
4	*Hippoglossoides platessoides*	American Plaice- Maritimes population	COSEWIC= Threatened GSWSC-NS=2 (May Be At Risk)	YES
5	*Hippoglossus hippoglossus*	Atlantic Halibut	GSWSC-NS=2 (May Be At Risk)	YES
6	*Lamna nasus*	Porbeagle	COSEWIC= Endangered GSWSC-NS= 1(At Risk)	Possible
7	*Leucoraja ocellata*	Winter Skate - Eastern Scotian Shelf population	COSEWIC= Threatened GSWSC-NS= 3 (Sensitive)	Possible
8	*Pollachius virens*	Pollock	GSWSC-NS= 3 (Sensitive)	YES
9	*Salmo salar*	Atlantic Salmon - NS Southern Upland Population	COSEWIC= Endangered GSWSC-NS= 1 (At Risk)	YES
10	*Squalus acanthias*	Spiny Dogfish	COSEWIC= Special Concern GSWSC-NS= 3 (Sensitive)	Possible
11	*Thunnus alalunga*	Albacore	GSWSC-NS= 3 (Sensitive)	Possible
12	*Thunnus albacares*	Yellowfin Tuna	GSWSC-NS= 3 (Sensitive)	Possible
13	*Thunnus obesus*	Bigeye Tuna	GSWSC-NS= 3 (Sensitive)	Possible
14	*Thunnus thynnus*	Atlantic Bluefin Tuna	COSEWIC= Endangered, GSWSC-NS= 2 (May Be At Risk)	Likely - Fished Nearby
15	*Urophycis tenuis*	White Hake-Atlantic and Northern Gulf of St. Lawrence population	COSEWIC= Threatened GSWSC-NS= 2 (May Be At Risk)	Possible

Each of these species is discussed briefly in the following paragraphs.

Atlantic Sturgeon

Atlantic Sturgeon are large, slow-growing armoured fish which live and mature in the sea, but spawn in freshwater, where some juvenile rearing also occurs. They occur in rivers, estuaries, nearshore marine environments and shelf regions to at least 50 m depth along the Atlantic Coast of North America (COSEWIC 2011a). They are listed as Threatened by COSEWIC and as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Breeding populations are known from the St Lawrence and Saint John Rivers and possible in other rivers flowing into the Bay of Fundy and the Gulf of St Lawrence. Adults spend most of their time at sea, but generally remain close to shore (COSEWIC 2011a).

While Atlantic Sturgeon was not listed in the 2010 ACCDC screening conducted for this Project, reliable sightings of a small group (4-5) of juvenile Atlantic Sturgeon were noted in 2009 within Guysborough County by a qualified AMEC biologist (Cameron-MacMillan, M., pers. comm. 2013). These records have recently been reported to ACCDC. The lake and watercourses on the Project site are unsuitable for Atlantic Sturgeon, but it is possible that adults may occasionally forage in the marine portion of the footprint. No critical habitat is present.

American Eel

The American Eel spawns and hatches in the marine environment, but grows to maturity in freshwater. Adults and early larval stages likely utilize the marine portion of the Project footprint as they migrate to and from streams in Guysborough County. While Eels are still relatively abundant in eastern Canada, population decreases in Ontario and Quebec have led to COSEWIC recently listing the American Eel as a Threatened species (COSEWIC 2012a). It is also listed as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Eels continue to be a significant species to Mi'kmaq people in eastern Canada.

The lake and watercourses on the Project site are unlikely to support American Eel, as they are very acidic, but it is quite likely that adults and early larval stages forage in the marine portion of the Project footprint. No critical habitat is present.

As a catadromous species, American Eel is also discussed in Section 6.7.2.1.1.

Atlantic Cod-Southern Population

The Atlantic Cod is a marine fish species which has historically been extremely important as a commercial species in eastern Canada, but is now at very low levels and only limited fishing is permitted. The Southern population, which encompasses the Project site, is now listed by COSEWIC as Endangered (COSEWIC 2010a) and as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Knowledge of the habitat requirements of Atlantic Cod is rather poor, and it has been suggested that habitat requirements change with age (COSEWIC 2010a). Cod are known to occur in inshore waters along the Guysborough coast, and Atlantic Cod likely forage within the Project footprint, though no habitat critical to this species is present.

American Plaice- Maritimes Population

American Plaice is a species of flounder which burrows in sediments to escape predators and ambush prey. Juvenile American plaice prefer depths of 100 to 200 m, but adults are less particular regarding habitat and could potentially occur within the Project footprint. The Maritime

population was designated as Threatened by COSEWIC in 2009 (COSEWIC 2009b) and as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Abundance of mature individuals has declined about 67% on the Scotian Shelf within the last few generations. It is reasonable to assume that adult American Plaice may occasionally forage within the Project footprint, though no critical habitat is present.

Atlantic Halibut

The Atlantic Halibut is the largest of the flatfishes and can be found in cool boreal and subarctic waters on both sides of the North Atlantic (Scott and Scott 1988). In the summer the Atlantic Halibut inhabits shallow waters and in the winter it moves into deeper waters, preferring temperatures above 2.5 ºC. The migratory patterns of the halibut can be strong and may migrate great distances at times however they are not classified as highly migratory. Depending on the Atlantic Halibut's size, the food sources are invertebrates, mainly marine annelid worms and crustaceans, and other fishes. The Atlantic Halibut is ranked as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca).

Porbeagle

The Porbeagle is a large cold-temperate coastal and oceanic shark which tends to be more common on continental shelves, but is occasionally found close inshore (Scott and Scott 1988; Compagno 2001). It feeds on wide variety of species, especially bony fishes and Squid (Joyce *et al.* 2002). Porbeagle abundance has declined greatly since Canada began fishing them in the 1990s. This species was listed by COSEWIC as Endangered in 2014 (COSEWIC 2004) and is listed as 1 (At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). It is possible that Porbeagles may occasionally forage within the waters at or near the Project site. No critical habitat is present.

Winter Skate

Winter Skate **(***Leucoraja ocellata***)** is a bottom-dwelling skate species, which is usually found on sand and gravel. The Project site falls within the region home to the Eastern Scotian Shelf population of this species, which is subject to a small directed fishery. Very little is known about the biology of Winter Skate; however, this species' delayed age at maturity, large size at birth, long generation time, low fecundity, and consequently slow population growth rate have led to COSEWIC listing this species as Threatened (COSEWIC 2005) and as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Winter Skate are also at risk of bycatch in fisheries for other groundfish species and/or scallops. Habitat within the marine footprint of the Project is likely marginal foraging habitat for winter skate. No critical habitat is present.

Pollock

Pollock occur on both sides of the North Atlantic and inhabit a broad depth range from 37 to 364 m, with a preferred depth of 110 to 181 m. Juvenile Pollock move inshore in summer and offshore in winter while adult Pollock are more commonly found in deeper water near shore, or on offshore banks. Pollock can endure temperatures as low as zero degrees Celsius but are more commonly found in higher temperatures, although not above 15.5 to 18.3 º C. Pollock feed on crustaceans and fish in mainly equal proportions, however larger Pollock tend to eat more fish than smaller Pollock (Scott and Scott 1988). Pollock is ranked as 3 (Sensitive) on the

GSWSC list for the Atlantic Ocean (www.wildspecies.ca). It is possible that juvenile Pollock may occur within the Project's marine footprint in summer.

Atlantic Salmon

Atlantic salmon prefer rivers or streams that are generally clear, cool and well-oxygenated for reproduction and the first few years of rearing, but undertakes lengthy feeding migrations in the North Atlantic Ocean as older juveniles and adults. The Southern NS Upland population, which encompasses the Black Point site, breeds in rivers from north-eastern mainland Nova Scotia, along the Atlantic coast and into the Bay of Fundy. Atlantic Salmon have historically supported important fisheries in eastern Canada; however, most populations are now listed as Endangered by COSEWIC (2010b) and as 1 (At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). The number of mature individuals has declined over the past few generations by about 61%. In addition, recent surveys have only found juvenile Salmon in 20 of 51 known historic spawning rivers in NS (COSEWIC 2010b). Human influences, such as dam construction, pollution and logging, have eliminated and/or degraded freshwater spawning and foraging habitats. Acidification of freshwater habitats brought about by acidic precipitation is another ongoing threat to this species' survival.

It is likely that adult Atlantic Salmon may occasionally forage within the marine portion of the Project footprint, though no critical habitat is present.

As an anadromous species, Atlantic Salmon is also discussed in Section 6.7.2.1.1.

Spiny Dogfish

The Spiny Dogfish *(Squalus acanthias)* is a small shark which occurs world-wide on the continental shelf, from the intertidal to the shelf slope, in temperate and boreal waters. While still relatively abundant in Canadian waters, this species' low fecundity, long generation time, and vulnerability to overfishing in nearby US waters, have led to it being listed as a species of Special Concern by COSEWIC (2010c) and as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Habitat within the marine footprint of the Project is likely suitable foraging habitat for Spiny Dogfish. No critical habitat is present.

Albacore Tuna

Albacore is a deep swimming tuna species which occurs worldwide in tropical and temperate seas. It can withstand temperatures as low as 9.5 ºC but prefers between 13.5 and 25.2 º C (Scott and Scott 1988). They do not breed in Canadian waters. Albacore is ranked as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Albacore can occur off NS during the late summer and fall months, and could potentially occur within the marine footprint of the Project site.

Yellowfin Tuna

Yellowfin Tuna is a slender, large fish which can be found in the Atlantic, Pacific, and Indian oceans. It prefers warmer temperatures, ranging from 18 to 31º C. The Yellowfin Tuna occurs along the continental shelf off Nova Scotia southward, into the Caribbean Sea and Gulf of Mexico, to southern Brazil (Scott and Scott 1988). They do not breed in Canadian waters. Yellowfin Tuna is ranked as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca) and can occur off NS during the late summer and fall months. Yellow

Tuna could potentially occur within the marine footprint of the Project site but none have been reported.

Bigeye Tuna

Bigeye Tuna occur worldwide, from Portugal to South Africa in the eastern Atlantic, and from off the Scotian Shelf to northern Brazil in the western Atlantic. This species occur in more temperate waters, ranging from 7.8 to 18.4 degrees Celsius (Scott and Scott 1988). Bigeye Tuna is ranked as 3 (Sensitive) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca) and can occur off NS during the late summer and fall months. Bigeye Tuna could potentially occur within the marine footprint of the Project site but none have been reported.

Atlantic Bluefin Tuna

Atlantic Bluefin Tuna is a large predatory fish species which spawns in the Gulf of Mexico. Adults and large juveniles move northward to forage on smaller schooling fish species in warm Canadian waters in the summer and fall (COSEWIC 2011b). They are ranked as Endangered by COSEWIC and as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). Despite large population decreases, Atlantic Bluefin Tuna are still fished commercially off Guysborough County (see Section 6.11), and it is likely that adults may forage within the waters at or near the Project site, though no critical habitat is present.

White Hake-Atlantic and Northern Gulf of St. Lawrence population

The White Hake occurs in cold water over deep mud bottom on the continental shelf and upper continental slope. In Canadian waters it occurs from southern Labrador into the Strait of Belle Isle and throughout the Gulf of St Lawrence, around Newfoundland, Scotia Shelf, Bay of Fundy, Passamaquoddy Bay, and Georges Bank. It can be found in deep parts of the Laurentian and Fundian channels and on the continental slope off Nova Scotia. White Hake are mainly found below 200 m moving progressively into deeper waters. White Hake feed heavily on fish, such as clupeids and gadoids, and less frequently, crustaceans (Scott and Scott 1988). This species was designated as Threatened by COSEWIC in 2013 and as 2 (May Be At Risk) on the GSWSC list for the Atlantic Ocean (www.wildspecies.ca). It is possible that adults may occasionally forage within the Project's marine footprint although no reports of this species have been collected within the Project Area.

6.7.3.2 *Marine Mammal SOCC*

Marine mammals potentially occurring off NS include whales, dolphins, porpoises and seals. A review of the COSEWIC database, the SARA Public Registry listings for NS, and the Canada General Status of Wild Species lists for the Atlantic Ocean found a total of seven marine mammals SAR or SOCC listed for the marine environment off Nova Scotia.

6.7.3.2.1 Marine Mammal SOCC Potentially Occurring at/near the Black Point Site

The NSMNH Screening states that the marine waters adjacent to the Project site may support resident or migratory species of cetaceans (whales) during the appropriate season. Habitat preferences of the species in Table 6.7.13 were compared to the site location and the habitat types known to occur in the waters at or near the Black Point site to determine species with potential to occur in the area of the Project site. All seven of these marine mammals SOCC are known to occur in the northwestern Atlantic Ocean off eastern Nova Scotia (**Appendix N**

Attachment E). Of these seven, only a single species, the Harbour Porpoise, is considered to have potential to occur in Project site waters. This species is discussed in the following paragraphs.

Table 6.7-13:
Marine Mammal SOCC with the Potential to Occur in Site Waters

Common Name Population	Species Name	COSEWIC Status /SARA Status & Schedule/ GSWSC- Atlantic	Potential in Site Waters
Blue Whale Atlantic	*Balaenoptera musculus*	SARA= Endangered (Schedule 1) COSEWIC = Endangered GCWSC-ATL= 1 (At Risk)	Unlikely
Fin Whale Atlantic	*Balaenoptera physalus*	SARA = Special Concern (Schedule 1) COSEWIC = Special Concern GCWSC-ATL = 3 (Sensitive)	Unlikely
Harbour Porpoise Northwest Atlantic	*Phocoena phocoena*	COSEWIC Special Concern GCWSC-ATL = 3 (Sensitive)	Possible
Killer Whale Northwest Atlantic	*Orcinus orca*	COSEWIC = Special Concern GCWSC-ATL = 3 (Sensitive)	Unlikely
North Atlantic Right Whale	*Eubalaena glacialis*	SARA = Endangered (Schedule 1) COSEWIC = Endangered	Unlikely
Northern Bottlenose Whale Scotian Shelf	*Hyperoodon ampullatus*	SARA = Endangered- (Schedule 1) COSEWIC = Endangered GCWSC-ATL = 3 (Sensitive)	Unlikely
Sowerby's Beaked Whale	*Mesoplodon bidens*	SARA= Special Concern (Schedule 1) COSEWIC = Special Concern GCWSC-ATL = 3 (Sensitive)	Unlikely

Harbour Porpoise

The Harbour Porpoise (*Phocoena phocoena*) is one of the smallest marine mammals, reaching a maximum of about 1.9 m in length and 76 kg. They occur primarily on continental shelves, and eat mostly small schooling fish (such as Herring, Capelin, Sprat, and Silver Hake), but also Squid (Waring *et al.* 2009). They are often spotted in harbours and bays. While currently abundant, this species is considered a species of Special Concern in Canada (COSEWIC 2006) and is listed as 3 (Sensitive) on the CGSWS list for the Atlantic Ocean. The Harbour Porpoise is also protected under the *Marine Mammal Regulations* of the *Fisheries Act*, which prohibits harvest. A major source of mortality for Harbour Porpoises is by-catch from fishing gear (especially gillnets) (COSEWIC 2006).

The marine footprint of the Project contains suitable foraging habitat for Harbour Porpoises, however this is not considered critical habitat.

6.7.3.3 *Marine Reptile SOCC*

A review of the COSEWIC database, the Species at Risk Public Registry listings, and the CGSWS status listings for NS and the Atlantic Ocean found a total of two marine reptiles SAR or SOCC which are known to occur in the northwestern Atlantic Ocean off eastern NS.

Distribution ranges and habitat preferences of these species were compared to the site location and the habitat types known to occur off Black Point to determine species with potential to occur in the waters at or near the Project site.

6.7.3.3.1 Marine Reptile SOCC Potentially Occurring on the Black Point Site

The NSMNH Screening states that the marine waters adjacent to the site may seasonally support migratory species of sea turtles in the appropriate season (**Appendix N** Attachment D). Only a single species, the Atlantic Leatherback (*Dermochelys coriacea coriacea*), is considered to have potential to occur in Project site waters (**Appendix N** Attachment E). A second marine turtle species, the Atlantic Loggerhead (*Caretta caretta*), is also listed by COSEWIC (2010d) as Endangered, but this species only occurs as juveniles far offshore, and is not expected to occur on or near the Project site.

Atlantic Leatherback

The Atlantic Leatherback (*Dermochelys coriacea coriacea*) is a large, slow-growing, long-lived migratory sea turtle species, which comes ashore only to lay eggs. This species breed in tropical or subtropical waters and moves to temperate waters in search of food (chiefly jellyfish) at other times of the year. While they do not breed in Canada, adult leatherbacks are a regular part of the Nova Scotian marine fauna in the summer and fall (James *et al.* 2006; Witzell 1999). Leatherbacks in Atlantic Canada occur in both offshore and coastal waters. The Atlantic Leatherback Turtle is listed by COSEWIC as Endangered (COSEWIC 2012d). Globally, this species is estimated to have declined by more than 70%. In the Atlantic, this species continues to be impacted by fisheries bycatch, coastal and offshore resource development, marine pollution, poaching of eggs, changes to nesting beaches and climate change (COSEWIC 2012d). Canadian waters provide an important foraging area for these turtles, however, entanglement in longline and fixed fishing gear remains a significant threat to Atlantic Leatherbacks in Canadian waters (COSEWIC 2012d).

It is possible that adult Atlantic Leatherbacks may forage within or near the marine portion of the Project footprint; however, no critical habitat for Atlantic leatherbacks is present.

For an assessment of the interaction between the Project and the herein described environment, refer to Section 7.12.

6.8 Socio-Economic Conditions

6.8.1 Nova Scotia Economic Outlook

The economic growth of Nova Scotia has been slower than the Canadian average (slowest of any province) for the past two decades (1990-2012). Demographic conditions have been the major driver for this slow growth rate: over the same time period, the population of Nova Scotia only grew by 0.2 %/year vs. the national population growth of 1%/year (GNS 2014a).

The economy of Nova Scotia was relatively stable during the global financial crisis (2008-2009). However, growth has been slow in subsequent years. The Gross Domestic Product (GDP) in 2012 declined due to reductions (-18.7%) in investments in machinery and equipment (end of Deep Panuke platform construction), reductions in natural gas production and the forestry sector restructure, which resulted in lowered exports from this sector (GNS 2014a).

Increased natural gas production, a more robust economy in the United States and a lower Canadian dollar value are expected to result in growth in 2014. The Department of Finance and Treasury Board estimates a real GDP growth of 1.4% in 2014 and 1.9 % in 2015 (GNS 2014a).

Nova Scotia's longer term economic outlook will be driven by large projects such as the national shipbuilding procurement strategy, the Maritime Link to Lower Churchill hydroelectric power, wind energy developments, MacDonald Bridge re-decking, offshore energy exploration and the completion of the Halifax Convention Centre (GNS 2014a).

6.8.2 Local Socio-Economic Conditions

6.8.2.1 Social Environment

Population and Demographics

The Project area is located in the Municipality of the District of Guysborough (MODG); approximately 10 km west of Canso, along the south shore of Chedabucto Bay. Since the collapse of the ground fishery in the 1990s, significant changes have occurred in the population of the region. Guysborough County as a whole has the fourth largest proportion of out-migration patterns in Nova Scotia (ACOA 2009). Canso has experienced a dramatic population loss and shift in demographic profile. From 1996 to 2006, its population declined 19%, from 1,127 to 915 compared to a population gain of 0.5% for the Province of Nova Scotia as a whole (Gardner Pinfold 2011). Similarly, the population of MODG decreased by 19% between 2001 and 2011, to a population of 4,990 (Gardner Pinfold 2011).

The age distribution in the MODG indicates an older population with a median age of 53.9, compared to the Province of Nova Scotia of 43.7. In 2011, 15.5% of the population was under the age of 20, and 27.4% of the population was 65 years or older (SC 2011). The age distribution in the MODG indicates an older population with a median age of 53.9, compared to the Province of Nova Scotia of 43.7. In 2011, 15.5% of the population was under the age of 20, and 27.4% of the population was 65 years or older (SC 2011).

In 2011 the population of Canso was 1,326. This is a 21.8% decline from 2001. During this time, 18.1% of the population was under the age of 20 and 22.4% was 65 years or older (GNS 2014b).

The cultural origins of the populations of Guysborough County and Canso in 2011 are presented in Table 6.8-1.The majority of the population of both Guysborough County and Canso are of European origins (60% and 69% respectively). North American and North American Aboriginal were the next highest ethnic origins identified by the populations of Guysborough County and Canso. Note that as part of the National Household Survey, respondents may have identified only a single ethnic origin or multiple ethnicities.

Table 6.8-1:
Cultural Origins of Guysborough County and Canso in 2011

Origin	Guysborough County		Canso	
	Number	%	Number	%
European	6110	60%	1026	69%
North American	3080	30%	394	26%
North American Aboriginal	610	6%	36	2%
African	270	3%	12	0.8%
Asian	40	0.4%	20	1.3%
Caribbean	15	0.1%	0	0%
Latin/Central/South American	0	0%	0	0%
Oceania	0	0%	0	0%

Source: GNS 2014b and SLR interpretation

Recreation and Leisure

The nearest recreational facility is the Canso SportsPlex, which houses an arena, pool, and several sports fields. Other outdoor multi-purpose facilities in the MODG are located in Larry's River, Little Dover, Country Harbour, and St. Francis Harbour.

There are several fitness centers located within the MODG that offer a variety of fitness activities and programs: Chedabucto Fitness Centre in Guysborough, The Fanning Fitness Centre in Hazel Hill, and Community Fitness Centres in Isaac's Harbour Medical Centre, Whitehead (at the old Fire Hall), New Harbour Community Centre, and the Queensport Fire Hall (MODG 2014a).

There are two seasonal outdoor heated pools, one is located at the Canso Sportsplex and the other is part of the Chedabucto Family of Schools in Guysborough. Other outdoor recreational activities/facilities include a nine-hole golf course (Osprey Shores Resort) and two lighted outdoor tennis courts in Guysborough and outdoor skating rinks are located in Guysborough, Queensport, Little Dover, Larry's River, and Country Harbour and a curling club in Hazel Hill (MODG 2014a).

Hunting and fishing are popular activities in the MODG with big game hunting of deer and bear and inland and deep sea fishing. The area is popular for fishing blue fin tuna, shrimp, ground fish, scallop, snow crab and Atlantic Mackerel (GCIFA 2014a). Recreational boaters use community wharfs or serviced marina located in Canso and Guysborough, Auld’s Cove and Ballantyne’s Cove. There is no recreational fishing occurring in any of the freshwater sites located on the Project site. The water does not provide suitable habitat for any fish species

(Section 6.5.2). No recreational ocean fishing is conducted from the Project site as there is no safe access to the ocean due to the cliffs on the northern edge of the property.

Health and Social Services

The Project site is located within the district health authority of Guysborough Antigonish Strait Health Authority (GASHA). Within Guysborough County the GASHA operates two hospitals near the Project site (Table 6.8-2). Both hospitals operate a 24-hour emergency service and a variety of outpatient services.

Table 6.8-2:
Hospitals Near the Project Site

Hospital Name	Location	Number of Beds	Services
Eastern Memorial	Canso	8	Diagnostic Imaging, EKG, Emergency Services, Laboratory Services, Mental Health Outpatient Services, Physiotherapy, Social Work Services, Cancer and Supportive Care
Guysborough Memorial	Guysborough	10	Diagnostic Imaging, EKG, Emergency Services, Laboratory Services, Mental Health Outpatient Services, Physiotherapy, Nutrition and Dietetic Counselling, Physiotherapy, Social Work Services

Source: GASHA 2014.

There is a nursing home in Canso (Seaside Manor) and a special care facility in Guysborough (Milford Haven). Social services can be found throughout the MODG and those available near the Project site are presented in the Table 6.8-3.

Table 6.8-3:
Social Services Located Within the MODG

Service	Location(s)
Mental Health	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Addiction Support	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Alzheimer Support	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Cancer Support Care	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Health Education,	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Prenatal Classes	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Social Work – Acute Care	Eastern Hospital in Canso and Guysborough Memorial Hospital in Guysborough
Addictions, gambling, mental health hotlines	NA
Career and Job Counselling	Canso, Guysborough

Service	Location(s)
Literacy and Adult Learning	Guysborough
Clothing Bank	Guysborough
Food bank	Half Way Cove, Canso and Guysborough

Sources: GASHA 2014; GALA 2012

There are the churches in Canso and seven in Guysborough, including Baptist, Catholic, and United, with many more throughout the MODG (CCD 2014).

Crime and Public Safety

The Royal Canadian Mounted Police are responsible for policing Guysborough County, with detachments located in Canso, Guysborough and Sherbrooke (RCMP 2014). The 2012 crime statistics for Guysborough County and the province of Nova Scotia are presented in Table 6.8.4.

Table 6.8-4:
2012 Crime Statistics for Guysborough County and Nova Scotia

Location	Total # of Crimes	Crime rate/10,000 population	Violent Crimes	Violent Crime/10,000 population	Property Crime	Property Crime/10,000 population	Other Crime	Other Crime/10,000 population
Guysborough County	220	293	54	72	129	172	37	49
Guysborough County Youth	8	174	7	153	1	22	0	0
Nova Scotia	60,042	633	12,954	137	37,307	393	9,781	103
Nova Scotia Youth	5,492	882	1,715	276	2,667	428	1,110	178

Source: GNS 2014b

The crime rate, violent crime, property crime and other crime (per 10,000 people) in Guysborough County is generally half of the corresponding provincial crime rate (per 10,000 people) (Table 6.8-4). Crimes that do occur in Guysborough County are mostly non-violent and are usually related to property crime, which is similar to what is observed on a provincial scale. The crimes committed by the youth of Guysborough County are predominately violent, whereas the type of crime predominately committed by the youth of Nova Scotia is non-violent property crimes (Table 6.8-4).

Community Health

In 2010 the Guysborough County Community Health Board randomly surveyed 370 residents over the age of 15. The survey questions about personal health and well-being were derived from the Canadian Community Health Survey administered by Statistics Canada. The key findings of this survey are summarized in Table 6.8-5, which also includes the results for the Guysborough Antigonish Strait Health Authority (GASHA) region. The GASHA region includes Antigonish County, Guysborough County and the Strait Richmond.

Table 6.8-5:
2010 Indicators of Community Health for Guysborough County and Canada

Indicator	Guysborough County	Canada
Physically Inactive	46%	51%
Adult incidence of Over Weight/Obesity*	74%	51%
Consumed Alcohol in past 12 months	73%	NA
Currently Smoking*	22%	23%
Tried Illicit Drugs	37%	NA
Incidence of Cancer	1%	2%*
Incidence of Diabetes	9%	7%
Incidence of Heart Attacks	4%	NA
Incidence of Heart Disease	6%	7%
Incidence of Asthma	12%	9%
Incidence of cataracts or glaucoma	9%	NA
Incidence of Arthritis/Rheumatism	32%	21%
Consider Daily Life Stressful	49%	57%

*Nova Scotia %, as National value not available.

Generally speaking, the people of Guysborough County find daily life less stressful than the average Canadian does. They are less physically active than the rest of Canada, which could be in part why they also have a much higher incidence of overweight/obesity. For several indicators Guysborough County is the same/similar to the rest of Canada (incidence of smoking, cancer, diabetes and heart disease) but has a higher incidence of asthma and arthritis/rheumatism.

6.8.2.2 Infrastructure and Services

Private Residences

The total number of occupied dwellings in Guysborough County in 2011 was 3,685. The majority (84%) of these occupied dwellings were single detached homes. Other types included moveable homes (11%), apartments (3%) and semi-detached/ row/duplex (2%) (GNS 2014b). The total number of occupied dwellings in Canso in 2011 was 593. The breakdown was similar to the County, with the majority (75%) of the occupied dwellings were single detached homes, then moveable homes (15%), apartments (5%) and semi-detached/ row/duplex (4%) (GNS 2014b).

Temporary Housing

A list of bed and breakfasts, motels and campgrounds located in Guysborough County are identified in Table 6.8-6.

Table 6.8-6:
Temporary Housing in Guysborough County

Name of Temporary Housing	Location
The DesBarres Manor Country Inn	Guysborough
Foxberry-by-the-Sea Bed and Breakfast and Cottages	Whitehead
Pepperlane Manor	Guysborough
On the Harbour Bed and Breakfast	Isaac's harbour
Seawind Landing Country Inn	Charlos Cove
Last Port Motel	Canso
Lonely Rock Seaside Bungalows	New Harbour
Osprey Shores Golf Resort	Guysborough
Seabreeze Campground and Cottages	Fox Island
Shore To Sea Cottage	Phillips Harbour
Boylston Provincial Park	Boylston
Cape Canso RV Park & Marina	Canso
Salsman Provincial Park	Country Harbour

Source: MODG 2014b

The 2011 average value of dwellings in Canso, Guysborough County and Nova Scotia are presented in Table 6.8-7. (GNS 2014b).

Table 6.8-7:
Average Value of Dwellings in 2011

Location	Average Value
Canso	$94,651
Guysborough County	$110,604
Nova Scotia	$201,991

The 2011 average value of dwellings in Canso and Guysborough County were 47% and 55%, (respectively) of the provincial average value of dwellings.

Potable Water, Wastewater and Solid Waste Management

The Project site is currently undeveloped and therefore services such as potable water, wastewater and solid waste management will be addressed during the Project development.

The Town of Guysborough and the community of Canso have municipal water and sewer systems. Little Dover has municipal sewer service and Hazel Hill and the Tickle have municipal water service (MODG 2014a).

The closest solid waste management facility to the Project site is the Guysborough Waste Management facility located in Boylston, approximately 39 km from the Project site (MODG 2014a).

6.8.2.3 Cultural Heritage

Several cultural performance spaces are located in Guysborough: Chedabucto Place Performance Centre, Guysborough Masonic Hall, and the Mulgrave Road Theatre Centre, (MODG 2014a, MRT 2014).

Cultural events that occur proximal to the Project site include:

- Stan Rogers Folk Festival (located within Canso) which usually occurs for several days during the month of July. This festival celebrates Stan Rodgers and his contribution to folk music and East Coast music;
- Queensport Mackerel Derby which occurs late August (http://www.authenticseacoast.com); and
- At the Guysborough Marina local fiddlers & step dancers perform every Wednesday evening in August.

6.8.2.4 Economic Environment

Employment and Wages

The 2011 average family income for Canso, Guysborough County and Nova Scotia are presented in Table 6.8-8.

Table 6.8-8:
Average Family Income in 2011

Location	Family Income
Canso	$57,697
Guysborough County	$62,136
Nova Scotia	$79,838

Source: (NSb 2014)

The average family incomes in Canso and Guysborough County were 72% and 78% (respectively) of the average family income of Nova Scotia.

Guysborough County has significant challenges to economic development in the region. Guysborough is primarily rural with a relatively low education level, compared to the provincial average. High unemployment levels, combined with high out-migration, dependency on traditional resource sectors, and weak infrastructure are negatively impacting local economic development. Local stakeholders are working to improve economic development on multiple fronts. Projects to develop exportable products, develop aquaculture, improve tourism infrastructure, enhance training opportunities, and a range of other initiatives are continuing (ACOA 2009).

Labour Force and Business Activity

In 2001 Canso's labour participation rate was at 60.5% close to the provincial average of 61%, by 2006 the number of people participating in the job market dropped to 44%, a decline of nearly one-third from 2001 (Gardner Pinfold, 2011) which is indicative of significant out-migration and an aging population.

The overall volatility in employment in Canso from 1996 to 2006 was reflected in notable changes across a number of key industries. The hardest hit sector over the ten-year period was manufacturing, which saw a near total loss of employment (-86%) attributable to the decline and closure of the local fish processing plant, the town's major employer. A number of other sectors experienced major declines in employment over the same period, including transportation and storage (-67%); other services (-63%); and accommodation, food and beverage (-50%) (Gardner Pinfold 2011).

The unemployment rate for May 2014 in the North Shore Economic Region, which includes Guysborough County, was 11.7%, which was higher than the provincial rate of 9.5%. The employment rate for the North Shore Economic Region was 53% which is lower than the provincial rate of 56.7% (SC 2014).

The labour force by industry (%) for Canso, Guysborough County and Nova Scotia is presented in Table 6.8-9.

Table 6.8-9:
Labour Force (%) by Industry in 2011

Location	Agriculture/Forestry/Fishing and Hunting	Mining/quarrying and Oil and Gas	Utilities	Construction	Manufacturing	Wholesale Trade	Retail Trade	Transportation and Warehousing	Information and Cultural Industries	Finance and Insurance
Canso	28.9	0	0	9.3	7.5	0	12.5	2.7	0	0
Guysborough County	18	2.1	0.5	10.6	6.7	0.8	9.6	3.7	0.5	1.5
Nova Scotia	3.8	0.8	0.6	6.7	7	3.2	12.6	4	2	3.2

Location	Real Estate, Rental and Leasing	Professional/ Scientific and Technical Services	Management of Companies and Enterprises	Administrative and Support/waste	Educational Services	Health Care and Social Assistance	Arts and Entertainment	Accommodation and Food Services	Other Services (except Public Administration)	Public Administration
Canso	0	1.6	0	0	1.3	6.7	0	2.7	0	10.7
Guysborough County	1.3	1.3	1.3	3.5	6.8	11.2	3.6	4.7	4.3	7.8
Nova Scotia	1.4	4.9	0.1	4.9	8	12.3	2	6.5	4.2	9.7

Source: (GNS 2014b).

Although unemployment in the region remains high, in 2011, the majority of working people in Canso and Guysborough County were employed through farming, forestry, fishing or hunting (Table 6.8-9a & 6.8-9b). The majority of the people of Nova Scotia were working retail trade or are in the health care/social assistance industry. Employment through retail trade is also high in Canso, followed closely by public administration. Health care and social services is a common industry of employment for Canso and Guysborough County. The area also has an emerging oil and gas industry, namely the Goldboro Gas Plant, which provides a significant tax base to the region (MODG 2014a).

In 2008, the major employers of Guysborough County were: Ocean Nutrition, St. Mary's River Smokehouses, Liscombe Lodge, Historic Sherbrooke Village, Nova Scotia Government, Local Inshore Fishery and Martin Marietta Materials (IRNS 2008).

The 2011 educational attainment of the population 15 years and older in Canso, Guysborough County and Nova Scotia are presented in Table 6.8-10. (GNS 2014b).

Table 6.8-10:
Educational Attainment of Population (%) 15 years or older in 2011

Location	No certificate, diploma or degree	High School	Post Secondary
Canso	50.6	20.3	29.9
Guysborough County	39.3	17.7	43.2
Nova Scotia	22.3	23.9	53.8

Canso had a higher percentage of the population with no certificate, diploma or degree than Guysborough County and considerably more than the province. The percentage of the population with a high school level of education was similar between Canso, Guysborough County and the province. Although Canso had the lowest percentage of population with a post secondary education when compared to Guysborough County and the province, it did however have a higher percentage of its population with a post secondary education than a high school education.

Municipal Economic Health

Due to the extensive amount of out-migration, mostly due to the loss of fisheries related employment, the economies of Guysborough County and Canso are stressed (CBDC 2013; Gardner Pinfold 2011). However, new employment opportunities are arising in the natural gas, mining and shipping industries (CBDC 2013).

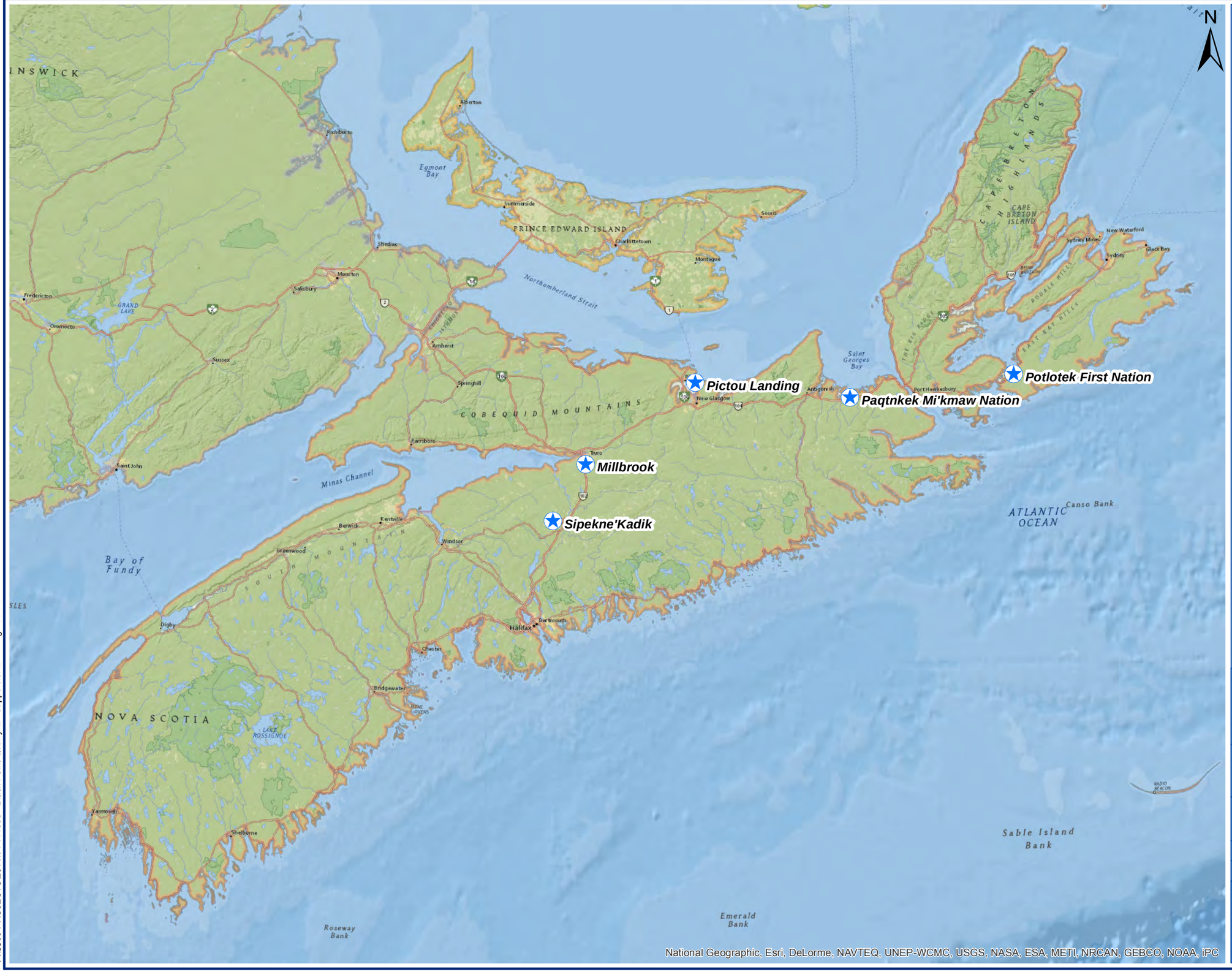
The 2011 – 2016 Strategic Plan of the Municipality of the District of Guysborough includes the following goals with the objective to balance economic opportunity and quality of life (MODG n.d.):

- To reverse the trend of population decline and have a 2% increase by 2015;
- To increase the establishment of new businesses; and create 200 new employment opportunities by 2015;
- To increase tax revenue by increasing the assessment base and increasing revenues from other sources;

- To maintain the quality of life for rate payers that may be affected as a result of potential dissolution of the Town of Canso;
- Improve service offerings to advance MODG as a liveable, healthy and sustainable municipality; and
- Strengthen internal operations.

6.8.3 First Nations Communities

A brief summary of the First Nation communities in close proximity to the Project site (**Figure 6.8-1**), which are known to have undertaken resource harvesting activities in the area are briefly described in the following sections.



LEGEND

0 25 50 100
Kilometers

SCALE: 1:1,684,296
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY
ENVIRONMENTAL ASSESSMENT

NOVA SCOTIA
FIRST NATIONS

October 1, 2014	Rev 1.0	Figure No. 6.8-1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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6.8.3.1 *Paqtnkek First Nation*

The nearest mainland First Nation (Mi'kmaq) community is Paqtnkek First Nation (in Afton, NS). It is located 66 km northwest of Queensport in Antigonish County near Heatherton - mid way between the Canso Causeway and the Town of Antigonish.

The Paqtnkek First Nation has a registered population of 539, of which 376 live on Reserve. The Paqtnkek Band Council consists of six members. Paqtnkek First Nation administers three Reserve properties (Table 6.8-11).

Table 6.8-11:
Paqtnkek First Nation Reserve Properties

Reserve	Area	Location	Population	Date Established
Franklin Manor 22 (48% share with Pictou Landing First Nation)	212.5 ha (525 acres)	32 km. southeast of Amherst	0	March 3, 1865
Paqtnkek-Niktuek 23	218.1 ha (539 acres)	24 km. east of Antigonish	373	March 3, 1820
Welnek 38	43.4 ha (107 acres)	18 km. east of Antigonish	0	August 28, 1990

6.8.3.2 *Pictou Landing First Nation*

The Pictou Landing First Nation is located on the Northumberland Strait approximately 150 km from the project site. The community has a registered population of 649, of which 476 live on Reserve. The Pictou Landing Band Council consists of seven members. The Band Council administers 5 reserves (Table 6.8-12).

Table 6.8-12:
Pictou Landing First Nation Reserve Properties

Reserve	Area	Location	Population	Date Established
Boat Harbour West 37	98.2 hectares (243 acres)	8 km. north of New Glasgow	0	May 18, 1961
Fisher's Grant 24	142.7 hectares (353 acres)	10 km. north of New Glasgow	467	March 3, 1866
Fisher's Grant 24G	60 hectares (150 acres)	3.2 km. southeast of Pictou Landing	0	March 3, 1927
Franklin Manor 22 (part)	212.5 hectares (525 acres)	32 km. southeast of Amherst	0	March 3, 1865
Merigomish Harbour 31	14.2 hectares (35 acres)	12.8 km. east of New Glasgow	0	March 3, 1865

6.8.3.3 *Potolotek*

Located on Cape Breton Island, approximately 140 km from the Project site, the Potolotek First Nation (also known as Chapel Island First Nation) has a registered population of 710, of which

542 live on Reserve. The Potolotek Band Council consists of eight members. The Band Council administers two reserves (Table 6.8-13).

Table 6.8-13:
Potolotek First Nation Reserve Properties

Reserve	Area	Location	Population	Date established
Chapel Island 5	592.5 hectares (1,464 acres)	69 km. southwest of Sydney	481	July 1, 1792
Malagawatch 4 (1/5 share)	661.3 hectares (1,634 acres)	62 km. southwest of Sydney	0	August 2, 1833

6.8.3.4 *Millbrook Band*

The Millbrook Band is located near Truro, NS approximately 160 km from the project site). The Community, one of the larger Mi'kmaq communities in Nova Scotia has a 12 member Band Council. Millbrook First Nation administers seven Reserve properties (Table 6.8-14).

Table 6.8-14:
Millbrook First Nation Reserve Properties

Reserve	Area	Location	Population	Date established
Beaver Lake 17	49.4 ha (122 acres)	78.4 km southeast of Halifax	23	March 3, 1867
Cole Harbour 30	18.6 ha (46 acres)	9.6 km east of Halifax	194	March 3, 1880
Millbrook 27	302.0 ha (746 acres)	8 km south of Truro	847	March 3, 1886
Sheet Harbour 36	32.7 ha (81 acres)	91.2 km northeast of Halifax	15	March 3, 1915
Truro 27A	16.7 ha (41 acres)	Joined south of Truro town limit	0	March 3, 1904
Truro 27B	16.4 ha (41 acres)	Joined with 27A on south	0	March 3, 1907

6.8.3.5 *Sipekne'katik First Nation*

The Sipekne'katik First Nation is located near Shubenacadie, NS 240 km from the Project site. The Band has a registered population of 2,534 of which 1,222 reside on Reserve. Sipekne'katik has a 12 member Council which administers four Reserve properties (Table 6.8-15).

Table 6.8-15:
Sipekne'katik First Nation Reserve Properties

Reserve	Area	Location	Population	Date established
Indian Brook 14	1,234.2 ha (3,050 acres)	28.8 km southwest of Truro	1,084	July 8, 1820
New Ross 20	408.3 ha (1,009 acres)	64 km northwest of Halifax	0	March 3, 1820

Pennal 19	43.5 ha (107 acres)	67.2 km northwest of Halifax	22	March 3, 1858
Shubenacadie 13	412 ha (1,020 acres)	32 km north of Halifax	0	March 3, 1820
Dodds Lot	NA	NA	NA	NA
Wallace Hills	54.8 ha (135 acres)	NA	NA	NA

6.9 Land and Resource Use

6.9.1 Existing Land Use

The Project area is located in the Municipality of the District of Guysborough (MODG); approximately 10 km west of Canso, along the south shore of Chedabucto Bay. The Project area is bound to the north by Chedabucto Bay and to the south by a power transmission line. Provincial Route 16 runs parallel to the southern boundary of the site approximately 750 m away.

Lands immediately surrounding the Project area are largely undeveloped. In 2011 Guysborough County had a population of approximately 8,100 residences (GNS 2014b). The adjacent communities to the Project area, Half Island Cove, Fox Island Main and Upper Fox Island along Route 16, are rural in character and low in population density. Residential development in the vicinity of the Project is relatively sparse, with no residential structures within 500 m of the site boundary, 11 within 1 km, and fewer than 50 within 2 km. The nearest residence is located 700 m from the property boundary on the coast at the east end of Half Island Cove Road. The nearest residence on Route 16 is approximately 750 m from the property boundary. The separation between residences and blasting activity is even greater (and nowhere less than 800 m) considering the preliminary Project layout. For the first ten years or so of operation, the closest residence will be greater than 1.0 km from blasting since work will begin in the north end of the site and proceed in a southerly direction.

The Property is owned by the MODG and is relatively inaccessible, although ATV trails and the transmission line provide access to the granite highlands. Access to the lower coastal platform is more difficult but can be gained through footpaths or boats. An overgrown ATV trails can be used to access Black Point from the east.

Local residents report visiting the beaches, both east and west of Black Point, on an occasional basis (G. Krause pers. comm. 2014). The property has long been used for trapping by at least one local resident (J. Murphy pers. comm. 2014) and the presence of shotgun shell casings and a hunting blind suggests the site may be been used for hunting in the relatively recent past. Forestry is not actively practiced on the site, although forests to the east near Fox Island Main have recently been harvested; an activity mistakenly attributed to the Proponent.

6.9.2 Land Ownership and Tenure

The land hosting the quarry is owned by the Municipality of the District of Guysborough (MODG), as per a recently approved land exchange with the Province (Grant No. 23711) and expropriation of two private land parcels. The land is currently zoned Industrial Heavy I-2. The property is not now, nor has it ever been, used for a marine terminal. These lands have not been specifically designated for use as a marine terminal by the MODG.

6.9.3 First Nation Land and Resource Use

Current Land Use Activities

While it is known that the Project area was once occupied by Mi'kmaq families who frequented the area for its rich fishing, since the implementation of federal policies under the *Indian Act*, no Mi'kmaq communities (reserves) are located in or in close proximity to the Project area.

As noted in the Mi'kmaq Ecological Knowledge Study (MEKS) (MAPS 2013 – **Appendix K**), high mobility has always been a crucial characteristic of the land use patterns of Mi'kmaq individuals and families. However, as long as resources remained predictable, it was natural that hunters, fishers and harvesters of other natural resources tended to utilize areas that they are intimately familiar with and pass on this familiarity to their children. As a consequence, spatial land use patterns of Mi'kmaq families have in general remained fairly stable; despite the fact government policy was to centralize Mi'kmaq families onto a few discrete reserves. However motorized transportation and the associated infrastructure have enabled Mi'kmaq harvesters to have opportunity to conduct harvesting activities throughout the province.

A review of outstanding specific land claims was undertaken by Mi'kma'ki All Points Services during the preparation of the Mi'kmaq Ecological Knowledge Study (MAPS 2013). At the time of the study there were no specific claims pending within the Project area. This does not imply, however, that a specific land claim may not arise in the future.

It is understood that Crown consultation on new projects is conducted with all first Nations. This is due to the shared Rights of all Mi'kmaq to the resources upon which they have historically and are currently dependent. However, in keeping with the understanding of resource harvesting strategies (opportunistic) and centralization policies, it is likely that those most familiar with, and actively involved with resource use in the Project area will be located in the present day communities in closest proximity to the project site; the Paqtnkek, Potolotek, Pictou Landing, Millbrook and Sipekne'katik First Nations. This is consistent with the findings from the MEKS which noted that until the 1960s, the Project area and its resources were used by members of the three closest communities of Paqtnkek, Chapel Island (Potolotek) and Eskasoni (the largest Mi'kmaq community to which many families were relocated). It was also noted that families in Millbrook (to which many were located) had also lived in several communities in the Guysborough area.

Subsequently, as a result of Canada's centralization policies, there was diminished use of the area since harvesting activities began to focus on areas closer to the reserve lands. While it is understood that Mi'kmaq rights to harvest in all areas of Nova Scotia are important and protected, gradually there has been reduced involvement in the Project area by Eskasoni Band members with greater harvesting opportunities in the highlands and wilderness areas closer to the community and today the Project area sees little, if any, harvesting effort by community members.

The MEKS presented in **Appendix K** identifies lands and resources of use and interest to the Mi'kmaq of Nova Scotia in the Project area, and which may be potentially affected by Project development. Although no reports of on-going resource harvesting or use are recorded in the MEKS, the report notes the Property hosts certain resources that could be used by Mi'Kmaq, should they choose to do so. The MEKS report has been presented to the Mi'kmaq Chiefs through the KMK. It should be noted that during Project conceptualization the Proponent

initiated an ongoing comprehensive Aboriginal Community Engagement Strategy (see Section 11.11 below).

As noted above, in addition to Paqtnkek some Band members from the Millbrook and Sipekne'katik First Nations have been involved in the resource harvesting in the lands and waters near the Project area, and are, as a result familiar with the region. Two other Mi'kmaq communities are also in relatively close proximity (<150 km) from the Project Site; Pictou Landing and Pololotek. Motorized transportation such as all-terrain vehicles, snowmobiles, pick-up trucks, engine-powered boats put the Project Area`s resources within relatively easy reach from any of these reserve communities.

Site visits were conducted with Mi'kmaq Elders, harvesters, Chiefs, and organizational representatives on June 18, 2014, August 12, 2014 and October 27, 2014 with the objective of familiarizing community representatives with the Project, and to determine the level and extent of current use of the site for social, ceremonial or livelihood harvesting. Mi'Kmaq community members were reported to have harvested several freshwater fishes (salmon, trout and eel) and hunted moose and deer, as well as various small game species in the region of the Project site. It had been noted in the MEKS that Mi'kmaq trapping activities occur within the general study area as well.

Based on the information compiled through the MEKS and findings during site visits, it is concluded that there is currently no direct Mi'kmaq use of the Project site for subsistence harvesting of food or furbearing in animals.

Mi'kmaq has continued to harvest a variety of plant species throughout Nova Scotia and the Project region is no exception. Harvesting of trees and plants such as maple, ash, birch as well as birch bark for tools, crafts and decorative items continue wherever these resources are known to occur. This is also true for blueberries, cranberries, strawberries and foxi berries. The MEKS also noted that several species of medicinal plants continue to be collected in the Guysborough region.

6.9.4 Protected Areas, Nature Reserves and Parks

The Restricted and Limited Land Use database maintained by NSDNR shows the following features in proximity to the proposed Project:

- Three private beaches protected under the Beaches Protection Act (Lower Half Island Cove 2.7 km west and Half Island Cove 3.9 km west, Fox Island Main 3.7 km east);
- Two Wilderness Areas: the Bonnet Lake Barrens Wilderness Area (6.9 km southwest) and the Canso Coastal Barrens Wilderness Area (1.7 km south and east);
- Third Lake Operational Non-Designated Parks and Reserve 4.2 km south and west.
- Designated Water Supply Area: Walsh or Wilkins Lake 4.5 km south and east; and
- Natural Watershed Municipal Surface Water Supply 3.65 km south and east.

These features are shown on **Figure 1.0-1.** Significant habitats and Important Bird Areas are shown on **Figure 6.4-3.**

6.9.5 Tourism and Recreation

There are a number of hiking trails and beaches, parks and wilderness viewing areas, museums and historic sites as shown on **Figure 6.9-1** (MODG 2014a). Some of these areas, such as the Canso Coastal Barrens Wilderness Area, several protected beaches (Lower Half Island Cove,

Half Island Cove, and Fox Island Main) and the Out of the Fog Lighthouse Museum in Half Island Cove are located within 5.0 km of the Project site. Recreational activity (trapping, ATV and snowmobile use) was observed on the Project site at the time of the winter bird survey in January 2011.

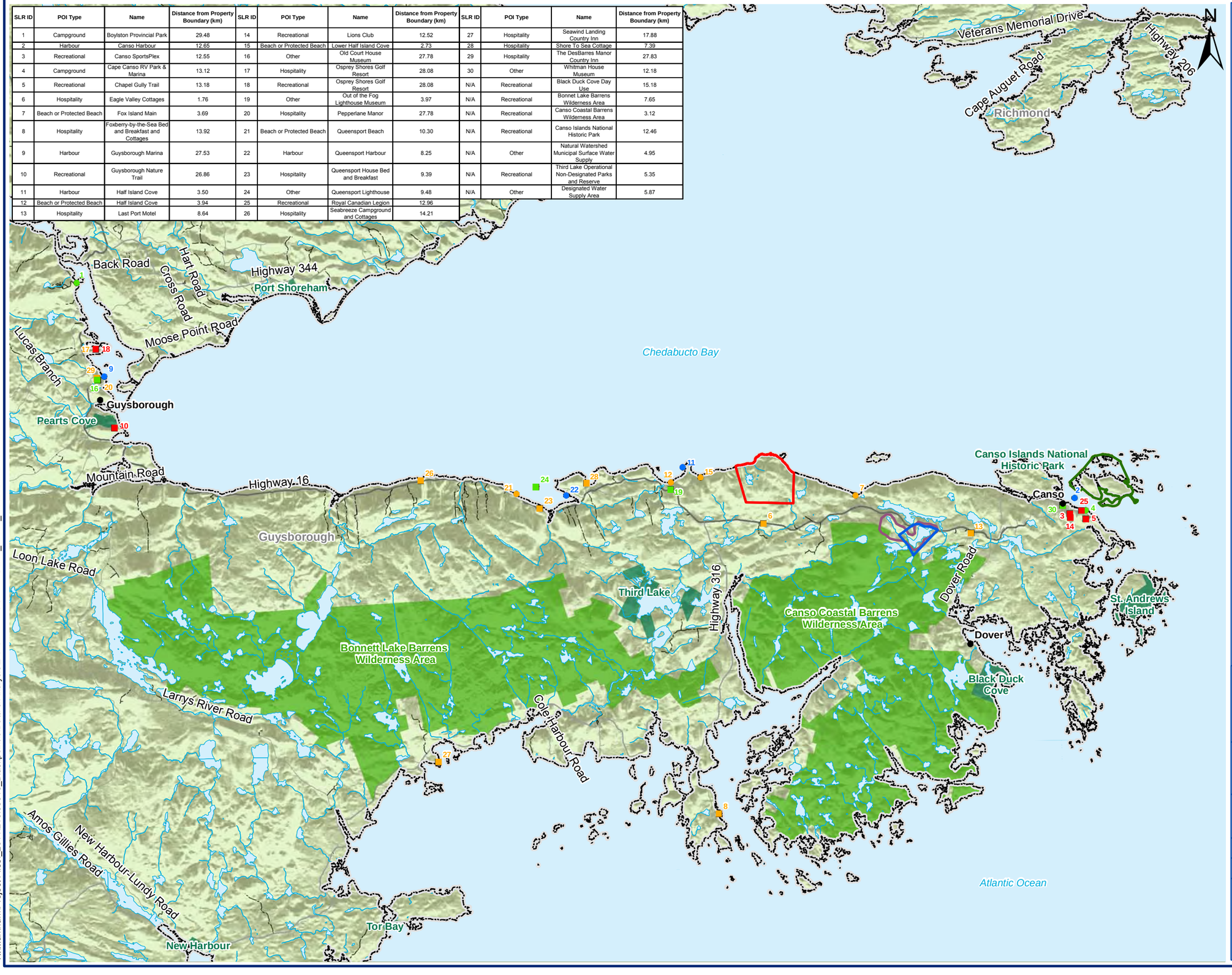
Activities located slightly further afield from the Project site include:

- Lighthouse Lookout and Park in Queensport (9.5 km east);
- the Whitman House museum (Nova Scotia 2014a) in the Town of Canso (10 km west) – provides visitors the history of Canso and eastern Guysborough;
- Queensport Beach (10 km west) – cobble beach with picnic tables overlooking the Queensport Lighthouse (GNS 2014e)
- Chapel Gully Trail (13 km east) – located in Canso, this 5 km trail allows for hiking and biking (GNS 2014f);
- Guysborough Nature Trail – Trans Canada Trail (26 km west)– a 44 km trail starting at Guysborough Harbour and is used for hiking, cross country skiing, snowshoeing and biking (Trail Peak 2014);
- Black Duck Cove Day Use Park (15 km south-east) – a 3.5 km shoreline hiking trail popular for birding (GNS 2014e);
- Canso Islands National Historic Park, located 15 km east of the Project site (http://threeshoresnovascotia.ca) - a National Historic Site, boat service is offered to the island to learn about the early European fishing port (PC 2011).
- Old Court House Museum (28 km west) - a museum for the local cultural heritage and an information centre for Guysborough County (GHS n.d.).

Hunting and fishing are popular activities in the MODG with big game hunting of deer and bear and inland and deep sea fishing. The area is popular for fishing blue fin tuna, shrimp, ground fish, scallop, snow crab and Atlantic mackerel (GCIFA 2014a).

The nearest recreational facilities include the Canso SportsPlex, which houses an arena, pool, and several sports fields. The Town of Canso also hosts a Royal Canadian Legion and a Lions Club. The Osprey Shores Golf Resort is located in Guysborough and is an all-encompassing resort with accommodation, food and beverage as well as a 2,691 yard, 9-hole golf course. The MODG has facilities to offer the community and visitors such as skating rinks, fitness centres, tennis courts etc. More information on local facilities can be found in Section 6.8. Guysborough is also home to local performing arts held in the Guysborough Masonic Hall, the Mulgrave Road Theatre Centre, Chedabucto Place Performance Centre and the Guysborough 300 seat performing arts space (MRT 2014).

SLR ID	POI Type	Name	Distance from Property Boundary (km)	SLR ID	POI Type	Name	Distance from Property Boundary (km)	SLR ID	POI Type	Name	Distance from Property Boundary (km)
1	Campground	Boylston Provincial Park	29.48	14	Recreational	Lions Club	12.52	27	Hospitality	Seawind Landing Country Inn	17.88
2	Harbour	Canso Harbour	12.65	15	Beach or Protected Beach	Lower Half Island Cove	2.73	28	Hospitality	Shore To Sea Cottage	7.39
3	Recreational	Canso SportsPlex	12.55	16	Other	Old Court House Museum	27.78	29	Hospitality	The DesBarres Manor Country Inn	27.83
4	Campground	Cape Canso RV Park & Marina	13.12	17	Hospitality	Osprey Shores Golf Resort	28.08	30	Other	Whitman House Museum	12.18
5	Recreational	Chapel Gully Trail	13.18	18	Recreational	Osprey Shores Golf Resort	28.08	N/A	Recreational	Black Duck Cove Day Use	15.18
6	Hospitality	Eagle Valley Cottages	1.76	19	Other	Out of the Fog Lighthouse Museum	3.97	N/A	Recreational	Bonnet Lake Barrens Wilderness Area	7.65
7	Beach or Protected Beach	Fox Island Main	3.69	20	Hospitality	Pepperlane Manor	27.78	N/A	Recreational	Canso Coastal Barrens Wilderness Area	3.12
8	Hospitality	Foxberry-by-the-Sea Bed and Breakfast and Cottages	13.92	21	Beach or Protected Beach	Queensport Beach	10.30	N/A	Recreational	Canso Islands National Historic Park	12.46
9	Harbour	Guysborough Marina	27.53	22	Harbour	Queensport Harbour	8.25	N/A	Other	Natural Watershed Municipal Surface Water Supply	4.95
10	Recreational	Guysborough Nature Trail	26.86	23	Hospitality	Queensport House Bed and Breakfast	9.39	N/A	Recreational	Third Lake Operational Non-Designated Parks and Reserve	5.35
11	Harbour	Half Island Cove	3.50	24	Other	Queensport Lighthouse	9.48	N/A	Other	Designated Water Supply Area	5.87
12	Beach or Protected Beach	Half Island Cove	3.94	25	Recreational	Royal Canadian Legion	12.96				
13	Hospitality	Last Port Motel	8.64	26	Hospitality	Seabreeze Campground and Cottages	14.21				



LEGEND

- Populated Place
- Beach or Protected Beach
- Campground
- Harbour
- Hospitality
- Other
- Recreational
- Property Boundary
- Wilderness Area
- Operational Non-Designated Parks and Reserves
- Canso Islands National Historic Park
- Designated Water Supply Area
- Natural Watershed Municipal Surface Water Supply
- County Boundary
- Waterbody
- Watercourse

0 2.5 5 Kilometers

SCALE: 1:150,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY PROJECT

TOURISM / RECREATIONAL PLACES

September 25, 2014	Rev 1.0	Figure No. 6.9-1
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

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Cultural events that occur in the neighbouring communities to the Project site include the annual:

- Stan Rogers Folk Festival (located within the Town of Canso) which usually occurs for several days during the month of July in honour of Canadian folk singer Stan Rogers. The festival is a popular event and has an attendance of over 10,000 people ; and
- Queensport Mackerel Derby which occurs late August (http://www.authenticseacoast.com).

Nova Scotia's shoreline is a popular destination for tourists including boaters. There are four marinas within 28 km of the Project site. The closest is Half Island Cove, 3.5 km to the west, which consists of one jetty. Queensport Harbour is 8.25 km to the west of the Project site and Canso Harbour is approximately 12.5 km from the site. Guysborough Marina is the largest of these and is located in Guysborough, 27.5 km from the site. The Guysborough Marina provides boat rentals including canoes and kayaks and also has a retail shop.

There are a range of tourist style accommodations in the MODG including motels, cabins, bed-and-breakfasts and campgrounds. Table 6.9-1 provides a list of accommodations and their location within the MODG.

Table 6.9-1:
Accommodations within the District of Guysborough

Accommodation Type	Name	Location	Distance from Property Boundary (km)
B&B/Inn	The DesBarres Manor Country Inn	Guysborough	27.83
B&B/Inn and Cottages	Foxberry-by-the-Sea Bed and Breakfast and Cottages	Whitehead	13.92
B&B/Inn	Pepperlane Manor	Guysborough	27.78
B&B/Inn	Queensport House Bed and Breakfast	Guysborough	9.39
B&B/Inn	Seawind Landing Country Inn	Charlos Cove	17.88
Cottage/Motel	Eagle Valley Cottages	Canso	1.76
Cottage/Motel	Last Port Motel	Canso	8.64
Cottage/Motel	Osprey Shores Golf Resort	Guysborough	28.08
Cottage/Motel	Shore To Sea Cottage	Phillips Harbour	7.39
Cottage/Motel and Campground	Seabreeze Campground and Cottages	Fox Island	14.21
Campground	Boylston Provincial Park	Boylston	29.48
Campground	Cape Canso RV Park & Marina	Canso	13.12

Source: MODG 2014b, GNS 2014g

In 2010, Nova Scotia Tourism released the Visitor Exit Survey Community Report, which outlines the total visits (stopped or stayed) to Nova Scotia communities organized by tourist region, as well as "capture rates" of communities within these regions (Nova Scotia Department of Economic and Rural Development and Tourism, 2013). The communities of Canso and Guysborough were among the Eastern Shore communities examined. The Eastern Shore was visited by 7% of people during their trip to Nova Scotia. According to the 2010 Nova Scotia Visitor Exit Survey, the number one reason to visit the Eastern Shore was for a holiday, closely

followed by visiting friends or relatives. The activities most commonly undertaken were costal sightseeing, hiking, and beach exploring.

6.9.6 Forestry and Agriculture

Clear cutting forest harvests have occurred to the west and south of the Project area in small patches (NSDNR 2007b) and forest harvesting is currently occurring to the east of the Project site along Highway 16 near the intersection with Fox Island Road. The forest within the Project site is largely non-merchantable and soil conditions do not allow for a viable agricultural practice (Section 6.1). No forestry is currently practiced on the Project site. The MODG has approximately 2,300 hectares in agricultural production which amounts to 1% of Nova Scotia's land in agriculture. None of this agricultural land is located in the Project area or neighbouring land (GNS n.d.).

6.9.7 Mining

There are no active mines on or adjacent to the Project site but there is a large aggregate mining operation near Mulgrave on the Strait of Canso (Martin Marietta's Auld Cove quarry located approximately 76 km northwest of Black Point) (MODG 2014a). Closer to the Project site, Chedabucto Aggregates is located in Half Way Cove approximately 12 km west of the Project site. Chedabucto Aggregates blasts, crushes, screens and trucks Goldenville Formation quartzite for sale to local markets.

The MODG is currently experiencing an increase in gold and rare earth metals exploratory studies. It is predicted that mining in this region will intensify in the near future (MODG 2014a).

6.9.8 Water Use including Groundwater

Currently there is no residential water use on the Project site. Residential homes adjacent to the Project site derive their water from drilled and dug wells (Section 6.2.1). The surface water uses near the Project site include recreational ocean and freshwater fishing (Queensport and Canso), commercial fishing in Queensport, Canso, and Half Island Cove (see Section 6.10.1). There are Designated Water Supply Areas (Walsh or Wilkins Lake 4.5 km south and east of the Project site) and Natural Watershed Municipal Surface Water Supply area located 3.65 km south and east of the Project site.

6.10 Fisheries and Aquaculture

6.10.1 Regulatory Framework

Fisheries and Oceans Canada (DFO) is the federal agency responsible for fisheries and fish habitat conservation and protection. DFO manages commercial fishing, licensing, conservation and enforcement through the *Fisheries Act* and associated regulations and policies. Commercial fisheries are managed by way of Integrated Fishery Management Plans (IFMPs), which in turn are based on information provided by DFO's Canadian Science Advisory Secretariat (CSAS) and other sources. The IFMP describes the management objectives for each fishery, the measures used to achieve these objectives, and the criteria by which the objectives are measured (DFO 2012b).

Under the *Fisheries Act,* the Atlantic Fishery Regulations (1985) provide management measures and define management areas for Atlantic coast fisheries. The Northwest Atlantic

Fisheries Organization (NAFO) Divisions are included in the Regulations, as are other fishing areas, such as Herring Fishing Areas, Crab Fishing Areas, Lobster Fishing Areas, Mackerel Fishing Areas and Shrimp Fishing Areas.

The Scotian Shelf comprises the main fishing grounds in Nova Scotia and has at least five zones and numerous stocks and sub-stocks. Chedabucto Bay is a component of NAFO fishing division 4W along the Scotian Shelf. The Project is located within NAFO Fisheries management Area 4Wd.

6.10.2 Commercial Fishing in Nova Scotia

At its peak in 2002-03, the landed value of commercial fisheries in the Scotian Shelf/Bay of Fundy region was $800 million. The landed value has since declined to $538 million in 2009 (DFO 2012b). A variety of fishing gears are used to capture over 30 different commercially saleable species, including bottom-contacting trawls and dredges, pots and traps, gillnets, seines and harpoons. Shellfish comprise about 80% of the fisheries by value (Gardner *et al.* 2009). The primary commercial shellfish species are lobster, scallop, snow crab and shrimp.

Groundfish contribute significantly to total landings (11% of landed value), but landings have drastically decreased since the 1970s and 1980s when this group accounted for over 50% of landed value. Cod, haddock, flatfishes and hake are now the leading commercial groundfish species (DFO 2012b).

Within the pelagic group (5% of landed value), herring, swordfish and tuna are the main species harvested. The relative importance of marine fisheries to the Nova Scotia economy has increased gradually over the past decade, with the contribution to the GDP rising from $235 million in 1995 to over $500 million in 2006 (Gardner *et al.* 2009; DFO 2012b).

6.10.3 Overview of the Guysborough County Commercial Fishery

In Guysborough County, the commercial fishing industry provides approximately 400 jobs in the form of small, independently owned businesses (GCIFA 2014b). There are over 200 registered fishing vessels ranging from 18 to 64.9 feet in Guysborough County, the majority of which are less than 34.9 feet in length (AMEC 2013). The core of the fishery is coastal, family-based, and uses small boats (SRSF 2001). In Guysborough, the estimated landed wharf value of all harvested species combined is over $65 million annually (GCIFA 2014b).

Within the Project area, DFO lists two “core” small craft commercial fishing harbours (Queensport and Canso), and one “non-core” small craft commercial fishing harbour (Half Island Cove). Canso and Queensport are also managed harbours; they both have Harbour Authorities: incorporated, not-for-profit organizations responsible for managing, operating and maintaining the public fishing harbours (DFO 2011a).

Although almost all license holders who fish along the south shore of Chedabucto Bay are multi-species license holders (G. Boudreau, pers. comm. 2014), the lobster industry is the backbone of the fishing industry in Guysborough County and a significant economic activity in many coastal communities. The Project area is located in Lobster Fishing Area (LFA) 31A, with over license holders that are permitted to fish from Ragged Head all the way around to Whitehead, Guysborough County (G. Boudreau, pers. comm. 2014).

A number of commercial species are taken in Chedabucto Bay. As noted, this includes lobster as well as shrimp, herring, mackerel, crab, scallop, tuna, squid and sea urchin (please see

below). Within Chedabucto Bay, fishers are allowed fixed gear only: herring nets, shrimp, lobster and crab traps. The only exception is applied to scallop fishers, who do not use fixed gear and tuna fishing.

Historically, cod, mackerel, and herring, were valued commercial species taken in Chedabucto Bay and the Bay was used as a spawning area by Atlantic cod and herring. Spawning may still occur, although herring spawning has not been documented in the area since 2009. Juvenile herring and hake use the Bay for nursery habitat. Mackerel and herring also utilize the Bay for over-wintering habitat (Gromack *et al.* 2010). In addition to spawning, and rearing habitat Chedabucto Bay is also an important feeding ground for herring.

Historic records indicate the Bay supported commercial fisheries for lobster, crab, shrimp, and shellfish. The area has supported lobster for many years, and in more recent years commercial landings have increased. The Bay also supports a healthy population of northern shrimp (Gromack *et al.* 2010).

6.10.4 First Nations Fisheries

Overview

In 1990, the Supreme Court of Canada's Sparrow decision upheld the Aboriginal right to fish for food, social and ceremonial purposes (DFO 2012b). In response, DFO initiated the Aboriginal Fisheries Strategy to provide a framework for the management of fisheries for food, social and ceremonial purposes (DFO 2003). In 1999, the Supreme Court affirmed a treaty right to hunt, fish and gather in pursuit of a "moderate livelihood" in its landmark Marshall decision (DFO 2012b; AFN 2011).

Since 1999 DFO has implemented several programs to promote the integration of First Nations into Atlantic Canadian fisheries. The Marshall Response Initiative (MRI) was created to provide Mi'kmaq and Maliseet First Nations with increased access to the commercial fishery through the provision of licenses, vessels and gear. The Aboriginal Aquatic Resource and Oceans Management (AAROM) program was instituted to facilitate the participation of Aboriginal groups in advisory and decision-making processes for oceans and fisheries resource management (DFO 2008c). The Atlantic Integrated Commercial Fisheries Initiative (AICFI) was developed to enhance corporate governance and business planning while offering a vehicle for future small scale fisheries asset acquisition (AFN 2011). Since the Marshall decision, Aboriginals throughout the Maritimes have participated in training, established administration, governance and business infrastructure, and have substantially increased their involvement in Atlantic commercial fisheries (APCFNC 2009).

Historically, First Nation fishers primarily exploited snow crab and lobster (Cooper *et al.* 2010) but considerable effort has been made in recent years to diversify the First Nation fishery. Currently, the most productive species in Atlantic Canada are bluefin tuna, lobster, scallop, shrimp and snow crab, with lobster and snow crab dominant in terms of licenses and shrimp and snow crab dominant in terms of economic return (AFN 2011; APCFNC 2009).

The landed value of Aboriginal fisheries tripled between 2000 and 2006, while fishing employment increased 60% between 2000 and 2007. In 2009, 11% of Aboriginal jobs in Atlantic Canada were in the fishing sector (APCFNC 2009). Aboriginal fishing licenses generated an economic return of approximately $35 million in 2009 compared to just over $4 million in 1999 (APCFNC 2009).

At this time, it appears that fishing assets have been successfully transferred to First Nation communities, promoting employment opportunities and economic return to many groups. Cumulatively, these initiatives have resulted in quantitative improvements in terms of employment and revenue in First Nation communities. These programs have also reportedly developed a more knowledgeable and sophisticated appreciation of the industry, fisheries management, and corporate governance at the community level (AFN 2011).

The First Nation fishery has experienced considerable growth along with a number of challenges over the past decade. In 1999 (pre-Marshall decision) 316 fishing licenses were held by First Nations in Atlantic Canada. By 2009, this had increased to 1,238 (APFNC 2009). Challenges to the industry over this period included low market price for lobster, which has created pressures on the demand for licenses, and economic loss in the snow crab fishery (AFN 2011). Additional challenges emerged with respect to how these resources were managed, implemented and controlled (Cooper *et al.* 2010). Nevertheless, the commercial fishery continues to represent a long term, sustainable industry for many Nova Scotia Mi'kmaq communities (Cooper *et al.* 2010; APCFNC 2009).

Mi'kmaq Fisheries

Those communities which have been involved in the local commercial groundfish, lobster, snow crab, tuna, swordfish, and mackerel fisheries include: Acadia, Potolotek, Eskasoni, Sipekne'katik, Membertou, Millbrook, Wagmatcook, Waycobah, Pictou Landing and Paqtnkek. All the Nova Scotia bands and the Native Council of Nova Scotia in the Maritimes Region are authorized to harvest in this area for food, social and ceremonial (FSC) purposes.

The MEKS noted that marine resources were reported to be harvested along the Study Area portion of the Chedabucto coast. These include mackerel, herring, cod, haddock, urchins, mussels, oysters, clams, as well as snow crab in deeper waters. The sandbar extending between Fox Island and the mainland was also noted as a productive shellfish bed.

Several Mi'kmaq communities are currently fishing marine species for livelihood purposes. Some of this activity was apparently initiated following the Supreme Court of Canada's decision on the *R v Marshall* case that confirmed recognition of Mi'kmaq communal rights to fish for livelihood purposes. These efforts 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.

Telephone interviews were conducted with the fishery managers from each of the communities which have licenses along the eastern shore to determine if any fishing effort is targeted in or near the Project site. Table 6.9-2 provides the findings from these interviews. Representatives from the Guysborough County Inshore Fishermen's Association were also contacted to determine local knowledge of fishing activity of Mi'kmaq fishers.

Table 6.9-2:
Project Area Mi'kmaq Commercial Fishing Activity

Band	Contact	Commercial Fishing activity – Eastern Shore
Millbrook	Adrian Gloade	1 sea urchin license 4 snow crab licenses Possible tuna fishing if fishery is not successful nearer Canso.
Shubenacadie	Brendan Maloney	No lobster licences in LFA 31
Waycobah	Phil Drennan	1 shrimp trap license in Chedabucto Bay Lobster licenses in Chedabucto Bay Elver fishery throughout area to Alder Point Snow crab fishery in Zone 24 Groundfish offshore: silver hake, redfish, hagfish, snow crab 1 offshore shrimp trawl license
Chapel Island	Charles Doucette	1 urchin license, 2 shrimp, 3 crab, 2 lobster
Eskasoni	Leonard Denny	10 mobile shrimp licenses, 14 snow crab license in Zones 23, 24
Membertou	Hubert Nichols	No active licenses in Guysborough- Canso area. They do fish tuna in the area. Remaining fisheries are far offshore.
Wagmatcook	Preston Bernard-	3 active snow crab licenses off shore. Also some tuna fishing in the area.
Paqtnkek	Marina Sark	No active licenses in the area.

6.10.5 Species Harvested in the Project Area

Lobster LFA 31A

Lobsters breed in summer to fall. Eggs hatch two years after breeding, generally in the July-August. Larvae swim in the water column for 4-6 weeks before settling to the bottom and seeking shelter. Six to nine years are required for lobsters to reach legal size. Mature lobsters generally move from shallow to deep water in the fall and from deep to shallow in late spring (DFO 2004).

As noted, the Project area is located within LFA 31A; the fishing season is currently April 29 to June 30. In 2011 there were 73 licenses within LFA 31A, each with a 250 trap limit (DFO 2011b); there are currently 68 actives licences (Table 6.10-1 reports 68 active licences in 2013).

Lobster prefer rocky seabed habitat. In the Project area, this habitat is generally confined to nearshore areas, typically within 250 m of the shore. Based on conversations with members of the GCIFA, in the vicinity of the Project site there are at least three lobster fishers who habitually the nearshore zone between Black Point and Gaulman Point.

Lobster fishermen are guided in their patterns of gear deployment not only by the abundance of lobster, but also by the weather and sea conditions, and levels of risk to gear, boats and human lives (Hatcher *et al.* 2013). Fishermen tend to deploy and redeploy gear throughout the season in response to weather patterns; the progressive depletion of catchable lobster; and the migration of lobster amongst various habitats. Despite these variations, the lobster fishermen tend to be conservative, typically fishing the same areas in the same fashion year after year (Hatcher *et al.* 2013).

A study of lobster fishing practices near the proposed Donkin mine in Cape Breton helps to provide a context for lobster fishing in Chedabucto Bay. Hatcher *et al.* (2013) note:

- The time-averaged average annual landings of per boat in the lobster fishery (near the Donkin mine) ranges from approximately 12,000 to 18,000 lbs (5,450 to 8,180 kg).
- Large (~25%) inter-annual variations in landings from the lobster fishery are not uncommon due to a variety of biological and environmental factors. For example, catch rates in the 2013 season were “exceptionally high” in comparison to the 2012 fishing season.
- On average, approx. 60% of each season’s lobster catch is landed during the first half of the 2 month season, even though effort intensity (# pot-hauls per day) remains essentially constant throughout the season.
- The number of days fished declines towards the end of most seasons, and the proportion of undersize and spawn females increases markedly during the second half of the season. Prices paid to fishermen at the dock also tend to decrease as the season progresses.

Indicators of lobster stock health for in LFAs 28-32 are mainly positive (DFO 2011b). Landings in 2010 in LFAs 28-32 (3,866 t) and the mean for the last 3 years (4,224 t) were well above the median for 1985-2004 (822 t). An index of egg production for LFA 31A is currently high (DFO 2011b). Table 6.10-1 lists landings and licences in for LFA 31A from 2011 through 2013.

Table 6.10-1:
Lobster Selected Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Lobster	LFA 31A	2011	67	757,385
Lobster	LFA 31A	2012p	67	806,998
Lobster	LFA 31A	2013p	68	670,824

Note: Data for the years 2012 and 2013 is preliminary (p).

Source: DFO Maritimes Region, Policy and Economics Response to Data Request

The Guysborough County Inshore Fishermen's Association (GCIFA) is at the forefront of research regarding sustainable lobster fishing (GCIFA 2013). The GCIFA has partnered with St. Francis Xavier University, the Gulf Nova Scotia Bonafide Fishermen's Association (Lakevale), the Mi'kmaq Fish and Wildlife Commission (Afton), and the Interdisciplinary Studies in Aquatic Resources (Antigonish) to achieve a series of fisheries conservation objectives established by the Association.

Since the late 1990s, the GCIFA has undertaken a number of at-sea sampling programs on an annual basis. Research programs are monitoring and assessing a number of factors that contribute to the productivity of the fishery: size, sex, health, by-catch, weather, water temperature, egg development/release/retention larval survival and other parameters. These programs provide an overall index of the commercial catch as well as other species interactions by way of by-catch. The GCIFA provides their data sets to the Canadian Fisheries Research Network on lobster biology and health (GCIFA 2013; GCIFA 2014c).

Shrimp

The Scotian Shelf shrimp fishery occurs off Eastern Cape Breton and mainland Nova Scotia. In 2006, the industry supported 20-25 vessels (Gardner Pinfold 2006). In addition to the mobile shrimp fishery (i.e., mobile vessels that tow shrimp trawls along the ocean bottom), there is also an inshore trap fishery that uses baited wire mesh traps similar to lobster traps. This fishery was developed by inshore fishermen in Guysborough and Richmond Counties. All trap shrimp fishermen operating in Chedabucto Bay fish out of Canso (G. Boudreau, pers. comm. 2014).

Shrimp are found at depths of 150 - 600 m off the east coast of Nova Scotia, and in shallower waters in Chedabucto Bay. They are an important food source for Atlantic cod, Greenland halibut, skates, snow crab and harp seals (Garner Pinfold 2006). In the Study Area, based on conversations with fishermen who harvest in the area, shrimp are typically trapped south of the established shipping lanes and within the deeper water bounded by the 40 fathom depth contour (**Figure 6.10-1**). The proposed shipping route between the marine terminal and the established shipping lane has been modified to avoid these preferred shrimping grounds.

Figure 6.10-1:
40 Fathom Depth Contour Near the Project Site

Within Shrimp Fishing Area 15, there are 14 trap licences in total, with an allocation of 100 traps each (the total trap limit is 800). Five of the licences are located in the north of Chedabucto Bay, eight in the south, and one along the eastern shore just south of the bay. The trap fleet is active primarily from late fall through winter (DFO 2014b).

Within Chedabucto Bay, the shrimp fishery started in 1991 and currently employs six or seven active vessels (MacAndrew 2014). The fishing season is open year round but is most intensive from November through April when water temperatures are coldest. Shrimp prefer soft and muddy seafloor such as are found in central portions of Chedabucto Bay (MacAndrew 2014).

Fishermen set up to 100 hundred modified lobster traps in strings of 10, on the muddy bottom of the Bay in depths of 50 to 60 fathoms. These depths correspond to the approximate southern side of the primary shipping lane accessing the Strait of Canso. The traps are baited with herring; shrimp gain entry through a funnel on top of the trap. Smaller shrimp slip back out through the netting, ensuring no waste in by-catch, and a re-generation of the species (MacAndrew 2014).

Over the past several years, catches averaged about 800 pounds per day per vessel (ranging from 300 to 1000 pounds) over the winter season. In 2012, Chedabucto Bay shrimp fishers

landed 500,000 lbs of shrimp representing a value of $725,000.00 for this fishery (EAC 2012). Table 6.10-2 lists the landings and active licences for this species from 2011 through 2013.

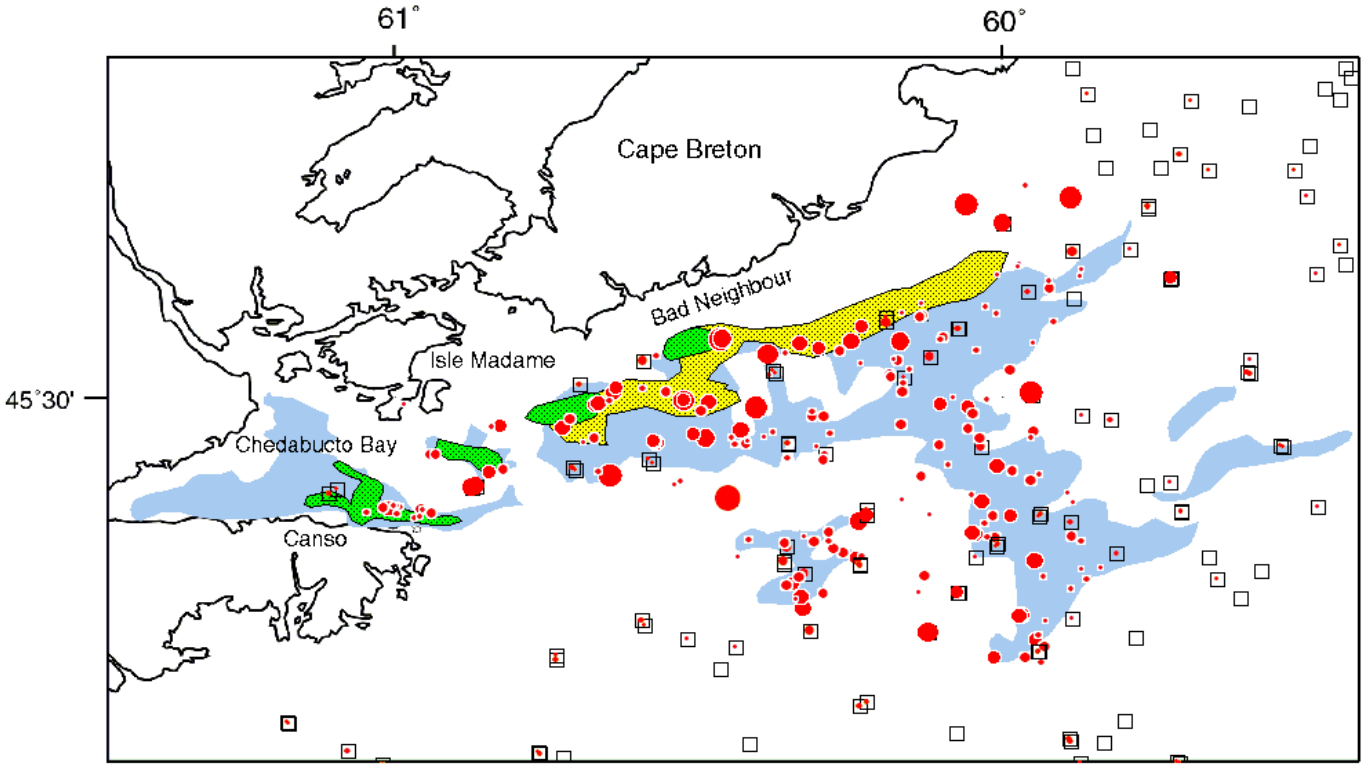


Figure 6.10-2:
Commercial Shrimp Trapping and Trawling; Relative Crab Catch Sizes

Source: Koeller *et al.* 2007 **(Note: Shrimp trapping areas in green, trawling in yellow and relative crab catches in red with larger circles representing larger catch sizes.)**

Note to Figure 6.10-2: Areas where commercial shrimp trapping (green shading) and trawling (yellow shading) are conducted in Chedabucto Bay and the Bad Neighbor, from log book data. Also shown are cumulative catches of DFO-industry shrimp surveys in June (1995-2006), DFO-industry crab surveys in fall (2004-2005) and DFO groundfish surveys in July (1999-2006) in relative numbers (red circles). Larger circles indicate larger catches, open squares indicate null catches. Shrimp habitat (La Have clay) is shown in light blue.

Table 6.10-2:
Shrimp Selected Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Shrimp, Pandalus Borealis	SFA 15 (4WD & 4WU only)	2011	23	797,893
Shrimp, Pandalus Borealis	SFA 15 (4WD & 4WU only)	2012p	19	680,423
Shrimp, Pandalus Borealis	SFA 15 (4WD & 4WU only)	2013p	23	540,696

Note: Data for the years 2012 and 2013 is preliminary (p).

Source: DFO Maritimes Region, Policy and Economics Response to Data Request

Herring and Mackerel

The Project area is located within Herring and Mackerel Fishing Areas 19. Mackerel, squid and herring are caught in the same type of trapnet, which is set in a fixed location. For this fishery, DFO assigns a fixed location for each mackerel trap or berth; typically a fisherman may operate from one to three berths. Mackerel are also caught locally using jiggers (GCIFA 2014a).

The herring fishery in Chedabucto Bay is subject to fishing restrictions (fishing season and quotas) outlined in the Canadian Atlantic Herring Southwest Nova Scotia Rebuilding Plan – Atlantic Canada 2013 (DFO 2014c). The fishing season in Chedabucto Bay (HFA 19) is November 1 to March 1.

A shared, Atlantic-wide quota is assigned to the mackerel fishery. Commercially caught mackerel must attain a conditional length established by DFO to qualify for harvest. Most mackerel is taken for use as bait for the lobster, shrimp and crab fishery, but there is also a food fishery for fall mackerel (GCIFA 2014a).

DFO landing and license data, as well as the exact trap locations for these species harvested in HFA 19 and LFA 19 were withheld to preserve stakeholder confidentiality. Local fishermen report that no trapnets are located within several kilometers of the Project Site. Trapnets are reported in Queensport Harbour (8 km west), Philips Harbour (7 km west) and near Fox Island in Indian Cove (5 km east).

Snow Crab

In 2005, many Crab Fishing Areas (CFAs) and subareas were merged. Formerly, CFA 24 East included Chedabucto Bay but this area is now contained within the larger South East Nova Scotia division (CSAS 2013).

On the Scotian Shelf, commercial size snow crab are typically found in deep, cold water at depths ranging from 60 to 280 m and temperatures from -1 to 6°C; they are fished on muddy or sand-mud bottoms (CSAS 2013). In the Project area, snow crabs are caught using wire conical traps set mainly in offshore waters extending to Sable Island (GCIFA 2014a).

The snow crab fishery has been in existence on the Scotian Shelf since the early 1970s. Total landings increased to record levels of approximately 10,000 t each year in the early 2000s and have surpassed these previous highs since 2009. Landings in 2012 for the South East Nova Scotia division were 11,707 t (CSAS 2013). Table 6.10-3 lists the landings and active licences for this species from 2011 through 2013. **Figure 6.10-2** above shows relative crab catch sizes within Chedabucto Bay.

Table 6.10-3:
Snow Crab Selected Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Crab, Snow	CFA 24 (4WD & 4WU only)	2011	26	1,380,906
Crab, Snow	CFA 24 (4WD & 4WU only)	2012p	33	1,610,928
Crab, Snow	CFA 24 (4WD & 4WU only)	2013p	29	1,645,730

Note: Data for the years 2012 and 2013 is preliminary (p). 4WU denotes effort within 4W without a sub-area selected.

Source: DFO Maritimes Region, Policy and Economics Response to Data Request.

Tuna

A prosperous bluefin tuna fishery is present in Chedabucto Bay, within NAFO division 4Wd. The bluefin tuna caught in Atlantic Canada are part of the western Atlantic stock. These migratory stocks are managed under the jurisdiction of the International Commission for the Conservation of Atlantic Tunas (GCIFA 2014a).

There are 10 license holders exploiting the Canso and Queensport areas as well as 40+ transient license holders from the Gulf of St. Lawrence and PEI (GCIFA 2014a). The bluefin tuna fishery uses rod-and-reel gear or tended hook and line, and this gear is restricted to a maximum of four lines per vessel and one hook per line (DFO 2014d).

The commercial fishing season extends from late spring into late fall with fishing period for individual fleets opening and closing at various dates. Traditionally, the fishery begins with the migration of bluefin into Canadian waters in early July and usually continues until mid-November. The majority of landings occur between late July and late September (DFO 2014d).

There are two tuna fleets each with GCIFA members that share the International Bluefin Tuna Quota:

1. Nova Scotia Fundy Based 4WD Tuna Fishery. This fishery has 10 licenses managed by the 4WD Tuna Fishery Association. The fishery is restricted to rod and reel gear and has a set percentage of the international quota that is fished competitively by the 10 license holders. The season is open from August 1st to December 31$^{st\ but}$ is typically fished in late August, September and October (GCIFA 2014a; G. Boudreau, pers. comm. 2014).

2. Gulf Nova Scotia Based Tuna Fishery. This fishery has 10 licenses that are managed under the Gulf Nova Scotia Tuna Association. It is also restricted to rod and reel gear but receives a percentage of the international quota that is competitively fished by all Gulf Based licenses (GCIFA 2014a).

The non-licensed (catch and release) tuna fishery also provides revenue for local charter boat operators and owners of lodges and other accommodations.

Table 6.10-4:
Bluefin Tuna Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Tuna, Bluefin	4WD	2011	28	14,178
Tuna, Bluefin	4WD	2012p	*	*
Tuna, Bluefin	4WD	2013p	*	*

Note: Data for the years 2012 and 2013 is preliminary (p).

* denotes data withheld by DFO to preserve stakeholder confidentiality

Source: DFO Maritimes Region, Policy and Economics Response to Data Request.

Scallop

Members of the GCIFA hold licenses for Scallop Fishing Area East of Baccaro for inshore scallop drag. The license holders have a quota per license and are managed by DFO through dockside monitoring, at sea trip logs. According to the GCIFA, many of the scallop licenses are inactive due to high cost of monitoring and low quota access (GCIFA 2014a). Table 6.10-5 lists the landings and active licences for sea scallop from 2011 through 2013. Scallop landings in and around Chedabucto Bay are shown on **Figure 6.10-3.**

Table 6.10-5:
Sea Scallop Selected Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Scallop, Sea	East of Baccaro (No SFA 29 West Landings)	2011	51	347,266
Scallop, Sea	East of Baccaro (No SFA 29 West Landings)	2012p	57	291,394
Scallop, Sea	East of Baccaro (No SFA 29 West Landings)	2013p	53	336,112

Note: Data for the years 2012 and 2013 is preliminary (p).

Source: DFO Maritimes Region, Policy and Economics Response to Data Request

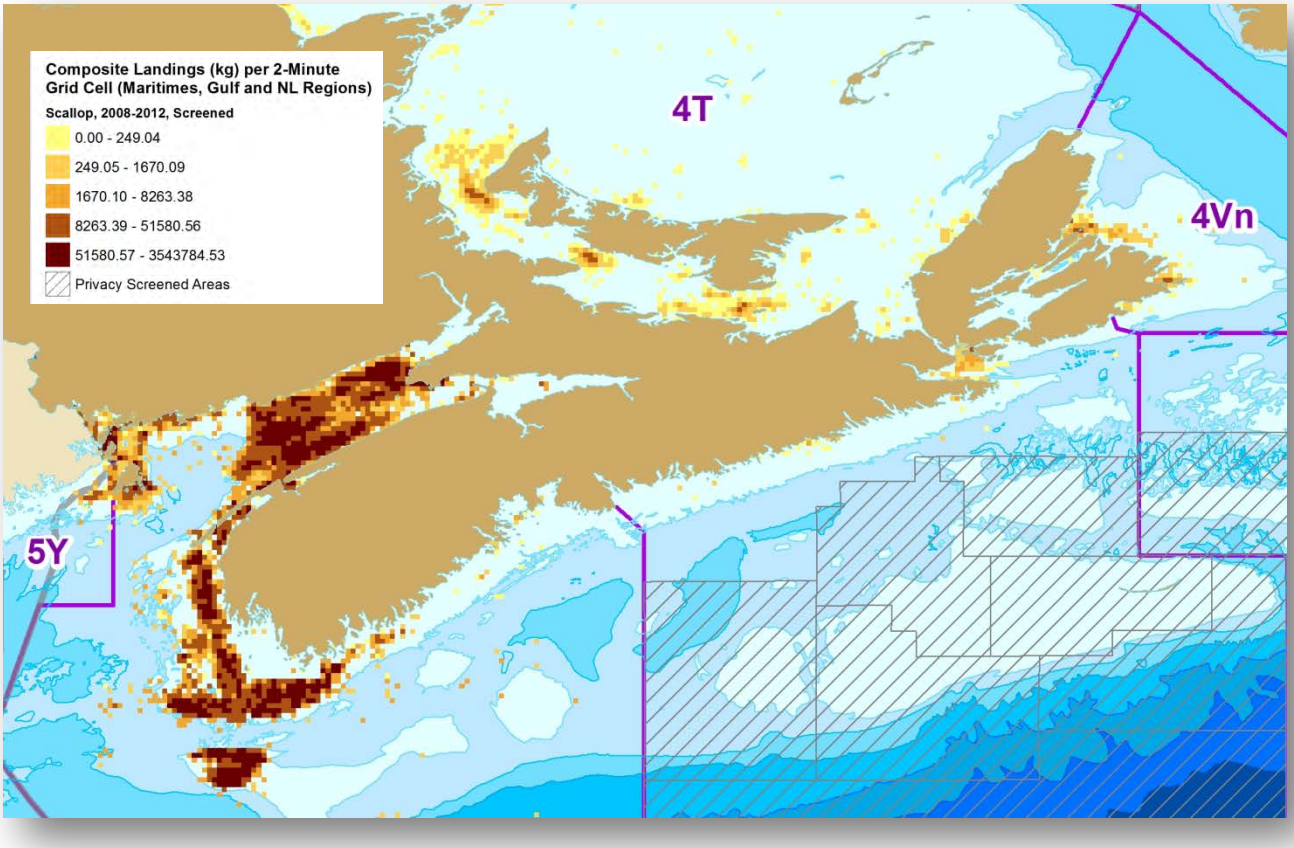


Figure 6.10-3:
Scallop Landings 2008-1012 (kg)

Other Species - Sea Urchin, Rock Crab, Marine Plants, Eels

According to the GCIFA, fishermen based in Canso and along the south shore of Chedabucto Bay hold licences to harvest other species, such as sea urchin, rock crab, marine plants, and eels, but these licenses are not currently active (GCIFA 2014a).

To the extent that these data are available from DFO, Table 6.10-6 lists the landings and active licences for these other species from 2011 through 2013.

Table 6.10-6:
Other Species Selected Landings and Active Licenses - 2011-2013

License Species	Fishing Area	Year Landed	Active Licenses	Landings (kg)
Crab, Rock	LFA 31A	2011	*	*
Crab, Rock	LFA 31A	2012p	*	*
Crab, Rock	LFA 31A	2013p	*	*
Crab, Unspecified	N/A	2011	0	0
Crab, Unspecified	N/A	2012p	0	0
Crab, Unspecified	N/A	2013p	0	0
Eel	Guysborough County	2011	*	*
Eel	Guysborough County	2012p	*	*
Eel	Guysborough County	2013p	*	*
Elver	Guysborough County	2011	*	*
Elver	Guysborough County	2012p	*	*
Elver	Guysborough County	2013p	*	*
Sea Urchins	Guysborough County	2011	*	*
Sea Urchins	Guysborough County	2012p	*	*
Sea Urchins	Guysborough County	2013p	*	*

Note: Data for the years 2012 and 2013 is preliminary (p);

* denotes data withheld by DFO to preserve stakeholder confidentiality

Source: DFO Maritimes Region, Policy and Economics Response to Data Request

6.10.6 Recreational Fisheries

Mackerel is the primary salt-water recreational species in the area (GCIFA 2014a), but catch and release recreational bluefin tuna fishing is also popular with local residents and tourists from Europe and the United States.

In Guysborough County, the freshwater inland lakes and streams support recreational speckled (brook) trout, brown trout, rainbow trout, landlocked salmon, chain pickerel, white perch, and yellow perch fisheries. The fishing season generally runs from April 1 to September 30. Recreational fishing in tidal waters extends from April 15 to September 30, to protect sea-run speckled trout, brown trout, and Atlantic salmon populations (NSFA 2014b).

6.10.7 Aquaculture

There are no aquaculture sites currently active in Chedabucto Bay (NSFA 2014a). There are a number of active aquaculture sites in Whitehead Harbour, primary for blue mussel and sea scallops. The nearest aquaculture site is located near Upper Whitehead, approximately 7.0 km south of the Project site. Records indicate a license was issued in 2002 for a 1.25 ha sea urchin site in Canso Harbour off the coast of George Island, but this lease is not currently active (NSFA 2014a).

A joint project was undertaken in 2001 to develop a coastal aquaculture planning tool for the Guysborough County Regional Development Authority (Stantec 2009). The study consisted of a constraint mapping exercise using Geographic Information System (GIS) tools to identify areas for potential aquaculture site development. The constraint mapping was based on a range of criteria, including biophysical conditions such as temperature, salinity, depth, oxygen and turbidity, and other practical constraints such as navigation routes, parks, and closed areas (Stantec 2009).

6.11 Shipping and Navigation

6.11.1 Overview of Commercial Shipping

Commercial shipping over the Scotian Shelf consists primarily of tankers and general, bulk and containerized cargo carriers. The Shelf is also crossed by fishing vessels, cruise ships and government vessels. The primary commodities transiting the region include crude oil and gas, minerals and chemicals, paper and forest products, coal and coke, and a variety of containerized goods (DFO 2005).

For safety, the *Vessel Traffic Services Zones Regulations* under the *Canada Shipping Act* establish Vessel Traffic Services (VTS) zones along Canada's coasts (TC 2014). Shipping in these zones is monitored by the Canadian Coast Guard's Marine Communications and Traffic Services (MCTS). A Pre-Arrival Information Report (PAIR) is required to be filed 96 hours prior to arrival in Canadian waters, as per the *Marine Transportation Security Regulations* in accordance with the instructions set out in the Canadian Coast Guard's *Radio Aids to Marine Navigation*. The MCTS logs movements of larger vessels but non-reporting traffic includes a significant proportion of tugs, fishing and recreational vessels.

To receive clearance to enter Canadian waters, ships of 500 tonnes gross tonnage or more must report to an MCTS officer 24 hours before entering the VTS zone. The incoming vessel reports information about the ship and its intended route, including any defects and deficiencies relevant to potential marine pollution, as well as position, speed, destination, etc. This allows any safety or environmental concerns to be addressed before ships enter Canadian waters. Vessels within the zone must also make regular reports at specified calling-in points (TC 2014).

Vessel Traffic Services does not operate like air traffic control. It is the ship master's responsibility to safely guide the ship; however the master must comply with a direction given by a MCTS officer.

Figure 6.11-1 illustrates the main shipping routes over the Scotian Shelf and shows (in red) the entrance lanes to Halifax Harbour and Chedabucto Bay. The entrance lanes or "approaches" to Chedabucto Bay and the calling in points referenced above are shown in more detail on **Figure 6.11-3.**

There are four regional shipping traffic patterns on the Scotian Shelf (DFO 2005):

1. international shipping between Europe and the eastern seaboard of the US and Canada;
2. international and domestic shipping along the coast of Nova Scotia bound to and from the United States, Bay of Fundy, Gulf of St. Lawrence and Newfoundland;
3. shipping through the Cabot Strait and into the St. Lawrence Seaway; and
4. traffic associated with the major ports of Halifax, Saint John, Port Hawkesbury (Strait of Canso) and Sydney.

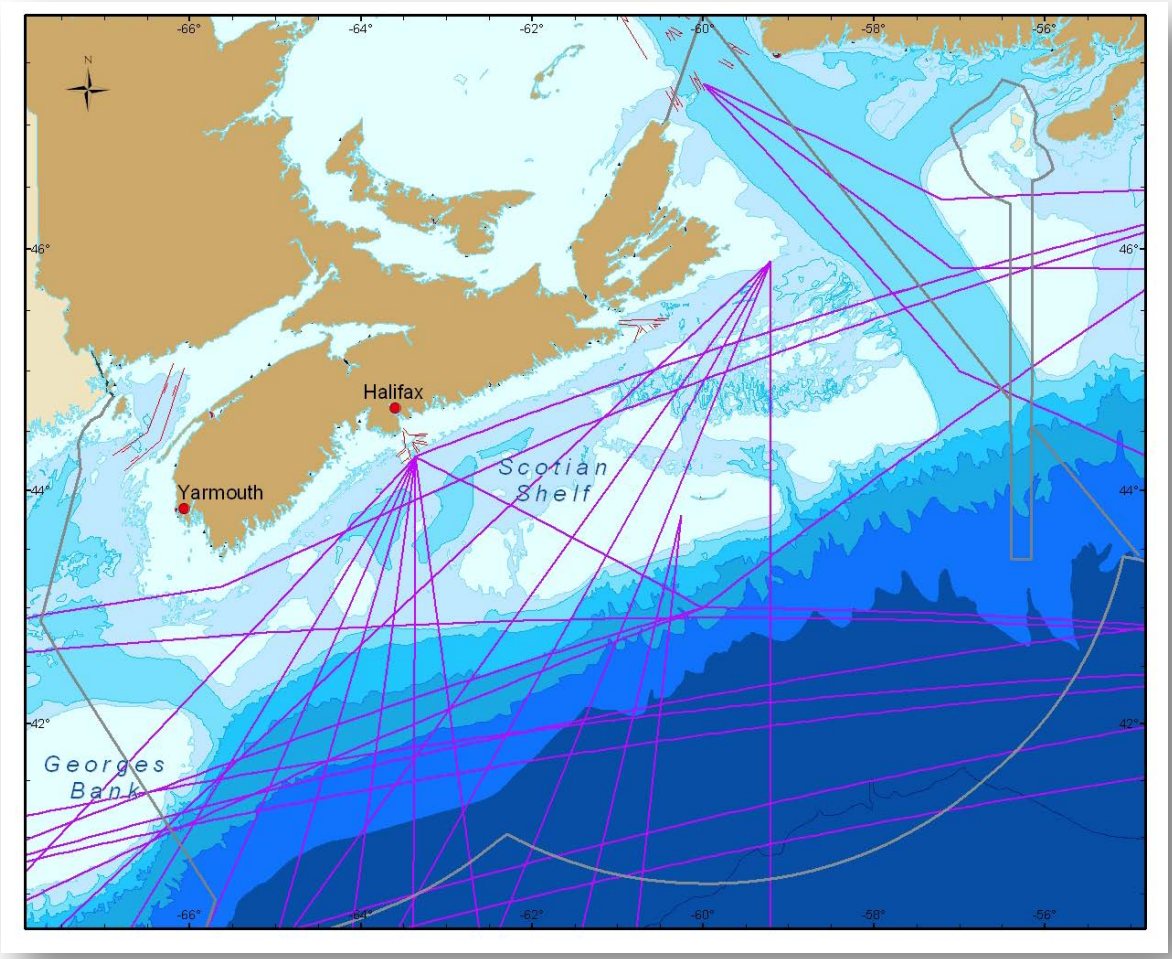


Figure 6.11-1:
Scotia Shelf Shipping Routes

Source: DFO 2005

On the Strait of Canso, the Strait Superport consists of the Mulgrave Marine Terminal and the Port Hawkesbury Pier. In 2011, it handled 23.8 million tonnes of cargo, slightly less than the most active year, 2009, when 33.5 million tonnes of cargo passed through the port (Strait Superport 2014). Most of the cargo is associated with the petroleum facility operated by Statia Terminals. Bulk exports of gypsum, paper products, aggregate and imports of coal make up the

balance. The Mulgrave Marine Terminal primarily services the offshore oil and gas industry (DFO 2011c).

Shipping density over the Scotian Shelf for the year 2000 is shown in Figure 6.11-2 (DFO 2005). The data were compiled by DFO and are taken from the Eastern Canada Vessel Traffic Services Zone (ECAREG) system. The Figure illustrates the relatively high density of traffic, shown in red transiting Chedabucto Bay.

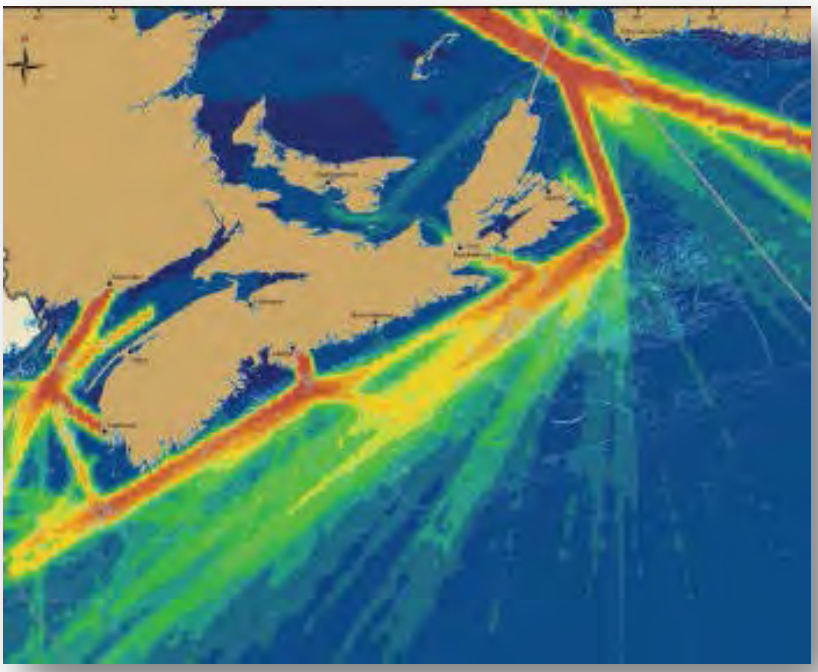


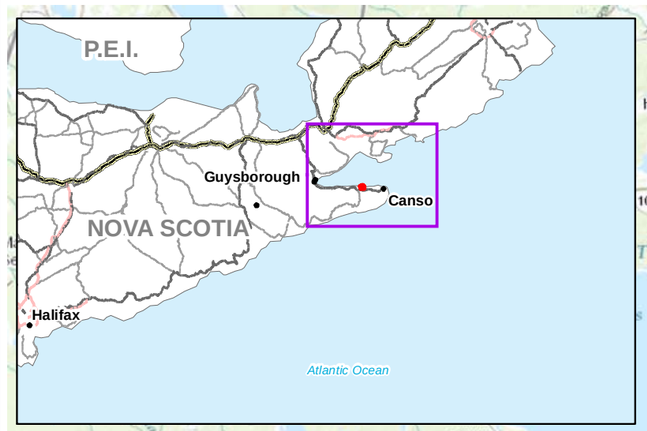
Figure 6.11-2:
Scotian Shelf Shipping Density (2000)

Source: DFO 2005

6.11.2 Accessing Chedabucto Bay

The Project site is located within Compulsory Pilotage Area Zone D as defined by the *Pilotage Act* (**Figure 6.11-3**). This means that incoming and outgoing vessels from the marine terminal must be attended by an experienced licenced pilot, who advises the ship master on navigational matters within the Pilotage Area.

The pilot boarding station that Proponent vessels will use for Chedabucto Bay is termed the "Southern Approach" and is located at 45º24'00N / 61º01'00W (APA 2013). The Southern Approach pilot station is assigned to vessels over 225.5 length overall (LOA). Proponent vessels will typically be on the order of 245 m LOA.



Pilotage Zone D

Project Site

2A

2B

1C

Sources: Esri, DeLorme, HERE, TomTom, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, and the GIS User Community

N

LEGEND

- Property Boundary
- Traffic Direction
- Incoming Shipping Lanes
- Outgoing Shipping Lanes
- Traffic Approaches
- Pilotage Limits
- CallingInPoints

0 2.5 5 10 Kilometers

SCALE: 1:225,000
WHEN PLOTTED CORRECTLY AT 11 x 17
NAD 1983 UTM Zone 20N

NOTES

This map is for conceptual purposes only and should not be used for navigational purposes.

Basedata: Nova Scotia Natural Resources, downloaded, June 2014; Orthoimagery from GeoNOVA, 2007.

VULCAN MATERIALS / MORIEN RESOURCES

BLACK POINT QUARRY PROJECT

SHIPPING ACCESS

September 16, 2014	Rev 1.0	Figure No. 6.11-3
Project No. 210.05913.00000		

SLR Consulting (Canada) Ltd.

N:\Markham\Project Files_2014\210.05913_Blackpoint\3.Data & Analysis\2.GIS\1.MXDs\3.WRKG\210_05913_MarineNavigation.mxd

An MCTS officer contacts the incoming vessel to describe when the pilot will board, what speed to maintain, and on which side the pilot boat will approach. The pilot arrives at the pilot boarding station on the Atlantic Pilotage Authority (APA) pilot boat. The pilot boards the Proponent's vessel and discusses the passage plan with the master and the bridge team. A pilot's duties are to aid the ship master, and give advice on the passage. In effect, the navigational command of the vessel, issuing helm and engine orders to the bridge team is assumed by the pilot (AMEC 2013). Despite this, the ship master remains ultimately responsible for ship operation and safety.

When a Proponent's vessel is preparing to leave the Black Point marine terminal, a pilot will board the vessel at the terminal. Tugs will be used to guide the ship as it leaves the berth until it reaches a safe, outbound position. The pilot remains on board providing navigational advice then leaves once the outer pilot station is reached or at some other mutually agreed upon position. MCTS continues to monitor the progress of the vessel and the vessel continues to report until it is clear of the VTS zone.

6.11.3 Vessel Activity in Chedabucto Bay

The Strait of Canso area has four ports: Port Hastings, Port Hawkesbury Port Tupper and Mulgrave. These ports, as well as Inhabitants Bay, come under the Harbour Master's jurisdiction. Port Hawkesbury and Mulgrave are the busiest ports, while Inhabitants Bay and Chedabucto Bay usually have one or two vessels at anchor. During the fall through winter storm season it is not uncommon to see additional vessels at anchor in Chedabucto Bay, waiting for the poor weather to pass (G. Freer, pers. comm. 2014). With two mooring locations servicing vessels up to 400,000 DWT, Port Tupper is a deep water, ice free harbour with access to rail, road and airport services (NSBI 2015).

As noted in Section 6.10.3, there are over 200 registered fishing vessels ranging from 18 to 64.9 feet in Guysborough County, the majority of which are less than 34.9 feet in length. It is difficult to estimate the number of fishing and recreational vessels in Chedabucto Bay since some of these vessels do not need to report to the Harbour Master. A general estimate is approximately 30-35 vessels (G. Freer, pers. comm. 2014).

In 2013 there were 577 large vessels recorded in Chedabucto Bay (harbour tugs and pilot vessels are not included in this count). Tankers and bulk carriers comprise the majority of this traffic and approximately 80% of these vessels are pilot-assisted. In 2014 (to mid-September) 422 vessels were recorded. May, June and July are typically the busiest months (G. Freer, pers. comm. 2014). Included within this traffic count are pilot-assisted vessels anchored in the Bay engaging in ship to ship transfers of coal.

6.11.4 Ballast Water Exchange and Pollution Prevention

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. 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 (TC 2011).

In addition, an international convention regarding ballast water has been adopted by the International Maritime Organization (IMO); this convention could enter into force as early as 2015 (G. Anderson pers. comm. 2014). 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.

The International Convention for the Prevention of Pollution from Ships (MARPOL) is the main international convention covering pollution prevention in the marine environment by ships from operational or accidental causes.

The MARPOL Convention was adopted by the IMO in 1973 and has been updated by amendments through the years. The Convention includes regulations aimed at preventing and minimizing pollution from ships - both accidental pollution and that from routine operations - and currently includes six technical Annexes. Special areas with strict controls on operational discharges are included in most Annexes:

Annex I: Regulations for the Prevention of Pollution by Oil. Covers prevention of pollution by oil from operational activities as well as from accidental discharges.

Annex II: Regulations for the Control of Pollution by Noxious Liquid Substances in Bulk. Describes the discharge criteria and measures for the control of pollution by noxious liquid substances carried in bulk; no discharge of residues containing noxious substances is permitted within 12 miles of the nearest land.

Annex III: Prevention of Pollution by Harmful Substances Carried by Sea in Packaged Form. Contains general requirements for the issuing of detailed standards on packing, marking, labeling, documentation, stowage, quantity limitations, exceptions and notifications. For the purpose of this Annex, "harmful substances" are those substances which are identified as marine pollutants in the International Maritime Dangerous Goods Code or which meet the criteria in the Appendix of Annex III.

Annex IV Prevention of Pollution by Sewage from Ships. Contains requirements to control pollution of the sea by sewage; the discharge of sewage into the sea is prohibited, except when the ship has an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land.

Annex V Prevention of Pollution by Garbage from Ships. Prohibits the discharge of all garbage into the sea.

Annex VI Prevention of Air Pollution from Ships. Sets limits on sulphur oxide and nitrogen oxide emissions from ship exhausts and prohibits deliberate emissions of ozone depleting substances; designated emission control areas set more stringent standards for SOx, NOx and particulate matter.

To enforce these IMO provisions and Canadian regulations, Transport Canada performs aerial surveillance to detect pollution from ships. In 2011-2012, crews observed more than 12,000 vessels and detected 135 pollution occurrences nationally, with an estimated total volume of 1,014 litres of oil (TC 2014). Transport Canada investigations have led to numerous successful prosecutions against marine polluters over the years, with some financial penalties reaching more than $100,000.

6.12 Archeological Resources

An archaeological resource impact assessment of the proposed Black Point Quarry Project was conducted by Davis MacIntyre & Associates Limited in 2011, followed by a second resource assessment in 2014 to address specific recommendations made in 2011 (**Appendix L**). Historical maps and manuscripts and published literature were consulted at Nova Scotia Archives and Records Management in Halifax. The Maritime Archaeological Resource Inventory, held at the Nova Scotia Museum's Heritage Division, was searched to understand prior archaeological research and known archaeological resources neighbouring the Project site. Additionally, two archaeological reconnaissance surveys of the Project site were conducted; the first in 2011 and the second in 2014.

6.12.1 Provincial

The history of human occupation in Nova Scotia has been traced back approximately 11,000 years to the Palaeo-Indian period or Sa'qewe'k L'nu'k (11,000 – 9,000 years before present or BP). The only significant archaeological evidence of Palaeo-Indian settlement in the province exists at Debert / Belmont in Colchester County. The Saqiwe'k Lnu'k period was followed by the Mu Awsami Kejikawe'k L'nu'k (Archaic period) (9,000 – 2,500 years BP) which was succeeded by the Woodland / Ceramic period or Kejikawek L'nu'k (2,500 – 500 years BP). The Woodland period ended with the arrival of Europeans and the beginning of recorded history (DMA 2011).

The initial phase of contact between First Nations people and Europeans, known as the Protohistoric period, was met with various alliances particularly between the Mi'kmaq and French. The Mi'kmaq inhabited the territory known as Mi'kma'ki or Megumaage, which included all of Nova Scotia and Cape Breton, Prince Edward Island, New Brunswick (north of the Saint John River), the Gaspé region of Quebec, part of Maine, and south-western Newfoundland. A historical Mi'kmaq presence is well documented in Guysborough County and specifically in the vicinity of Canso, less than 15 kilometres east of the Project site.

It is thought that the French began fishing off the coast of Nova Scotia as early as 1504 and possibly earlier (DMA 2011). Activity on land was coastal and seasonal, consisting of trade with the native Mi'kmaq and the use of beaches to dry fish for the long voyage back to France. The fishery continued to be profitable for centuries, supplying the French, English, and Basque seamen who sailed along these coasts.

6.12.2 Black Point

Prior to 1721, a British Government regulation decreed that all tracts of forest land containing trees suitable for ship masts should be set aside as Crown Reserves (DMA 2011). It is possible that this regulation is related to the surprising scarcity of land grants within the study area. Indeed, only two grants appear to have been made: the first to Michael Fogarty and the second to Peter James Lukeman (DMA 2011).

In 1820, William Timothy Fogarty and his wife arrived on the shores of the Chedabucto Bay, in the area now known as Fogherty Head, from Ireland. In 1821, their first son, Mickal (Michael), was born. In 1858, five years after the death of his father William, Michael sought a land grant from the Nova Scotia government for this area, which started succession of the land in the Fogarty family (Frank Fogarty, pers comm. May 2014).

Between 1820 and 1928, the area south of Fogherty Head was home to four generations of the Fogarty family. During this time, a number of children were born on the property from the original family line and the ensuing families. Given the number of births on the property, it is possible that there were multiple deaths at the property from a variety of causes for both young and old. Due to the poverty of the time, and the distance to Canso, it is also possible that burials could have occurred on the property (Fogarty Family 2014).

Until 1857 the "Stagecoach Road" between Crow Harbour and Canso ran along the coast, passing close to Fogarty Head and Black Point. The rocky nature of this road meant that passage in the summer by buggy or wagon was nearly impossible. However, it appears that in the 1870s at least two houses were located in or near the eastern end of the study area. When the new road was built farther inland it encouraged settlement along level and fertile ground off the hard coastline (DMA 2011).

Oral history recounts that Black Point had a vibrant settlement in the late nineteenth century. The settlement included the Black Point School, and one oral report suggests that a Roman Catholic Church may have been located in the area (DMA 2011). Another source stated that by the late 1800's, the area had both a church and a school, with the church being destroyed by fire in the 1930's resulting in the loss of all records (Fogarty Family 2014). Also, another clue that may corroborate a church having stood in the vicinity is a vital statistics record showing that Murdock McNeil and Bridget Eaton were married on July 2nd, 1891 at Black Point, Guysborough County under a Roman Catholic licence (NSHVS 1891).

Around 1890, Joseph Fogarty (2nd generation Fogarty) began a fishing operation at near Fogarty Head with his sons. After Joseph Fogarty's death, the fishing operation was continued by his son Vincent, and Vincent's sons. The fishing operation continued long after the Fogarty's moved to Hazel Hill in 1928, with Vincent and his sons commuting to the site, and even spending extended periods of time living south of Fogherty Head during fishing (Fogarty Family 2014).

Local residents also report that Martin Daley and his son Vincent were the last residents of Black Point. In his later years, Martin lived at nearby Fox Island or Fox Island Main during the week, working as a fisherman. On weekends, he would return to Black Point to live with his son. The two were farmers and fishermen, a type of dual employment that was not uncommon on the coast of Nova Scotia during the nineteenth and early twentieth century. Sometime after the 1930s, the Daley house and barn were demolished. Both were located in a meadow with a brook running down its centre, where one local resident reported pasturing his family horse in the summers (DMA 2011).

Sometime after all of the residents of Black Point had moved to Fox Island Main or further afield, John Rhynold and his son reportedly flew a flag on Black Point in memorial to John's mother, who was born at Black Point (DMA 2011). Additionally, a descendent of the Lukeman family kept a cabin on his family property at Fogherty Head, and used to visit the site each year (DMA 2011).

6.12.3 Project Site

As noted above, an Archeological Resource Assessment of the Project site was completed by archaeologists of Davis MacIntyre & Associates Limited in July, 2011 (**Appendix L Attachment A**). The goal of the study was to establish the layout and conditions of the Property in order to determine whether or not a complete walkover survey would be necessary. During

the assessment survey, no evidence of cultural activity was observed; however, the entire site was not accessed as is typical in a reconnaissance level survey (DMA 2011). The authors recommended that (a) the historic coastal road to Canso be further evaluated for archaeological resources and (b) the two on-site water bodies (the outlet of Fogarty Lake and the barachois[5] immediately south of Black Point) be examined for potential Mi'kmaq activity.

This Resource Assessment report was received and reviewed by the Nova Scotia Heritage Division. They found the report acceptable and agreed with the recommendations stated within (**Appendix L Attachment A**).

As a follow up to recommendations made in 2011, archeologists from Davis MacIntyre and Associates Ltd. revisited the site in October 2014. The study team also contacted the Fogarty family for additional background information and ultimately focused their efforts on the southern coastal platform where house foundations had been reported (Fogerty Family 2014; J. Murphy pers. comm. 2014). The 2014 Archeological Resource Assessment is presented in **Appendix L Attachment B**.

A number of items of historical interest that indicate past habitation of the coastal platform were recorded during the 2014 Resource Assessment. In total, six probable house foundations were identified, comprising three on the former Lukeman property, one on the former Fogarty property and two located in the center of coastal platform, possibly associated with the Daly family. Other historical artifacts include stone piles, apple trees and the remnants of an iron stove (**Appendix L**). No evidence of human burials was recorded (i.e., headstones, burial-like mounds or depressions, etc.) although the study team identified an area near the west coast of the Property that reportedly would have been suitable for burials. In addition, no evidence of Mi'kmaq use of the Property was observed; the archeological study team noted that for a variety of reasons the Property was likely not as attractive to Mi'kmaq peoples as other nearby areas. The study team also noted that beach areas that may have been used in passing by Mi'kmaq are high energy environments that typically do not preserve historical remains.

The Project layout as currently conceived will easily and effectively avoid historical foundations on the former Lukeman and Fogarty properties. Avoidance is the preferred follow-up activity when potential historical artifacts are discovered (DMA 2014). In contrast, the two probable house foundations located in the center of the coastal platform will undoubtedly be disturbed during site preparation in advance of processing plant construction. Recommendations to address these sites and other general mitigation measures to protect archeological resources are presented in Section 7.16.

[5] A **barachois** is a term used in Atlantic Canada to describe a coastal lagoon separated from the ocean by a sand or shingle bar. The "barrachois" near Black Point is a freshwater wetland rather than a coastal lagoon.