4.2.4 Hydrogeology and Groundwater

The Town of Canso is supplied by a Designated Protected Water Area, Walsh or Wilkins Lake, located 33 km away from the Property Boundary. This is likely the reason only 16 wells were listed within the Nova Scotia Well Log Database for the surrounding area (NSE, 2011a). Well logs are from 1951 to 2005 and generally are installed in granite bedrock (NSE, 2011a).

The closest drilled well is located 2.2 km away. A summary of the well properties are presented in Table 4.3. Drawing 4.3 shows the locations of wells in the surrounding area.

Table 4.3: Summary of Drilled Well Records

	Well Depth (m)	Casing Length (m)	Estimated Yield (Lpm)	Water Level (m)	Overburden Thickness (m)	Water Bearing Fractures (m)
Minimum	18.3	3.4	2.3	0.91	0.61	7.3
Maximum	96	26.8	68.3	24.7	23.8	65.5
Average	51.7	11.8	14	7.5	7.0	23.6
Geomean	46.5	9.7	9.1	4.6	3.0	18.2
Number of well records	16	16	15	14	14	10

Source: NSE, 2011a

Based on short term driller's estimates for the 16 drilled wells identified in the NSE Well Log Database, the average yield for wells is approximately 14.0 Lpm and average well depth is approximately 51.7 m. These yields represent very short term yields estimated by the driller at the completion of well construction.

Groundwater in granitic bedrocks is highly fracture-dependent, with the majority of drilled wells containing one to two water bearing fractures. Fracture depths ranged from 7.3 m to 65.5 m.

An observation well (Number 028) is situated in Monastery approximately 57 km from the Property Boundaries. This well forms part of the NSE Nova Scotia Groundwater Observation Well Network (NSE, 2011b). A 50 hour pump test was completed on the well in 1974 and results indicated a T value of 9.8 m^2/L and a 20 year safe yield rate of 439 m^3/day (NSE, 2011b).

The NSE Pump Test Database (NSE, 2009c) provides longer term yields for select wells throughout the province. A regional well drilled through granite bedrock is located 7.6 km from the Property Boundaries. Data indicates that the long term safe yield (Q_{20}) is 29.5 Lpm. Apparent transmissivity and storativity values are not available.

61°4'0"W 61°2'0"W 61°0'0"W 60°58'0"W

45°20'0"N

45°18'0"N

N

Upper Sand Cove
Lumsdens Lake
Three Mile Lake
Wilkins Lake
Whistlehouse Lake
Little Lake
Ice Lake
Winter Creek
Fogartys Pool
Fogartys Little Lake
Yellow Marsh
Southwest Lake
Hazel Hill Lake
Softwood Hill Lake
Blowdown Lake
Eastern Lookout Lake
Charles Lake
Walshs Lake
Muskrat Lake
Spinney Gully
Swaines Lake
Louis Boudreaus Lake
Young Lake
Basin Lake
Eastern Lake
Publicover Lake
Seven Island Lake
Dover Lake
Gaspereaux Brook
Three Islands Cove
Penaul Cove
Black Duck Cove
Deep Pond Stillwater
Louie's Lake
Kavanaughs Lake
Negrowac Lake
Basin Run
Warrens Lake
Gull Lake
Round Lake
Snyders Lake
Maguire Lake

16

Durells Island Road Exten
Tickle Rd
Rocky Rd
Water St
Canso
Union St
Telegraph St
Sterling St
Kamsok
Main St
Dover Rd
Dover
Hillside Dr

61°4'0"W 61°2'0"W 61°0'0"W 60°58'0"W

45°20'0"N

45°18'0"N

SableWind

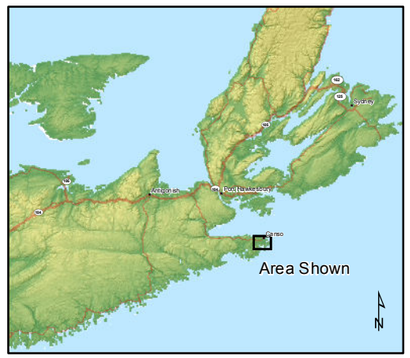
Sable Wind Project

Well Locations

Project Components
- Project Boundary

Provincial Layers
- Well Location
- Other Road
- Local Roads
- Collector
- Arterial
- Chapel Gully Trail
- Watercourse
- Waterbody
- Wetland

Notes:



0 0.25 0.5 1 1.5 Kilometers

Date: June, 2012

Scale: 1:35,000
Projection: UTM Zone20 NAD83
Sources: DNR, GeoBase, NSTDB 1:10,000,
NS Mineral Resources Well Log Database

Sheet:

4.3

Information regarding dug wells is not available since this data is not included in the NS Well Drillers Log Database; however, with the majority of residences of the Town of Canso being supplied by community water, bedrock very close to surface and a low number of drilled wells in the area, it is unlikely that many dug wells would be close to the Property Boundaries.

Groundwater Quality

Water quality for wells in the surrounding area was not available. Generally, groundwater in contact with granite bedrock will tend to have higher alkalinity, hardness and total dissolved solids (TDS). Potential health-related concerns associated with groundwater supplies in granite bedrock aquifers include elevated concentrations of arsenic (related to sulphide and base metal mineralization), as well as radionuclides such as radium, uranium, fluoride, radon and lead-210 (Fracflow, 2004). Mineralized zones near the contacts of granite bedrock and the Goldenville Formation bedrock can result in elevated concentrations of arsenic, iron and manganese.

4.2.5 Effects and Mitigation

Potential geophysical effects from Project activities include localized disturbances of surface soil and shallow bedrock from ground stripping, excavation and heavy machinery during construction. Mobilization of soils by wind or water may be transported to nearby surface water bodies. If sulphide bearing minerals are present on-site, ARD may occur once bedrock is disturbed.

Proposed turbine locations are greater than 2.2 km from any domestic well location; while large scale blasting is not anticipated to occur, the potential for short term, localized blasting may arise during construction throughout the site.

Potential effects to the geophysical environment during the different phases of the Project are identified in Table 4.4

Table 4.4: Potential Effects on the Geophysical Environment

Potential Effect	Source of Effect	Project Phase*		
		C	**M/O**	**D**
Soil mobilization by wind or water	Localized disturbances of surface soil and shallow bedrock from ground stripping, excavation and heavy machinery	✔		✔
Acid rock drainage (ARD)	Disturbance or exposure of sulphide bearing minerals during excavation activities.	✔		✔
Radon soil emissions	Road construction.	✔		
Localized blasting	Impacts on domestic drinking water quality.	✔		

**C – Construction phase M/O Maintenance/Operational Phase D – Decommissioning Phase*

The following measures will be implemented to minimize or eliminate impacts to the geophysical environment:

- Development and implementation of an EPP for all phases of construction that will include specific sediment and erosion controls, as well as provisions for the inspection and monitoring of erosion and sedimentation controls and environmental protection measures;
- In the event mapped areas of the Meguma Group contact are detected during the geotechnical assessment, the potential for environmental issues relating to ARD will be assessed if future disturbance or exposure of bedrock is anticipated (i.e. as part of construction). Any issues related to ARD will be completed in accordance with the Nova Scotia Environment's *Sulphide Bearing Material Disposal Regulations* (NSE, 2011c);
- Upon confirmation of the final turbine layout:
    - The location of any required blasting will be confirmed, and an inventory of wells in the vicinity of the blasting will be completed. The need to complete a pre-blast survey and monitor during blasting will also be evaluated;
    - The location of any watercourses and water bodies will be confirmed, blasting activities will be in accordance with the setback distances and practices outlined in the Department of Fisheries and Oceans (DFO) *Guidelines for the Use of Explosives Near Canadian Fisheries Waters, 199;* and
    - The location of the Protected Watershed will be confirmed relative to any blasting; communications with the responsible regulatory agency will be conducted.
- Minimize the extent of blasting activities, to the extent possible;
- Areas of exposed bedrock or previously undisturbed soils will be minimized during construction; and
- Following any blasting or disturbance of soils or bedrock, exposed soils or bedrock will be recovered with soil and re-vegetated as required to minimize any exposure.

The measures described above are considered to be standard best practices and are expected to address any potential impacts. Therefore, the geophysical environment is not further assessed.

4.3 Freshwater Environment

4.3.1 Freshwater Habitats

The Property Boundaries lie within the Canso Barrens (theme region 852), which extends northeastward from New Harbour to Cape Canso Theme Region (Nova Scotia Museum of Natural History, 2012). The shape of the coastline reflects two influences: the presence of the Chedabucto Fault on the northern coast and submergence on the southern shore (Nova Scotia Museum of Natural History, 2012). Within this region, there are many different sized lakes and ponds fed by complex

patterns of streams and tributaries. Surface water tends to be slightly acidic, with pH levels generally below 6.0 (Nova Scotia Museum of Natural History, 2012).

The Property Boundaries lie within the primary watershed of New Harbour/Salmon (1EQ) Watershed (NSE, 2011d). The New Harbour River and Salmon River are the major watercourses. The watershed drains a total landmass area of 1,019 km^2, with 70 km^2 of water surface within this watershed (Nova Scotia Museum of Natural History, 2012).

The mouth of New Harbour River is located south and west of the Property Boundaries, approximately 40 km away. Its headwaters start at Eight Mile Lake and drains through Juniper Lake, Ephraims Lake and Lower Stillwater Lake. There are many smaller lakes and tributaries which flow into this watercourse before it discharges to New Harbour, a tidal estuary and, shortly thereafter, the Atlantic Ocean.

The mouth of Salmon River is located north and west of the Property Boundaries, approximately 44 km away. Its headwaters start at Cross and Island Lakes, which merges with Kelly's Lake, and Salmon River Lake. There are many smaller lakes and tributaries which flow into the watercourse before it discharges to tidal flats, which then open back up again prior to discharging through a narrow opening between headlands and beach, ultimately discharging to the Atlantic Ocean.

The Property Boundaries do not contain any named water bodies. However, there are several lakes located adjacent to the Property Boundaries and include Hazel Hill Lake, Ice Lake, Whistlehouse Lake, Blowdown Lake and Charles Lake.

Water quality data was obtained for lakes surrounding the Property Boundary from the Lake Inventory Program (NSE, 2012b). Data from three lakes were reviewed from sampling events completed between 1974 and 1990. Summary data of each lake, including proximity to the Property Boundary, is provided in Table 4.5. Corresponding water chemistry results are provided in Table 4.6.

Table 4.5: Summary of Lake Characteristics

Lake	Mean Depth (m)	Lake Volume (m^3)	Surface Area (ha)	Headwater Lake (y/n)	Approximate Distance from Property Boundary (km)
Blowdown	1.4	193,000	14	N	2.2
Hazel Hill	1.7	739,332	43.3	N	0.2
Ice	1.1	63,500	6	Y	1.4

Source: NSE, 2012b

Table 4.6: Water Chemistry Results

Lake	Sample Date	Temperature(°C)		Dissolved Oxygen (mg/L)		Sechhi Disk (m)	Conductivity (umho/cm)	pH
		Surface	Bottom	Surface	Bottom			
Blowdown	Aug 9, 1990	25	18.5	7.8	4.1	1.05	58	4.9
Hazel Hill	July 18, 1974	18	17	9	7	0.9	55	5.5
Ice	July 3, 1974	18	17	10	9	1.5	90	6.5

Source: NSE, 2012b

The water quality data was collected between 1974 and 1990. Although data collected from over 30 years ago may not represent current conditions, results were relatively consistent among all lakes with few observations. Conductivity levels reflected dilute waters ranging from 21.8 to 90 umho/cm. All lakes surveyed reported acceptable pH levels (guideline 5.0 – 9.0) except for Blowdown Lake (4.9). The secchi disk value is typically <1.2 m except for Blowdown Lake (1.05) and Hazel Hill Lake (0.9). DO levels (>5.0 mg/L) based on water quality guidelines for the protection of aquatic life (CCME, 2009) and recreational use guidelines (Health Canada, 2009) was achieved for all lakes except for the bottom reading at Blowdown Lake (4.1).

4.3.2 Fresh Water Resources

Nova Scotia provincial 1:50 000 maps were reviewed and there are 2 watercourses located within the Property Boundaries: a watercourse draining the higher elevations of the site to Spinney Gully (watercourse 1) and Winter Creek (watercourse 4). Drawing 4.4 shows the locations of the watercourses.

61°0'0"W

N

Ice Lake

Watercourse 4

Watercourse 1

Watercourse 3

Watercourse 2

Spinney Gully

1

2

3

4

5

6

61°0'0"W

SableWind

Sable Wind Project

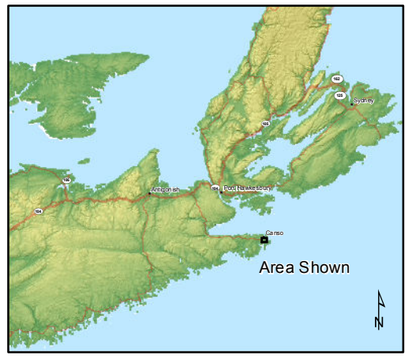
Watercourse Crossings

Project Components
- Turbine Location
- Project Boundary

Strum Layers
- Watercourse
- Drainage

Provincial Layers
- Well Location
- Other Road
- Local Roads
- Collector
- Arterial
- Chapel Gully Trail
- Watercourse
- Waterbody
- Wetland

Notes:



0 50 100 200 300 Meters

Date: June, 2012

Scale: 1:9,000
Projection: UTM Zone20 NAD83
Sources: DNR, GeoBase, NSTDB 1:10,000,
NS Mineral Resources Well Log Database

Sheet:

4.4

Between September 8 and 10, 2004, a fish and fish habitat survey was conducted on Winter Creek and a tributary to Winter Creek (AMEC, 2006).The fish survey consisted of presence/absence electrofishing, pH and dissolved oxygen (DO) concentration measurements (AMEC, 2006). The fish habitat survey was conducted using New Brunswick Department of Natural Resources and Fisheries and Oceans Canada Survey Form (AMEC, 2006). Data sheets can be found in Appendix B.

The pH throughout the watercourses surveyed was 4.5 and DO ranged between 5.4 – 7.1 mg/L (AMEC, 2006).

The electrofishing did not result in any fish being observed.

The results of the survey indicated that no fish species were located within either watercourse (AMEC, 2006).

The watercourse that drains from the Property Boundary to Spinney Gully has not been surveyed at the time of this EA submission. The proponents consider this watercourse fish bearing until proven otherwise by an assessment.

Two additional watercourses have been identified during field assessments in May 2012. Table 4.7 provides a summary of data collected.

Table 4.7: Location of Watercourse Crossings along Existing Access Roads

Watercourse	Flow Direction	Substrate	Width (m)	Depth (m)	Bank Vegetation
1[1]	West to East	Organic debris	0.5	0.05 - 0.15	Mid-aged black spruce, standing dead softwood
2[1]	South to North	Mucky	<1	0.05 - 0.15	Sheep laurel, other woody shrubs
3[1]	Northwest to Southeast	Gravel/cobble	0.5 - 1	0.10 - 0.20	Mid-aged mixed woods
4 - Winter Creek[2]	West to East	Cobble/rubble and gravel materials	1 – 1.5	0.1 – 0.3	Not available

[1] AMEC, 2006
[2] Watercourse characterization completed in May, 2012

4.3.3 Fish and Fish Habitat

There are nine fish species of concern in Nova Scotia, based on the General Status Ranks of Wild Species in Nova Scotia (Online Search, 2009); 6 species are considered priority list species in Eastern Nova Scotia (AMEC, 2006). Of these 6, three species have an elevated potential to occur in watercourses in proximity to the Property Boundary, based on habitat considerations (Table 4.8) (AMEC, 2006).

Table 4.8: Fish Species with Elevated Potential to Occur near Property Boundary (AMEC, 2006)

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
Pearl Dace	*Margiscus margarita*	Yellow	Not listed	Not Listed	Not Listed
Brook Trout (Char)	*Salvelinus fontinalis*	Yellow	Not listed	Not Listed	Not Listed
Gaspereau (Alewife)	*Alosa pseudoharengus*	Yellow	Not listed	Not Listed	Not Listed

[1] NSDNR, 2009; [2] COSEWIC, 2009a; [3] SARA, 2011; [4] NSESA, 2007; [5]
Source: ACCDC, 2012

A review of the Atlantic Canada Conservation Data Center (ACCDC) database for fish species recorded within a 100 km radius of the Property Boundary was completed and no fish species was identified. Four molluscs were identified; Table 4.9 includes their status rankings.

Table 4.9: Fish Species Recorded within a 100 km radius of the Property Boundary

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
Brook Floater	*Alasmidonta varicosa*	Yellow	Special Concern	Not Listed	Not Listed
Eastern Lamp Mussel	*Lampsilis radiata*	Yellow	Not Listed	Not Listed	Not Listed
Triangle Floater	*Alasmidonta undulata*	Green	Not Listed	Not Listed	Not Listed

[1] NSDNR, 2010; [2] COSEWIC, 2009a; [3] SARA, 2011; [4] NSESA, 2007
Source: ACCDC, 2012

Brook Floater

The Brook Floater is a small to medium-sized freshwater mussel.

The vast majority of Brook Floater populations occur in running water habitats with a range of flow conditions, from small creeks and streams to large rivers (COSEWIC, 2009b). In Nova Scotia, some Brook Floaters also occur locally in small and medium-sized lakes with no evident water flow (COSEWIC, 2009b). Brook Floaters prefer waters with a pH greater than 5.4, indicating that acidity may be an important factor (COSEWIC, 2009b). Brook Floaters have a complex life cycle and rely on a fish host to complete their life cycle.

There is a known population within the north branch of the Salmon River, 44 km from the Property Boundary; in 2010, a survey of Salmon River was conducted, and 19 individuals were counted (COSEWIC, 2009b).

Winter Creek, within the Property Boundary, has a lower pH than what is favorable for the Brook Floater, and the absence of fish in Winter Creek makes it unlikely that this species would be present. It is possible that this species could be found in the tributary to Spinney Gully, since a fish habitat study has not been completed.

Eastern Lampmussel

Eastern Lampmussel is a medium to large freshwater mussel. This species inhabits a variety of habitats, including small streams, large rivers, ponds and lakes and prefers sand or gravel substrate (NatureServe, 2012).

Eastern Lampmussel have a complex life cycle that relies on a fish host; several fish have been confirmed as hosts including rock bass, bluegill, longear sunfish, smallmouth bass, largemouth bass, white perch, yellow perch and bluntnose minnow, among others (NatureServe, 2012).

As no fish species were found within the Property Boundary, it is unlikely that the Eastern Lampmussel is present. It is possible that this species could be found in the tributary to Spinney Gully, since a fish habitat study has not been completed.

Tidewater Mucket

The Tidewater Mucket is a very small freshwater mussel. This species inhabits ponds, canals and slow-moving sections of rivers; it's usually found in waterbodies close to (but not necessarily connected to) the ocean (NatureServe, 2012). It is found in a variety of substrates, including silt, sand, gravel, cobble and, occasionally, clay (NatureServe, 2012).

Tidewater Mucket has a complex life cycle and relies on a fish host to complete their life cycle (Perch) (NatureServe, 2012). As Perch was not identified as present within the Property Boundary, it is unlikely that Tidewater Mucket would be present. It is possible that this species could be found in the tributary to Spinney Gully, since a fish habitat study has not been completed.

4.3.3 Marine Resources

Marine water resources include a salt marsh at the head of both Winter Creek and Spinney Gully, cobble beaches and shorelines, and the Atlantic Ocean.

Construction of the turbines is a minimum of 140 m from the shoreline. The impact on the shoreline and/or marine resources will typically be from surface runoff channelled by the watercourses discusses above.

4.3.4 Watercourse Crossings

Based on the proposed road layout, it is estimated that turbine access roads will require four (4) watercourse crossings within the Property Boundaries (Drawing 4.4). No watercourse alteration impacts are expected in association with turbine pads.

4.3.5 Effects and Mitigation

The potential effects on the aquatic environment are mostly related to the construction and decommissioning phases of the Project. Site activities may result in erosion and sedimentation leading to the introduction of silt and sediments to aquatic habitats, thereby affecting both surface water quality, and fish and fish habitat at local and downstream areas. Direct and indirect effects creating alterations to flow and fish habitat are also possible during both construction and decommissioning phases, as large equipment is utilized to complete activities associated with these phases. Improper disposal of wastes throughout all Project phases can also impact surface water quality and fish and fish habitat. Potential effects to the freshwater environment are summarized in Table 4.10.

Table 4.10: Potential Effects on the Freshwater and Marine Environment

Potential Effect	Source of the Effect	Project Phase*		
		C	M/O	D
Sediment and erosion	Excavation, installation of water crossing infrastructure, grubbing, vegetation clearing, blasting (if required), etc.	✔		✔
	Increased surface run-off due to impervious surfaces (i.e. access roads).	✔	✔	✔
Flow alteration	Culvert and ditch blockages and use of large machinery.		✔	
Disturbance/alteration to fish habitat	Use of large machinery, and installation of watercourse crossings.	✔		✔
Improper disposal of wastes	Leaks and accidental spills.	✔	✔	✔

**C – Construction phase M/O Maintenance/Operational Phase D – Decommissioning Phase*

Fish habitat assessments will be completed where needed (i.e. watercourse crossings) during the permitting stage of the Project. Avoidance of watercourse crossings (related to access roads) will be practiced, to the extent possible, and where unavoidable, completed in accordance with the NSE Watercourse Alterations Specifications (i.e. protective of fish habitat).

To minimize other potential impacts to the freshwater environment, the following measures will be employed:

- Development and implementation of an EPP for the Project, which will include provisions for an erosion and sediment control plan, as well as a spill

contingency plan. EPP will be approved by NSE prior to commencing construction;
- Field confirmation of all watercourse locations in relation to road and pad locations (once the road and turbine layout is finalized);
- Placement of turbine pads at a minimum of 30 m from any watercourse, where possible;
- Maintenance of equipment in good working order to reduce the risk of spill/leaks and avoid surface water contamination;
- Proper storage of fuel (as well as proper locating of re-fuelling locations); and
- Completion of any blasting (if required) in accordance with the setback distances and practices outlined in the DFO *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters* (1998).

Mitigation measures described above are considered to be standard best practices and are expected to address potential impacts. Therefore, the freshwater and marine environment is not further assessed.

4.4 Terrestrial Habitats

4.4.1 General Habitats

The Property Boundaries lie within the Eastern Shore Ecodistrict of the Atlantic Coastal Ecoregion (Neily et al., 2003). Forests in this Ecodistrict reflect the consistent coastal climate and, on the Canso peninsula, exist at elevations of up to 150 m (Neily et al., 2003). Typical assemblage includes balsam fir (*Abies balsamea*), black spruce (*Picea mariana*), and scattered white spruce (*Picea glauca*); some eastern sections of this Ecodistrict feature deeper soils on which balsam fir dominates over the spruces (Neily et al., 2003). Forest species in this region are short-lived due to natural disturbances, including blowdown, disease, insects, and fire (Neily et al., 2003). In addition, the Canso peninsula is characterized by granite barrens, which inhibit long-term forest establishment (Neily et al., 2003).

Ground vegetation typical of this type of mixed wood forest includes bracken fern (*Pteridium aquilinium Kuhn*), bunchberry *(Cornus Canadensis)*, sheep-laurel (*Kalmia angustifolia*) and blueberry (*Vaccinium angustifolium)* (Neily et al., 2003).

Habitat types present within the Property Boundary, as identified by the Nova Scotia Forest Inventory (2010), are presented in Drawing 4.5. Relative percent cover of habitat types is listed in Table 4.11.

N

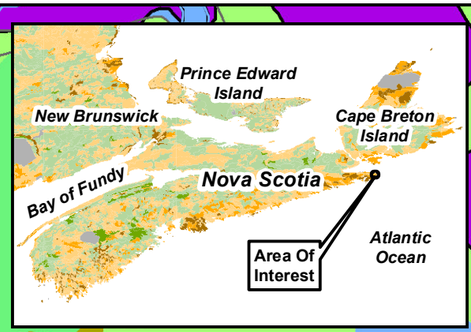
Winter Creek

Hazel Hill Lake

Spinney Gully

Spinney Gully Island

Sherewink Island



0 120 240 480 720 960 Metres

Notes:

1. Reference: Site Plan Supplied by Client. Digital Topographic Mapping by Nova Scotia Geomatics Centre. Cover Type by Nova Scotia Forest Inventory.
2. Projection: NAD83(CSRS), UTM Zone 20N

Legend:

- Project Site Boundary
- Field Identified Wetlands - 2006
- Watercourse
- Building

Transportation

- Roads
- Major Roads and Highways

NS DNR Wetland Inventory

- Bog or Fen
- Water Body

Non-Forested Land

- Unclassified Forest
- Burned Stand
- Sugar Bush
- Brush
- Alders <75%
- Coastal Habitat
- Cliffs, Dunes, Coastal Rocks
- Rock Barren
- Barren
- Agriculture
- Urban
- Beach
- Road Corridor

Forested Land

- Softwood
- Mixedwood

Habitat Cover Types

Strum Environmental

Date: June 2012	Project #: 12-4375
Scale: 1:7,500	Drawing #: **4.5**
Drawn By: G. Gregory	
Checked By: M. Smith	

Table 4.11: Percent Cover of Habitat Types at the Property Boundary

Habitat Type	Area	Percent of Site
Softwood	105.91	77%
Mixed wood	14.19	10%
Bog/Fen	6.93	5%
Barren	5.5	4%
Rock Barren	2.58	2%
Brush	1.62	1%
Burned Stand	0.305	<1%
Coastal Habitat	0.01	<1%
Inland Water	0.12	<1%
Total	**137.165**	**100%**

The Property Boundary is mostly forested but also supports other habitats including barren, bog, brush and mixed wood. Softwood stands dominate the landscape (77%) and consist mainly of balsam fir and black spruce. Mixed wood accounts for 10%, and bog/fen and barren account for 9% of the cover type within the Property Boundary. In addition to the softwoods already mentioned, the mixed wood stands also consist of red maple (*Acer rubrum*), paper birch *(Betula papyrifera)* and American mountain ash (*Sorbus Americana*) species.

Bog/fen habitat is present at the southeastern extent of the Property Boundary, extending off-site to the south. A much smaller area of bog/fen habitat exists in association with Winter Creek, present at the western boundary of the site (Drawing 4.5). Additional information related to wetlands is provided in Section 4.4.2.

Barren habitat is predominantly south of the Property Boundary; however, there is some transitional habitat within the site. Common plants within this habitat type include bearberry (*Arctostaphylos uva-ursi*), rhodora (*Rhododendron canadense*), blueberry (*Vaccinium spp*.), black huckleberry (*Gaylussacia baccata),* and sheep laurel (*Kalmia angustifolia*). A small area (< 2.6 ha) of rock barren habitat is located south of Spinney Gully (Drawing 4.5).

Wetland habitat is most abundant across lands associated with lake margins, watercourses and barrens. Additional information related to wetlands is provided in Section 4.4.2.

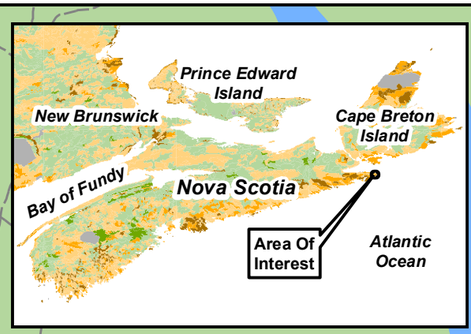
Other minor habitat types within the Property Boundary include burned stand, coastal habitat, inland water, and brush.

Field Assessment

Field habitat surveys were conducted in the Property Boundary on May 15-16, 2012 to confirm habitat types identified in the data review. Although various habitat types

across the Property Boundary were considered, focus was directed at four Study Areas determined to be most suitable for development, based upon the Project constraints analysis (Drawing 4.6).

N



Winter Creek

Study Area 1

Study Area 2

Study Area 3

Study Area 4

Glasgow Harbour

Spinney Gully

Spinney Gully Island

Sherewink Island

0 100 200 400 600 800 Metres

Notes:

1. Reference: Site Plan Supplied By Client. Digitial Topographic Mapping By Nova Scotia Geomatics Centre,
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Points And Tracks Taken Are Typically To +/- 5m Accuracy.

Legend:

- Project Site Boundary
- Study Area
- Municipal Boundary
- Roads
- Access Roads / Trails
- Mapped Stream
- Water Bodies

Study Areas

Strum ENVIRONMENTAL

Date:	Project #:
June 2012	12-4375
Scale: 1:7000	Drawing #: **4.6**
Drawn By: H. Serhan	
Checked By: A. Walter	

Habitat survey methodology consisted of walking strategic transects throughout the Property Boundary, noting general habitat characteristics at periodic intervals and encounters with new habitat types.

Habitat within the Property Boundary is strongly influenced by the proximity to the coast. Stand composition and canopy closure were varied but could be broadly considered boreal in nature. In general, the site lacks large trees, even in mature stands, but contains an abundance of stands with standing dead trees (snags). This is likely due to recurring natural disturbances, including blowdown from coastal storms and die-off from insect infestation. The largest trees observed were softwoods (black and white spruce, and balsam fir), occurring in riparian areas at the base of gradual slopes.

In some areas, particularly at the southern extent of the Property Boundary, forest habitat changed to shrub barrens, characterized by stunted jack pine (*Pinus banksiana*). Growth on these barrens is limited by soil depth and quality, as bedrock is either variably exposed or close to the surface.

Specific habitats, observed within each of the four Study Areas, are described below.

Study Area 1

Several distinct habitat types were identified within Study Area 1. At the eastern and southwestern extents, the Study Area is characterized by shrub barren dominated by stunted jack pine; sheep laurel, rhodora and Labrador tea (*Ledum groenlandicum*); and teaberry (*Gaultheria procumbens*) and black crowberry (*Empetrum nigrum*) as ground cover.

Towards the western sections of the Study Area, mid-aged white spruce stands are present, with a small white birch (*Betula pubescens*), also known as downy birch component. Young to mid-aged mixed woods of the coastal forest association (white spruce, balsam fir, red maple, white birch) are present towards the southern boundary. Areas of standing dead softwood with a dense balsam fir understory are located in several areas throughout this Study Area.

Study Area 2

A gentle hill rises towards the centre of Study Area 2. The eastern slope of the hill is typified by young to mid-aged mixed woods, primarily balsam fir, grey birch (*Betula populifolia*), and white birch. Ground vegetation is sparse but consists of occasional patches of Schreber's moss (*Pleurozium schreberi*) and bunchberry. Mid-aged white spruce (with a lesser balsam fir component) stands are present towards the crest of the hill, with young wood fern species growing under openings in the canopy. The western slope of the hill features young mixed woods, primarily balsam fir and white birch, while the mid-aged to mature white birch-balsam fir association dominates the

toe of the northwestern slope. As is typical of this forest type, the shrub layer is dominated by extensive balsam fir regeneration.

Study Area 3

The dominant habitat type within Study Area 3 is softwood shrub barren, characterized by stunted jack pine with an extensive shrub layer consisting primarily of sheep laurel, rhodora, and Labrador tea. This habitat extends throughout the majority of the southern portion of this Study Area. Towards the northern boundary, stands of mature balsam fir with scattered white birch are present. Ground cover in this area consists primarily of regenerating balsam fir, with an extensive mat of Schreber's moss throughout.

Study Area 4

Similar to Study Area 3, the dominant habitat type within Study Area 4 is jack pine shrub barren. Two barren areas within this Study Area are separated by a mid-aged balsam fir-white birch stand with a significant snag component. Ground cover in these fir-birch stands is typified by regenerating balsam fir and sheep laurel shrubs, with small patches of bunchberry.

4.4.2 Wetlands

In September 2004, a field survey of the area was conducted to identify wetlands within the former Property Boundary and surrounding area. Four wetlands were originally identified (AMEC, 2006).

In 2012, a desktop identification of the location and extent of potential wetlands across the area encompassing the Property Boundary was completed by reviewing the following information sources:

- Results from the 2006 EA;
- NSDNR Significant Species and Habitat Database;
- NS Geomatics Centre;
- NSDNR Wet Areas Mapping (WAM);
- Aerial photography; and
- Topographical maps.

This information was analyzed to produce a site plan showing areas with a high potential for wetland habitat. A conservative approach was used by applying the following general strategies to identify areas considered to be high potential for wetland habitat:

- All wetlands identified on topographical maps and the NS Significant Species and Habitats Database;

- All areas identified by WAM to have a depth to groundwater of less than 0.5 m;
- All areas identified by WAM to have a depth to groundwater of between 0.5 m-2.0 m and located adjacent to “mapped” wetlands; and
- All areas of relatively flat land existing between areas identified by the WAM to have a depth to groundwater of less than 0.5m, or between NSDNR mapped wetlands.

The NS Geomatics Centre identifies a small area of swamp habitat adjacent to Spinney Gully, located in the eastern portions of the Property Boundary.

In addition, three watercourses are identified: the first drains through the northern extent of the Property Boundary from northeast to southwest, and the second originates adjacent to the southern Property Boundary and extends off-site, to the south. A third indefinite stream extends from Spinney Gully into the western half of southern portions of the Property Boundary (Drawing 4.7).

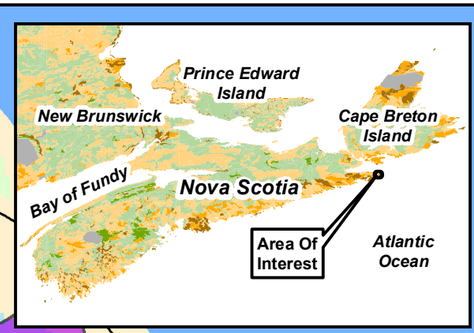
The NS Significant Species and Habitats database identifies four areas of bog or fen habitat within the Property Boundary. At the northern extremity of the Property Boundary, a small area of bog/fen exists in association with a mapped watercourse. In addition, two larger areas of bog/fen habitat extend from beyond the southern and western Property Boundaries, and a smaller area, located to the east of Hazel Hill Lake, straddles the western Property Boundary.

The WAM database indicates the potential for wet areas in the same locations as the above described wetlands. Furthermore, the potential for additional wet areas exists in association with the three mapped watercourses and land abutting northern portions of the bog/fen in the southeastern corner of the Property Boundary. A wet area also exists north of Spinney Gully in eastern portions of the Property Boundary.

Results of the desktop review, including identification of high potential areas for wetland habitat, are illustrated in Drawing 4.7.

N

Main Street
Sterling Street
Telegraph Street
Queen Street
Union Street
Chapel Gully
Winter Creek
Spinney Gully
Spinney Gully Island
Sherewink Island
Glasgow Harbour



0 125 250 500 750 1,000 Metres

Notes:

1. Reference: Site Plan Supplied By Client. Wet Areas Mapping and Wetland Inventory By Nova Scotia Department of Natural Resources (NS DNR). Digitial Topographic Mapping By Nova Scotia Geomatics Centre,
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Project Site Boundary
- High Potential Wetland Areas

NS DNR Wetland Inventory

Wetland Type

- Bog or Fen
- Fen
- Marsh
- Salt Marsh
- Swamp
- Water
- Roads
- Access Roads / Trails
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Swamp

Depth to Water Table

Depth (metres)

- 0 - 0.10 m
- 0.11 - 0.50 m
- 0.51 - 2 m
- 2.01 - 10 m
- > 10 m

Wetland Assessment: Desktop Review

Strum Environmental

Date: June 2012	Project #: 12-4375
Scale: 1:10,000	Drawing #: **4.7**
Drawn By: G. Gregory	
Checked By: A. Walter	

Based on the results of the desktop review and the optimized site layout, a wetland field survey was completed in May 2012 to broadly identify wetland habitat within the four Study Areas (Drawing 4.8). The assessment focussed on land associated with the preliminary turbine layout design and within the four Study Areas described in Section 4.4.1. Wetland habitat identified in the 2006 EA was confirmed, and any additional wetland habitat encountered was noted.

Wetland habitat was identified in the field using a GPS receiver capable of sub 5 m accuracy and was confirmed based on the presence of the following criteria: dominant vegetation, hydric soils, and wetland hydrology (US Corps of Engineers Wetland Delineation Manual 1987). Waypoints were recorded at wetland boundaries when encountered along strategic transects, designed to intercept portions of land suitable for the placement of wind turbines, both within the Study Areas, and across the broader Property Boundary. Using field identified wetland boundaries, in combination with desktop information, conservative wetland boundaries were identified.

The 2006 EA identified four areas of wetland habitat; wetlands 1 and 4 extend onto the current Property Boundary, and Wetland 2 is located approximately 200 m northeast of the current Boundary (Drawing 4.8) (AMEC, 2006). Wetland 3 is located approximately 500 m northeast of the current Boundary and is not shown on Drawing 4.8. Table 4.12 describes the habitat type for each identified wetland.

Table 4.12: Wetland Habitat Types (2006)

Wetland ID	Wetland Type
1	Shrub Bog
2	Shrub Bog
3	Shallow Marsh
4	Shallow Marsh/Shrub Swamp (on-site), Bog (off-site).

Source: AMEC, 2006

An additional ten wetlands were identified in 2012. Wetland characterizations and photos are provided in Appendix C.

Wetlands identified within the four Study Areas consisted predominantly of small areas of treed and shrub swamps, with larger areas of bog habitat. Most of the swamps function as outflow or seepage features that drain water from higher land and seep into lower lying watercourse systems via drainage channels or seepage wetlands. Outside of the Study Areas, in southern portions of the Property Boundary, treed and swamp habitat exists on the periphery of larger areas of bog habitat. Wetland conditions are typically dominated by saturated surfaces and groundwater existing within 15 cm of the surface. The majority of plant species were identifiable at the time of assessment; however, in some cases identification was to genus level only due to the lack of flowering parts or other identifiable characteristics.

N

Wetland 1 (AMEC)

Wetland 2 (AMEC)

Wetland A

Wetland B

Wetland C

Wetland D

Wetland 4 (AMEC)

Wetland F

Wetland D

Wetland E

Wetland G

Wetland H

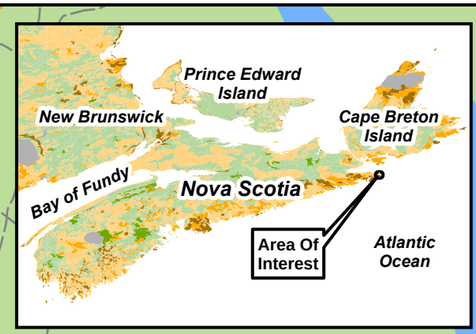
Wetland I

Spinney Gully

Glasgow Harbour

Sherewink Island

Spinney Gully Island



0 100 200 400 600 800 Metres

Notes:

1. Reference: Site Plan Supplied By Client. Digitial Topographic Mapping By Nova Scotia Geomatics Centre,
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Points And Tracks Taken Are Typically To +/- 5m Accuracy.

Legend:

- Field Identified Watercourse
- Field Identified Drainage
- Confirmed Wetland Boundary
- Approximate Wetland Boundary
- AMEC 2006 Wetlands
- Project Site Boundary
- Study Area
- Municipal Boundary
- Roads
- Access Roads / Trails
- Mapped Stream
- Water Bodies

Wetland Assessment: Field Results

Strum ENVIRONMENTAL

Date: May 2012	Project #: 12-4375
scale: 1:7000	Drawing #: **4.8**
Drawn By: H. Serhan	
Checked By: A. Walter	

Wetland Impacts

The Project team is committed to ensuring that all turbine pads are located outside of identified wetland boundaries, such that there will be no direct effects to wetland habitat as a result of turbine placement. However, the construction of access roads in support of the Project will require the alteration of wetland habitat where avoidance is not possible. Impacts to wetlands as a result of road construction have been minimized to the extent possible by designing straight road sections that bisect narrow portions of wetland habitat or wetland edges.

Based upon field identified wetland boundaries, it is estimated that 0.107 ha of wetland habitat, including parts of four wetlands, will be directly impacted by road construction. These alterations are very small in size, ranging from 0.009 ha to 0.041 ha, with an average alteration size of 0.021 ha. Alterations primarily involve treed/shrub swamps, which are the most common wetland types at the Project site and are prevalent across the province. A small area of bog habitat located within the southeastern extent of the Project site will also be altered during road construction. However, this 0.013 ha area represents less than 1% of the bog habitat within the boundaries of the Project site. Minimal adverse effects to wetland function and hydrology are expected due to the small size of the impacted wetland habitat.

4.4.3 Effects and Mitigation

The potential effects on terrestrial habitats are mostly related to the construction phase of the Project, though some effects may also occur during maintenance and decommissioning activities. General habitats are susceptible to sedimentation and erosion, exposure of surface soils and subsequent habitat fragmentation due to clearing of vegetation in association with construction activities. Potential for colonization of invasive species exists in areas cleared of native vegetation.

As discussed above, the vast majority of wetland alterations represent a small area of disturbance. Therefore, while wetland functions will be further evaluated during the permitting phase of the Project, it is expected that the Project will have a minimal effect on wetland habitat and hydrological functions. Indirect effects on wetlands could be triggered by other Project activities such as the management of water supplying and exiting wetland habitat via culverts and drainage ditches. In addition, the ongoing use of machinery and vehicles adjacent to wetland habitat could potentially cause water quality issues related to sediment and erosion and/or contamination via accidental spills and leaks during all phases of the Project.

Potential effects to terrestrial habitats, including wetlands, during the different phases of the Project are identified in Table 4.1

Table 4.13: Potential Effects on Terrestrial Habitats

Potential Effect	Source of the Effect	Project Phase*		
		C	M/O	D
General Habitats				
Sediment and erosion	Clearing, excavating, grubbing, and machine use.	✔		✔
Introduction of invasive species	Colonization of invasive species in areas of cleared vegetation.	✔	✔	
Habitat fragmentation	Clearing, grubbing, excavation.	✔		
Wetland Habitats				
Contamination	Fuel leaks and accidental spills from vehicles and machinery.	✔	✔	✔
Hydrologic imbalances	Landscape alterations, installing and maintaining culverts and drainage ditches.	✔	✔	✔
Habitat fragmentation	Infilling.	✔		
Loss of wetland habitat	Clearing, grubbing, infilling of wetland.	✔		
Disturbance to plant communities and substrates	Machine use within and adjacent to wetland habitat.	✔		✔

**C – Construction phase M/O Maintenance/Operational Phase D – Decommissioning Phase*

Provincial wetland alteration permits will be sought for each wetland alteration location, as required by the *Nova Scotia Wetland Alteration Application* process, during the permitting stage of the Project. Preliminary drawings and assessment information will be shared with NSE prior to the Wetland Alteration Application submission to ensure that the design options provide the maximum avoidance of wetlands, taking into account all other constraints presented within the EA registration document and economics. The Proponent will complete a detailed delineation of the Project footprint within the growing season to confirm impact areas and characterizing functions of all impacted wetlands.

Detailed mitigation measures and best management practices to reduce adverse effects on the altered wetlands, as well as the adjacent, non-altered wetlands, will be outlined as part of the wetland alteration application. Compensation for direct impacts to wetlands will be provided in accordance with NSE Wetland Policy requirements.

The following additional measures will be implemented to minimize or eliminate impacts to terrestrial habitats:

- Development and implementation of a site specific Environmental Protection Plan (EPP) that will include best practices for erosion and sediment control,

protection of vegetation, spill prevention, and site drainage. EPP will be approved by NSE prior to the commencement of construction;
- Use of existing road networks, to the extent possible;
- Wetland functional assessments will be completed to support any application for a wetland alteration;
- Machinery will be cleaned before and after use on-site to prevent the spread of invasive species; and
- Siting of roads and turbines 30 m minimum from expected wetland boundaries, where possible; otherwise, use best design practices to minimize the footprint of alteration to as small as are reasonably achievable.

Potential impacts to wetlands will be further evaluated, as a VEC, in Section 8.

4.5 Terrestrial Vegetation

In 2012, ACCDC data of recorded observations of flora species within 100 km of the Property Boundary was reviewed. Records of 178 vascular plant species were identified by ACCDC (Appendix D, Table D1). Species not previously identified by ACCDC when 2004/2005 assessments were conducted are shaded in Table D1.

Of the 178 vascular plant species identified in the 2012 ACCDC data list in Table D1, 211 species not previously identified in 2004 have been added. Of these 211 species, the following 12 species are considered priority species according to established criteria:

- bog willow (*Salix pedicellaris*) – "Yellow" (NSDNR 2010);
- Canada germander (*Teucrium canadense*) – "Yellow" (NSDNR 2010);
- dwarf bilberry (*Vaccinium caespitosum*) – "Yellow" (NSDNR 2010);
- Eastern white cedar (*Thuja occidentalis*) – "Red" (NSDNR 2010), Vulnerable (NSESA 2007);
- long-leaved starwort (*Stellaria longifolia*) – "Yellow" (NSDNR 2010);
- marsh horsetail (*Equisetum palustre*) – "Red" (NSDNR 2010);
- meadow horsetail (*Equisetum pratense*) – "Yellow" (NSDNR 2010);
- pubescent sedge (*Carex hirtifolia*) – "Yellow" (NSDNR 2010);
- sage willow (*Salix candida*) – "Red" (NSDNR 2010);
- sharp-fruited rush (*Juncus acuminatus*) – "Yellow" (NSDNR 2010); and
- sweet wood reed grass (*Cinna arundinacea*) – "Red" (NSDNR 2010)..

These species are added to the other 114 "Red" or "Yellow" NSDNR listed species found in Table D1. Although the number of "Green" listed species is low relative to the entire list, this is likely due to the fact that, most often, species with lower populations are reported to the ACCDC database.

2012 ACCDC data of recorded observations of lichen species within 100 km of the Property Boundary was also reviewed. Records of nine lichen species were identified by ACCDC (Table 4.14). Species not previously identified by ACCDC are shaded in Table 4.14.

Table 4.14: Lichen Species Recorded Within 100 km of the Property Boundary

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
Arctic kidney lichen	*Nephroma arcticum*	Red	Not Listed	Not Listed	Not Listed
blistered tarpaper lichen	*Collema furfuraceum*	Yellow	Not Listed	Not Listed	Not Listed
bloody beard lichen	*Usnea mutabilis*	Yellow	Not Listed	Not Listed	Not Listed
blue felt lichen	*Degelia plumbea*	Not Listed	Special Concern	No Status	Not Listed
boreal felt lichen	*Erioderma pedicellatum*	Red	Endangered	Endangered	Endangered
naked kidney lichen	*Nephroma bellum*	Yellow	Not Listed	Not Listed	Not Listed
peppered moon lichen	*Sticta fuliginosa*	Yellow	Not Listed	Not Listed	Not Listed
poor-man's shingles lichen	*Parmeliella parvula*	Red	Not Listed	Not Listed	Not Listed
tree pelt lichen	*Peltigera collina*	Yellow	Not Listed	Not Listed	Not Listed

[1] NSDNR, 2010; [2] COSEWIC; 2009a; [3] SARA, 2011; [4] NSESA, 2007
Source: ACCDC, 2012

Of the nine lichen species identified in the 2012 ACCDC data list, four species not previously identified have been added, all of which are considered priority species according to established criteria:

- blue felt lichen (*Degelia plumbia*) – "Special Concern" (COSEWIC 2009a);
- peppered moon lichen (*Sticta fuliginosa*) – "Yellow" (NSDNR 2010);
- poor-man's shingles lichen (*Parmeliella parvula*) – "Red" (NSDNR 2010); and
- tree pelt lichen (*Peltigera collina*) – "Yellow" (NSDNR 2010).

These 4 species are added to the 5 previously identified species:

- Arctic kidney lichen (*Nephroma arcticum*) – "Red" (NSDNR 2010);
- blister tarpaper lichen (*Collema furfuraceum*) – "Yellow" (NSDNR 2010);
- bloody beard lichen (*Usnea mutabilis*) – "Yellow" (NSDNR 2010);
- boreal felt lichen (*Erioderma pedicellatum*) – "Red" (NSDNR 2010); "Endangered" (COSEWIC 2009a); "Endangered" (SARA 2011); "Endangered" (NSESA 2007); and
- naked kidney lichen (*Nephroma bellum*) – "Yellow" (NSDNR 2010).

Of the 114 "Red" or "Yellow" NSDNR vascular listed species, as identified in 2006, 27 of them have the potential to occur within the Property Boundaries:

- A hawthorn (*Crataegus flabellate*) – "Yellow" (NSDNR, 2010);
- Alpine blueberry (*Vaccinium uliginosum va*) – "Yellow" (NSDNR, 2010);
- black ash (*Fraxinus nigra*) – "Yellow" (NSDNR, 2010);
- chestnut coloured sedge (*Carex castanea*) – "Red" (NSDNR, 2010);
- common Alexanders (*Zizia aurea*) – "Red" (NSDNR, 2010);
- downy rattlesnake plantain (*Goodyera pubescens*) – "Red" (NSDNR, 2010);
- Farwell's water milfoil (*Myriophyllum farwellii*) – "Yellow" (NSDNR, 2010);
- hairy swamp loosestrife (*Decondon verticillatus v*) – "Yellow" (NSDNR, 2010);
- hemlock parsley (*Conioselinum chinense*) – "Yellow" (NSDNR, 2010);
- Hornemann willow herb (*Epilobium hornemannii*) – "Yellow" (NSDNR, 2010);
- Joe-Pye thoroughwort (*Eupatorium dubium*) – "Red" (NSDNR, 2010);
- march bellflower (*Campanula aparinoides*) – "Yellow" (NSDNR, 2010);
- meadow horsetail (*Equisetum pretense*) – "Yellow" (NSDNR, 2010);
- mountain sandwort (*Arenaria (Minartia) groenlandica*) – "Yellow" (NSDNR, 2010);
- Northern blueberry (*Vaccimium boreale*) – "Red" (NSDNR, 2010);
- Northern bur reed (*Sparganium hyperboreum*) – "Yellow" (NSDNR, 2010);
- Northern comandra (*Geocaulon lividum*) – "Yellow" (NSDNR, 2010);
- Plymouth gentian (*Sabatia kennedyana*) – "Red" (NSDNR, 2010);
- rose coreopsis (*Corespisis rosea)* – "Red" (NSDNR, 2010);
- silky willow (*Salix sericea*) – "Red" (NSDNR, 2010);
- showy tick-trefoil (*Desmodium canadense*) – "Red" (NSDNR, 2010);
- slender blue flag (*Iris prismatica*) – "Red" (NSDNR, 2010);
- small flower bitter cress (*Cardmine parviflora va*) – "Yellow" (NSDNR, 2010);
- Southern rein orchid (*Plantanthera flava var.*) – "Yellow" (NSDNR, 2010);
- swamp birch (*Betula glandulosa (B. nana))* – "Red" (NSDNR, 2010);
- Wiegand's wild rye (*Elymus wiegandii var. w*) – "Red" (NSDNR, 2010); and
- yellow Canada lily (*lilium canadense ssp.ca.*) – "Yellow" (NSDNR, 2010).

Suitable habitat is present within the Property Boundaries for five new priority species of vascular plants, and three new priority species of lichens:

- bog willow;
- Canada germander;
- dwarf bilberry;
- marsh horsetail;
- sage willow;
- blue felt lichen;
- poor-man's shingles lichen; and
- tree pelt lichen.

These species are added to one vascular species and a lichen, previously listed, and have the potential to exist 100km of the Property Boundary, based on ACCDC data:

- Southern Twayblade (*Listera australis*); and
- boreal felt lichen.

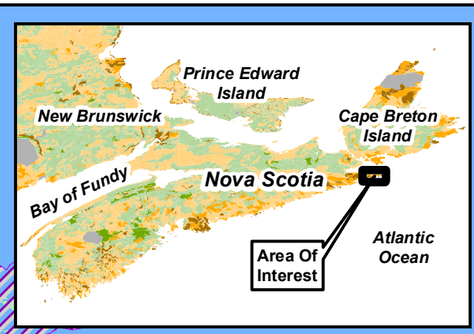
The Significant Species and Habitats database (NSDNR, 2012a) was also reviewed, and all records within a 50 km radius of the Property Boundary were identified (Drawing 4.9).

N

Highway 16

Highway 316

Town of Canso



0 1,200 2,400 4,800 7,200 9,600 Metres

Notes:

1. Reference: NS Significant Species and Habitats Database
2. Projection: NAD83 Zone 20N

Legend

- Project Site Boundary

Significant Species and Habitats

- Common Eider
- Harlequin Duck
- Tern (unclassified)
- Bald Eagle
- Double-crested Cormorant
- Migratory Bird
- Roads
- Highways
- Water Body

Significant Species and Habitats

Strum ENVIRONMENTAL

Date: June 2012	Project #: 12-4375
Scale: 1:75,000	Drawing #: ***4.9***
Drawn By: G. Gregory	
Checked By: M. Smith	

Field Assessment

Field surveys were conducted on June 23-24 and September 8-10, 2004 and June 28-30 and August 10-12, 2005; surveys were designed to target timing of flowering species (AMEC, 2006).

Areas no longer part of the Property Boundary have been omitted from the discussion within this section. A list of species observed in 2004 and 2005 can be found in Appendix D (Table D2). No priority species were identified during the 2004 and 2005 flora surveys based on current listings (AMEC, 2006).

Although a field survey for flora was not conducted within the Property Boundaries in 2012, flora species were considered during the May 2012 habitat assessment (Section 4.4.1). Field biologists were conscious of sensitive habitats and flora priority species and focused the survey on the following areas within the Property Boundary:

- The four Study Areas, incorporating land suitable for wind turbine placement (Drawing 4.6); and
- Priority habitats with potential to contain flora priority species. Where priority habitats extended beyond the Property Boundaries, the rare plant survey was restricted to the transect route.

A comprehensive list of all identified species was not completed during this survey; however, none of the priority species listed in Appendix D or Table 4.14 were observed.

4.5.6 Effects and Mitigation

Potential effects on flora species within the Property Boundary will be primarily a result of site preparation, construction, and decommissioning activities, as well as maintenance (vegetation management) and will result in the removal and loss of some flora. Improper disposal and management of fluids can also affect plant health. Potential effects to flora during the different phases of the Project are identified in Table 4.15.

Table 4.15: Potential Effects on Flora

Effect	Source of Effect	*Phase applicable to		
		C	M/O	D
Loss and physical damage	Clearing, grubbing, infilling, heavy machinery, implementation of watercourse crossings.	✔		✔
	Vegetation management.		✔	
Contamination	Release of hazardous materials chemicals, fuels, lubricants or hydraulic fluids.	✔	✔	✔

**C – Construction phase M/O Maintenance/Operational Phase D – Decommissioning Phase*

The following measures will be implemented to minimize or eliminate impacts to flora:

- Development and implementation of an Environmental Protection Plan (EPP) for the Project, which will include provisions for erosion and sediment control, protection of flora, spill prevention, and post-construction monitoring (as necessary). The EPP will be approved by NSE prior to the start of construction;
- Minimization of the footprint of physical disturbance by:
  - identification and avoidance of sensitive areas;
  - maintenance of a 30 m buffer around sensitive habitats such as watercourses, lake edges, and wetlands, where possible; and
  - minimization of routine vegetation clearing.
- Once the layout has been finalized, complete pre-construction plant surveys within the layout footprint.

Many of the mitigation measures described above are considered to be standard best practices and are expected to address potential impacts. General flora is not further assessed in the EA report; although no flora species of concern or SAR were identified within the Property Boundaries, Flora SAR will remain a VEC as further assessment (micrositing) of flora species of concern within the turbine pads and roads will be conducted upon the successful award of the PPA.

4.6 Terrestrial Fauna

4.6.1 Mammals

The landscape of Nova Scotia features a variety of habitats for mammalian fauna, including forests, fields, mountains, wetlands, and shorelines (Davis and Browne, 1996). These environments provide habitat for 57 species of terrestrial and semi-aquatic species, ranging from small rodents such as the Deer mouse (*Perymyscus maniculatis*) and Red-backed vole (*Clethrionomys gapperi*) to large ungulates such as Mainland moose (*Alces alces americana*) (Davis and Browne,1996).

The distribution of mammals in the province is driven by species specific cover and food requirements and is influenced by other factors such as local climate, introductions and extirpations, and natural barriers to dispersal/migration (Davis and Browne, 1996). Some species, such as the American red squirrel (*Tamiasciursus hudsonicus*), are common and abundant throughout the province, while others, such as the American marten (*Martes americana*), occupy restricted ranges and exist in disjunct populations (Davis and Browne, 1996; MTRI, 2008).

Information regarding the mammalian community in the vicinity of the Property Boundary, including any species of concern or SAR, was obtained through a combination of desktop review and field studies conducted in 2012. The desktop component included a review of the Nova Scotia Significant Species and Habitat Database and ACCDC data on species recorded within a 100 km radius of the Property Boundary, and the comparison of habitat mapping data (Section 4.4.1) against known habitat requirements for species expected to occur within the Property Boundary and for all SAR.

ACCDC data of recorded observations of fauna species within 100 km of the Property Boundary was reviewed. Records of 11 species, including eight mammals and three reptiles/amphibians, were identified by ACCDC (Table 4.16).

Table 4.16: Fauna Species Recorded Within 100 km of the Property Boundary (2012).

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
Mammals					
American marten	*Martes americana*	Red	Not Listed	Not Listed	Endangered
Canada lynx	*Lynx canadensis*	Red	Not at Risk	Not Listed	Endangered
Eastern cougar	*Puma concolor*	Undetermined	Data Deficient	Not Listed	Not Listed
Eastern moose (Mainland Population)	*Alces americanus*	Red	Not Listed	Not Listed	Endangered
Rock vole	*Microtus chrotorrhinus*	Green	Not Listed	Not Listed	Not Listed
Southern bog lemming	*Synaptomys cooperi*	Green	Not Listed	Not Listed	Not Listed

[1] NSDNR, 2010; [2] COSEWIC, 2009a; [3] SARA, 2011; [4] NSESA, 2007
Source: ACCDC, 2012

The Significant Species and Habitats Database was also reviewed for fauna species, and all records within a 50 km radius of the Property Boundary were identified (Appendix E). Of the 37 unique WLD number listings, there are two listings for the Wood turtle, which is the only priority species identified in the records.

There are no Significant Species and Habitat records for fauna within the Canso area; however, there is coastal area for Harlequin Ducks. Please refer to Section 4.6 for more information on significant species and habitats.

On September 8-10, 2004, a habitat survey was conducted to support the 2006 EA report. The survey focused on locating SAR at or near the proposed turbine locations, at the time (Drawing 3.5 shows former locations of turbines per the 2006 EA submission) (AMEC, 2006). The EA document reports; "No species at risk were noted during the field survey" (AMEC, 2006). Table 4.17 lists the species identified.

Table 4.17: Fauna Species Identified during the 2004 Field Survey

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
Deer (not specified, but assumed to be "White-tailed Deer")	*Odocoileus virginianus*	Green	Not Listed	Not Listed	Not Listed
American toad	*Bufo americanus*	Green	Not Listed	Not Listed	Not Listed
Coyote	*Canis latrans*	Green	Not Listed	Not Listed	Not Listed
Rabbit (specific species not noted)					
Frog (specific species not noted)					

[1] NSDNR, 2010; [2] COSEWIC, 2009a; [3] SARA, 2011; [4] NSESA, 2007
Source: AMEC, 2006

A habitat survey was conducted within the Property Boundaries in May 2012, during which all observations of fauna, including direct observations, vocalizations, and signs (i.e., tracks, scat, browse, etc.) were noted. Seven mammals were observed during the field survey (Table 4.18).

Table 4.18: Fauna Species Identified during the 2012 Field Survey

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
Coyote	*Canis latrans*	Green	Not Listed	Not Listed	Not Listed
North American porcupine	*Erethizon dorsatum*	Green	Not Listed	Not Listed	Not Listed
Raccoon	*Procyon lotor*	Green	Not Listed	Not Listed	Not Listed
Red fox	*Vulpes vulpes*	Green	Not Listed	Not Listed	Not Listed
Red squirrel	*Tamiasciurus hudsonicus*	Green	Not Listed	Not Listed	Not Listed
Snowshoe hare	*Lepus americanus*	Green	Not Listed	Not Listed	Not Listed
White-tailed deer	*Odocoileus virginianus*	Green	Not Listed	Not Listed	Not Listed

[1] NSDNR, 2010; [2] COSEWIC, 2009a; [3] SARA, 2011; [4] NSESA, 2007

No priority species were observed in the field.

Although evidence of the presence of other mammals was not confirmed during field studies, other mammal species are expected to occur within the Property Boundaries, based upon habitat observations. These species include many that are more difficult to locate, due to specific habits and/or small size.

Species at Risk

Mammal species identified during field studies or that have been recorded within a 100 km radius of the Property Boundary were screened against the criteria outlined in the "*Guide to Addressing Wildlife Species and Habitat in an EA Registration Document*" (NSE, 2005) to develop a list of priority species. These priority species include:

- American marten – "Red" (NSDNR, 2009b), "Endangered" (NSESA ,2007);
- Canada lynx – "Red" (NSDNR, 2009b), "Endangered" (NSESA, 2007);
- Long-tailed shrew – "Yellow" (NSDNR, 2009b); and
- Mainland moose – ""Red" (NSDNR, 2009b), "Endangered" (NSESA, 2007).

American marten

American marten prefer mature coniferous forests and have been more recently observed in mixed forests and cutovers (MTRI, 2008). Although mixed forest is present within the Property Boundaries, the current known distribution of American marten in Nova Scotia is limited to Cape Breton and the southwestern part of the province. Therefore, it is unlikely that Project activities will interact with and/or impact American marten populations.

Canada lynx

The distribution of Canada lynx is limited to the availability of extensive coniferous forests and snowshoe hare (main prey item), and, in Nova Scotia, the Canada lynx is limited to the Cape Breton Highlands (MTRI, 2008). Although Canada lynx may travel great distances in times of food scarcity, potentially passing through the Property Boundary, the probability of this occurring during the construction phase of the Project is low. Although lynx prefer continuous cover and the removal of flora cover may cause lynx to avoid the Project Area, the Project footprint relative to the natural habitat in the area is small. Based on the current knowledge of the range of this species in Nova Scotia, it is unlikely that Project activities will impact Canada lynx populations.

Long-tailed shrew

Long-tailed shrew in Nova Scotia is thought to be found only in the Cobequid Mountains (240 km from the Property Boundary) (Kirkland, 1981). The species appears to favour rocky areas and sites adjacent to cool, mountain streams, and the presence of rocks is considered a principal habitat component (Kirkland, 1981). The watercourses and rocky barrens found within the Property Boundaries may provide adequate secondary habitat for the species but do not constitute preferable long-tailed shrew habitat. This fact, combined with the current knowledge of the range of this species in Nova Scotia, suggests that it is unlikely that Project activities will impact Long-tailed shrew populations.

Mainland moose

Concentrations of Mainland moose in Nova Scotia occur in the Tobeatic Wilderness and the Cobequid Mountains areas, although the current range of the species extends across much of the province (MTRI, 2008). According to the ACCDC database, the closest sighting of the Mainland moose was 91 ± 10 km from the Property Boundaries. No indication of the species was observed during field studies and there is no direct evidence to suggest that a viable population exists in the area.

None of the priority species listed above or evidence of them were observed during the 2004, 2005 and 2012 field surveys.

4.6.2 Herpetofauna

Nova Scotia's reptile and amphibian community consists of 25 species, a relatively low level of diversity when compared to mainland areas of the continent (Davis and Browne, 1996). However, the same factors that have limited post-glacial species colonization in the province, namely climatic changes, have caused amphibian and reptile populations to become isolated leading to a higher degree of morphologic variation than seen in continental populations (Davis and Browne, 1996).

Information regarding the amphibian and reptile fauna within the Property Boundaries was obtained via a desktop review of the ACCDC database, a review of available habitat mapping for the known habitat requirements, and by field studies. Table 4.19 lists the amphibian and reptile species recorded within a 100 km radius of the Property Boundary.

Table 4.19: Reptile and Amphibian Species Recorded within a 100 km Radius of the Property Boundary

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
Four-toed salamander	*Hemidactylium scutatum*	Green	Not at Risk	Not Listed	Not Listed
Wood turtle	*Clemmys insculpta*	Yellow	Threatened	Threatened	Vulnerable
Snapping turtle	*Emydoidea blandingi*	Green	Special Concern	Special Concern	Not Listed

[1]NSDNR, 2010; [2] COSEWIC, 2009a; [3] SARA, 2011; [4] NSESA, 2007
Source: ACCDC, 2012

The same data limitations and interpretations as noted for the mammalian fauna (Section 4.6.1) are also applicable to the reptile and amphibian data.

Field observations of amphibian and reptile species were conducted in conjunction with other surveys completed May, 2012. Species were either identified directly through visual observation or indirectly using other evidence or their presence (i.e. calls, egg masses, tadpoles, etc). Table 4.20 lists the amphibian and reptile species identified at or near the Property Boundaries during field studies.

Table 4.20: Reptile and Amphibian Species Observed during Field Studies (2012)

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
Common garter snake	*Thamnophis sirtalis*	Green	Not Listed	Not Listed	Not Listed
Red-bellied snake	*Storeria occipitomaculata*	Green	Not Listed	Not Listed	Not Listed

[1]NSDNR, 2010; [2] COSEWIC, 2009a; [3] SARA, 2011; [4] NSESA, 2007

Although evidence of the presence of other reptile and amphibian species was not confirmed during field studies, other mammal species are expected to occur within the Property Boundaries, based upon habitat observations. These species include many that are difficult to locate, due to specific habits and/or small size, without employing a more focused approach (i.e. trapping).

Species at Risk

Amphibian or reptile species identified during field studies or that have been recorded within a 100 km radius of the Property Boundary were screened against the criteria outlined in the "*Guide to Addressing Wildlife Species and Habitat in an EA Registration Document*" (NSE, 2009b) to develop a list of priority species. These priority species include:

- Snapping turtle – "Green" (NSDNR 2010), "Special Concern" (COSEWIC, 2009a), "Special Concern" (SARA 2011) and
- Wood turtle – "Yellow" (NSDNR, 2010), "Threatened" (COSEWIC, 2009a), "Threatened" (SARA, 2011), "Vulnerable" (NSESA, 2007).

Snapping turtle

Snapping turtle habitat is generally shallow freshwater, and they prefer slow-moving water with a soft mud bottom and dense aquatic vegetation (most often located in ponds, river edges or areas combined with wetlands) (SARA, 2011). Nesting typically occurs on sand or gravel riverbanks (SARA, 2011). Although there are multiple watercourses within a kilometer of the Property Boundary, the watercourses present are unlikely to be favourable habitat for Snapping turtles. Therefore, it is unlikely Project activities will impact Snapping turtles.

Wood turtle

Suitable Wood turtle habitat is present within the Property Boundaries. This species prefers clear, moderately flowing watercourses in forests and is often associated with alder riparian zones. Wood turtles are found throughout the province, with a known concentration in Guysborough County (MTRI, 2008). It is possible that Wood turtles occur in association with the watercourses and wetlands found within or near the Property Boundary.

None of the priority species listed above or evidence of them were observed during the field surveys.

4.6.3 Butterflies

There are approximately 13,000 species of insects in Nova Scotia of which 2,000 are moths and butterflies (Davis and Browne, 1996). Some species have ranges limited by habitat type and/or the availability of host species (Davis and Browne, 1996), and others are present only at certain times of year (Butterflies of Nova Scotia, 2008).

Ten species of butterflies are listed by DNR (DNR, 2010). There are no recorded sightings of these species within the ACCDC database.

Species at Risk

No butterflies were listed in the ACCDC database.

Butterfly or moth species identified as at risk by DNR were screened against the criteria outlined in the "Guide to Addressing Wildlife Species and Habitat in an EA Registration

Document" (NSE, 2005) to develop a list of priority species. These priority species include:

- Arctic fritillary (*Boloria chariclea*) – "Yellow" (NSDNR, 2010);
- Bog elfin (*Incisalia lanoraieensis*) – "Red" (NSDNR, 2010);
- Jutta arctic (*Oeneis jutta*) – "Red" (NSDNR, 2010);
- Monarch (*Danaus plexippus*) – "Yellow" (NSDNR, 2010), "Special Concern" (COSEWIC, 2009a), "Special Concern" (SARA, 2010);
- Northern cloudywing (*Thorybes pylades*) – "Yellow" (NSDNR, 2010);
- Satyr comma (*Polygonia satyrus*) – "Yellow" (NSDNR, 2010);
- Early Hairstreak (*Erora iaeta*) – "Red" (NSDNR, 2010);
- Hoary comma (*Polygonia gracilis*) – "Yellow" (NSDNR, 2010);
- Short-tailed Swallowtail (*Papilio brevicauda*) – "Yellow" (NSDNR, 2010); and
- Mustard white (*Pieris oleracea*) –"Yellow" (NSDNR, 2010).

Arctic fritillary

The Arctic fritillary is generally found in boreal woodlands and bogs in the eastern part of its range (Layberry et al., 1998). These habitats are found within the Property Boundaries, so it is possible that this species occurs in the vicinity of the proposed Property Boundaries.

Bog elfin

The Bog elfin is known from only four bogs in Nova Scotia (Layberry et al., 1998). The species is closely tied to black spruce and a preference for inaccessible bog habitat, which is found throughout the Property Boundary. It is possible that this species may occur at the Property Boundary; however, given its restricted known range in Nova Scotia, it is unlikely that Project activities will affect the species.

Jutta arctic

The Jutta arctic is closely tied to black spruce-eastern larch bogs, which is similar habitat as used by the Bog elfin. The larvae stage of this species feed on sedges (Layberry et al., 1998). Both the larvae food plant and black spruce are present within or near the Property Boundary, so it is possible that this species could occur in within or near the site.

Monarch

The Monarch is common to abundant in Nova Scotia during the species' fall migration (Butterflies of Nova Scotia, 2008). This species is known to gather in large numbers

during migration, and this concentration of the population is one reason why the Monarch has garnered conservation concern. The larvae's main food source is various species of milkweed (Layberry et al., 1998), a species of which has been identified in the Property Boundary. It is possible that this species may be found on or near the Property Boundary.

Northern cloudywing

The Northern cloudywing is common and widespread but rarely abundant (Layberry et al., 1998). Ferguson (1955) indicated only three records of this species in Nova Scotia, from Pictou and Colchester Counties, and no recent sightings have been reported to the ACCDC (Maritime Butterfly Atlas, 2011). Northern cloudywings live in folded leaf-nests on the food plants, always herbaceous *Fabaceae* (the legume family) (Layberry et al., 1998). There are no identified food plants in the Property Boundary; the likelihood of impacting this species is low.

Satyr comma

The Satyr comma occurs sporadically in the eastern provinces (Layberry et al., 1998) and exploits boreal forest habitat in the region. During the larval stage, the Satyr comma feeds on stinging nettle (Layberry et al., 1998). Considered locally common in western Canada, it becomes less common from Manitoba eastward, becoming quite sporadic in appearance in the eastern provinces (Layberry et al. 1998). There are no stinging nettle plants identified in the Property Boundary; the likelihood of impacting this species is low.

Early hairstreak

The Early hairstreak's known range is in southern Nova Scotia (Layberry et al., 1998). The larvae feed on the developing beechnuts (Layberry et al., 1998). The mature butterfly is associated with fairly extensive mature beech-maple forests (Layberry et al., 1998) Food plants and habitat has not been identified in the Property Boundary; it is unlikely that this species will be impacted by Project activities.

Hoary comma

The Hoary comma occurs in boreal forests (Layberry et al., 1998). The larval stage feeds on currants (Layberry et al., 1998). Although the habitat for the mature butterfly is present to some degree, the food plant is not identified in the Property Boundary; it is unlikely that this species will be impacted by Project activities.

Short-tailed swallowtail

The Short-tailed swallowtail is very much a Maritime Provinces species; however, rare sighting have occurred in Quebec and Newfoundland (Layberry et al., 1998). The larval stage feeds on plant species from the parsley family (Layberry et al., 1998). This food source has not been identified in the Property Boundary; it is unlikely that this species will be impacted by Project activities.

Mustard white

The Mustard white has a known range across Canada. The food plants for the larva are from the mustard family (rock cress and toothwort) (Layberry et al., 1998). This plant family has not been identified in the Property Boundary; the likelihood of impacting this species during Project activities is very low.

Due to a lack of habitat and food sources for the listed butterflies, coupled with the lack of reported sightings within the ACCDC database, the likelihood of protected butterflies being impacted by the Project activities is very low.

4.6.4 Effects and Mitigation

It is widely acknowledged that wind energy development can have a suite of potential direct and indirect impacts on terrestrial fauna, including direct mortality, habitat fragmentation by access roads and transmission corridors, and habitat alteration through the introduction of exotic species (Kuvlevsky, Jr. et al., 2007).

Sensory disturbance related to noise and increased visual stimuli have the potential to affect wildlife populations in the vicinity of the Project. These types of disturbances will occur throughout all phases of the Project. Disturbance will be greatest during construction, where the increased presence of site personnel, vehicles, and heavy equipment will likely disturb local wildlife and may result in the temporary avoidance of work areas. This is most likely to affect diurnal species because work will be restricted to daylight hours whenever possible. However, these effects are not expected to persist in the long-term and should subside after the construction phase has been completed.

During the operational phase of the Project, sensory disturbance to wildlife will be limited to the presence of on-site personnel conducting maintenance on Project infrastructure. Since the Project has a small footprint and low number of turbines, the extent of the Project personnel's activities are limited, and are, therefore, not expected to have adverse ongoing effects on wildlife.

The likelihood of direct mortality of wildlife resulting from the Project is very low. Most wildlife species are mobile and thus are able to actively avoid areas of disturbance.

Furthermore, many of the more prominent species should be detected by site personnel during construction activities such that work will not endanger observed wildlife. Nonetheless, there is potential for small mammals to suffer mortality during the construction phase of the Project, especially during site and road clearing stages.

Once the Project enters the operational phase, no direct mortality of terrestrial wildlife is expected. Possible mortality of wildlife through collisions with vehicles in the Property Boundary will be minimized by the implementation of safe work practices (strict adherence to speed limits, obeying all warning signs, etc). Collisions, should they occur, will be infrequent and will not have significant population level effects.

Potential effects on terrestrial fauna during different phases of the Project are summarized in Table 4.21.

Table 4.21: Potential Effects on Terrestrial Fauna

Effect	Source of Effect	*Phase Applicable to		
		C	M/O	D
Habitat loss	Clearing of vegetation, hydrologic alterations leading to wetland loss.	✓	✓	✓
Mortality	Heavy equipment operation; vehicle collision.	✓	✓	✓
Displacement/local extirpation	Noise, vibration, and/or visual disturbance from site personnel, equipment, and/or turbines.	✓	✓	✓
Changes to local breeding/activity patterns	Noise, vibration, and/or visual disturbance from site personnel, equipment, and/or turbines.	✓	✓	✓

**C – Construction phase M/O Maintenance/Operational Phase D – Decommissioning Phase*

The following measures will be implemented to minimize or eliminate impacts to the terrestrial fauna (not including avifauna) and associated habitat:

- Minimization of the footprint of physical disturbance by:
  - where the aforementioned is not possible, design and construction of access roads to avoid environmentally sensitive habitats and ensure the most efficient means to access turbines is achieved;
  - identification and avoidance of sensitive areas;
  - maintenance of a 30 m buffer around sensitive habitats such as watercourses and wetlands, where possible;
  - minimization of routine vegetation clearing;
  - clearing of land only if required for construction area footprint;
  - restoration of areas of disturbance where possible, post construction phase completion; and
  - use of existing access roads during Project operation and decommissioning phases to avoid additional disruption.

- Completion of pre-construction fauna surveys within the Project footprint, once finalized, if required by DNR; and
- Completion of a comprehensive schedule and determination of timelines to efficiently complete site activities within the shortest time frames possible.

Species-Specific Mitigation

Desktop and field SAR analyses have revealed several priority species that have the potential to occur within the Property Boundary. Addressing the potential impacts of the Project on these species will require species-specific mitigation techniques as described below.

Mainland moose:

- Evidence of moose habitation within the Property Boundary will be noted and consultation with DNR regarding strategies to minimize and mitigate potential impacts will be initiated.

Wood turtle:

Based on recommendations from Nova Scotia's Stewardship Plan for Wood Turtles (MacGregor and Elderkin, 2003) and NS Transportation and Public Works "Generic Environmental Protection Plan (EPP) for the Construction of 100 Series Highways" (2007), the following general procedures should be implemented to ensure the protection of Wood turtles:

- Immediately prior to grubbing in areas of potential Wood turtle habitat, a herpetologist and/or other qualified searchers will attempt to locate any foraging wood turtles or any turtle SAR;
- Any turtles found shall be relocated outside of the construction zone, preferably upstream within the riparian habitat corridor in which they were found;
- In addition, construction crews shall be provided with environmental awareness training including Wood turtle identification and management procedures;
- If Wood turtles are found during construction, they should be moved off-site along the same habitat corridor in the direction of travel the turtle was originally oriented. Moving the turtles 100 m to 400 m from the original site where they were found should not unduly disrupt the turtle; and
- Adequate, permanent buffers of vegetation shall be left around important Wood turtle habitat. If necessary (i.e. in the event that wood turtles are confirmed at the site), an appropriate mixture of shrubs and trees shall be planted to create a buffer.

These measures are only to be used in areas that offer either good nesting sites or over-wintering habitat. If required, a more detailed site-specific protection plan, with timing constraints, can be developed for work in or near these specific habitats through consultation with DNR.

Arctic fritillary:

- Where possible, Project activities will avoid bog habitats used by this species.

Jutta artic:

- Where possible, Project activities will avoid black spruce habitats used by this species.

Many of the mitigation measures described above are considered to be standard best practices and are expected to address potential impacts. General fauna is not further assessed in the EA report; although no fauna species of concern or SAR were identified in the Property Boundary, Fauna SAR will remain a VEC as further assessment of species of concern in the Property Boundary will be conducted upon award of the RFP if the proponent is successful.

4.7 Avifauna

4.7.1 2006 Summary of Methodologies

Field surveys were conducted to characterize the pre-construction (baseline) bird community. Field surveys were based on ten (2004) to twelve (2005) proposed turbine locations, and reference sites included a 5 km and 20 km buffer around the Property Boundary to identify bird movement through the area and colonial species near the Project Area (AMEC, 2006).

Field surveys were designed in 2003 to 2004 by Barrington Wind Energy Limited in consultation with officials from DNR and the CWS (AMEC, 2006).

Breeding bird surveys were carried out in 2004 and 2005. Point counts were located at the original ten proposed turbine locations, some of which were moved in 2005 (AMEC, 2006). Please refer to Drawing 4.10 for survey locations. The addition of new sites resulted in twelve proposed turbine locations and a second year of surveys (Drawing 4.10) (AMEC, 2006). Dawn chorus observations added to the point count data and any observed colonial breeding species within 20 km of the site were recorded (AMEC, 2006).

61°0'0"W

60°58'0"W

45°20'0"N

N

Durells Island Road Exten

Tickle Rd

Rocky Rd

Middle St

Water St

Canso

School St

Queen St

Union St

Sterling St

Whitney St

Kamsok

Main St

Winter Creek

Little Lake

Ice Lake

16

Hazel Hill Lake

1d

6d

7d

8d

2d

9d

3d

11d

10d

5d

4d

12d

Spinney Gully

Publicover Lake

SableWind

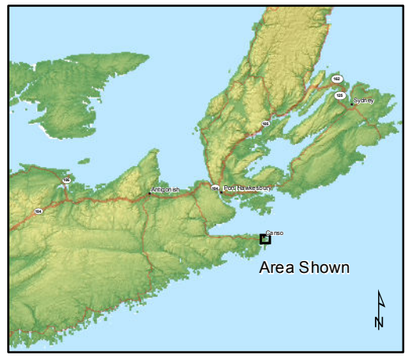
Sable Wind Project

Bird Survey Locations

- Turbine/Survey Location
- Study Area
- Other Road
- Local Roads
- Collector
- Arterial
- Chapel Gully Trail
- Watercourse
- Waterbody
- Wetland
- Wooded Areas

Notes:

1. Locations were used for the followng bird surveys
Breeding Birds (2004-05), Fall Migration (2004), Spring Owl (2005)



0 75 150 300 450 Meters

Date: June, 2012

Scale: 1:20,000
Projection: UTM Zone20 NAD83
Sources: DNR, GeoBase, NSTDB 1:10,000,
Canso Wind Farm EIS 2006

Sheet:

4.10

Fall migration surveys were carried out between July and October 2004. Area searches, point counts and stop over searches were carried out during peak times in the fall season (September and October), at the proposed turbine locations (AMEC, 2006). Results for November migration were obtained from historical data and records of local birders (AMEC, 2006).

The resident winter bird community within the Property Boundary, and at adjacent reference sites, was investigated using local Christmas Bird Counts (CBC), co-ordinated by Bird Studies Canada (AMEC, 2006). During the first week of January 2005, a CBC survey was carried out by the surveyor on the Property Boundary, and additional information was gathered from surveys carried out near the site but outside of the Property Boundary (AMEC, 2006).

Spring migration survey area searches were carried out at twelve proposed turbine sites in mid-April 2005 (AMEC, 2006). In addition to the early spring migration surveys, further work was completed in May 2005; supplemental data was gathered from local bird enthusiasts. All twelve proposed turbine sites (as of May 2005) were surveyed (AMEC, 2006).

For more detail on previous bird work, the 2006 EA report is available at http://www.gov.ns.ca/nse/ea/cansowind/CansoWF_Registration.pdf. Associated appendices are available at http://www.gov.ns.ca/nse/ea/cansowind/CansoWF_App_L.M.N.pdf.

4.7.2 2006 Species at Risk

Species identified during the 2004 and 2005 bird surveys as species of concern in the Property Boundary are found in Table 4.22. Table 4.23 demonstrates priority species in relation to their locations found, based on the 2006 turbine layout.

Table 4.22: Priority Species Found in the Property Boundary in 2004 and 2005

Common Name	Scientific name	DNR Rank[1]	Spring migration	Breeding season	Fall Migration	Winter
Baltimore Oriole	Icterus galbula	Red			✓	
Black-billed cuckoo	Coccyzus erythropthalmus	Red	✓ (2005)			
Black-crowned Night-heron	Nycticorax nycticorax	Red	✓(2005)			
Long-eared Owl	*Asio otus*	Red	✓(2004, 2005)	✓(2004, 2005)		
Olive sided	*Contopus cooperi*	Red		✓(2005)		

flycatcher						
Pine Grosbeak	*Pinicola enucleator*	Red	✓(2004, 2005)			
Willet	*Tringa semipalmata*	Red	✓ (2005)			
Blackpoll warbler	*Dendronica striata*	Yellow	✓ (2005)	✓(2004, 2005)	✓	
Boreal Chickadee	*Parus hudsonicus*	Yellow	✓(2004, 2005)	✓(2004, 2005)		✓
Common Loon	*Gavia immer*	Yellow		✓(2004)		
Golden-crowned Kinglet	*Regulus satrapa*	Yellow	✓(2004, 2005)	✓(2004, 2005)		✓
Gray Jay	*Perisoreus canadensis*	Yellow		✓(2004, 2005)		
Greater yellowlegs	*Tringa melanoleuca*	Yellow			✓	
Pine siskin	*Spinus pinus*	Yellow	✓(2004, 2005)	✓(2004, 2005)	✓	✓
Ruby-crowned Kinglet	*Regulus calendula*	Yellow	✓ (2005)	✓(2004, 2005)	✓	
Semi-palmated sandpiper	*Calidris pusilla*	Yellow			✓	
Tennessee warbler	*Vermivora peregrina*	Yellow	✓ (2005)	✓ (2005)	✓	
Whimbrel	*Numenius phaeopus*	Yellow			✓	
Wilson's warbler	*Wilsonia pusilla*	Yellow		✓(2004, 2005)	✓	
Yellow-bellied flycatcher	*Empidonax flaviventris*	Yellow		✓(2004, 2005)		

[1]NSDNR, 2010
Source: AMEC, 2006

Table 4.23: Locations of Species at Risk Found in 2004 and 2005

Site Numbers (2004 and 2005)																		
Common Name	1*	1d*	2	2d	3	3d	4	4a	4d	5	5d	9a	9d	10	10d	11d	12d	unspecified**
Baltimore Oriole																		✓
Black-billed cuckoo		✓																
Black-crowned Night-heron																		✓
Long-eared Owl							✓		✓B						✓B	✓	✓	
Olive sided flycatcher													✓			✓		
Pine Grosbeak									✓		✓							
Willet																		✓
Blackpoll warbler	✓B				✓B					✓B							✓	✓
Boreal Chickadee					✓B						✓						✓	✓
Common Loon																		✓
Golden-crowned Kinglet				✓		✓	✓		✓		✓							✓
Gray Jay											✓							
Greater yellowlegs														✓				
Pine siskin	✓B	✓	✓B				✓					✓						✓
Ruby-crowned Kinglet		✓				✓				✓	✓		✓					✓
Semi-palmated sandpiper														✓				
Tennessee warbler		✓		✓									✓		✓		✓	
Whimbrel	✓																	
Wilson's warbler	✓B																	
Yellow-bellied flycatcher				✓			✓				✓		✓			✓	✓	

*These turbine locations are not being considered for the 2012 EA submission due to their coastal nature
** The nature of the 2006 report does not allow for full identification of species per turbine site, sometimes referenced as on or near all sites, winter creek or on or near turbine sites (no numbers specified)
Source: AMEC, 2006

Habitat Considerations for the sites outlined in Table 4.24 can be found below:

- Site 1: evergreen dominated forest with increased amounts of deciduous shrub nearby.
- Site 2: evergreen dominated forest with smaller deciduous trees.
- Site 3: evergreen dominated forest with smaller deciduous trees.
- Site 4: white spruce, balsam fir and white birch which are taller than elsewhere on-site.
- Site 5: Jack pine dominated, boarded by small wet area.
- Site 6: coastal, has a denser combination of spruce and fir than the inland sites.
- Site 7a: mostly cut over with dese spruce and fir where cover remains.
- Site 8: a dense combination of spruce and fir, with a strong coastal influence.
- Site 9a: Jack pine dominated vegetation.
- Site 10: evergreen dominated forest, with taller deciduous trees of white birch, red maple and mountain ash (AMEC, 2006).

4.7.3 2012 Review

The diversity and abundance of birds in Nova Scotia is related to habitat factors, geography, and seasonality (Davis and Browne, 1996). This diversity of cover types in the Property Boundary provides suitable habitat for a variety of breeding, resident, and migratory bird species.

A review of the Important Bird Areas (IBAs) in Canada (IBA Canada, 2010) revealed that there is an IBA in the vicinity of the Project Area. The closest IBA is Country Island complex (NS028) located approximately 18 km from the Property Boundary. This site is classified as a globally significant site by IBA Canada due to its concentrations of congregatory species and colonial waterbirds/seabirds, and nationally significant for Threatened Species including:

- Roseate Tern -“Red” (NSDNR 2010), “Endangered” (NSESA 2007), “Endangered”(COSEWIC 2009a), “Endangered”(SARA 2011);
- Common Tern -“Yellow” (NSDNR 2010); and
- Arctic Tern -“Red” (NSDNR 2010).

In addition, a review of the Nova Scotia Significant Species and Habitat Database indicates that there is habitat for Harlequin Duck along the coast around Canso (Drawing 4.9).

ACCDC data of recorded observations of bird species within 100 km of the Property Boundary was reviewed in 2012 to update original data, compiled as part of the 2006 EA. Records of 81 bird species, including 40 passerines, were identified by ACCDC (Appendix F, Table F1). Species not previously identified by ACCDC are shaded in Table F1. Additional information on the bird community in the Canso area was obtained from the Maritime Breeding Bird Atlas (MBBA, 2011) (Map squares 20PR51 and 20PR52).

Of the 81 species identified in the 2012 ACCDC data list, eight species not previously identified have been added. Of these eight species, the following three species are considered priority species according to established criteria:

- Brant (*Branta bernicla*) – "Yellow" (NSDNR 2010);
- Purple Martin (*Progne subis*) – "Red" (NSDNR 2010), and
- Willow Flycatcher (*Empidonax traillii*) – "Yellow" (NSDNR 2010).

There were no observations of the new priority species during field surveys completed in support of the original EA submission. The likelihood of each new priority species to occur in the Property Boundary in relation to habitat suitability, as well as known geographic range, is discussed below.

Brant

The Brant nests in the Arctic but uses coastal bays in Nova Scotia during spring and fall migration. The Property Boundary borders Spinney Gully, a coastal bay on the Atlantic Ocean, which could be used by this species. The closest observation of this species in the eBird Canada database (2012) is in Waterside Provincial Park in Pictou County, approximately 148 km to the northeast of the Property Boundary; however, ACCDC records indicate a sighting of the Brant within 30 km. There is, thus, a high potential for the Brant to occur at or near the Property Boundary.

Purple Martin

The Purple Martin is a colonial nesting species that typically breeds in close association with human settlement. The close proximity of the Property Boundary to the Town of Canso, therefore, provides suitable breeding habitat for this species. However, Purple Martin colonies are currently rare in Nova Scotia and are thought to be restricted to the Amherst and Oxford areas in Cumberland County. The single observation of this species in the ACCDC records was at least 80 km from the Property Boundary in the Liscomb area, and no breeding records of this species are noted with the MBBA for the general Project Area. Although the species can be widely distributed during migration, it is unlikely that the Purple Martin occurs in or near the Property Boundary.

Willow Flycatcher

Breeding records for the Willow Flycatcher are relatively rare in Nova Scotia. The Property Boundary features open shrub lands and vegetated riparian areas that provide suitable habitat for this species. However, the closest breeding record is in the Liscomb area, approximately 80 km to the southeast. Most records of this species in Nova Scotia probably represent vagrant migrants, so it is possible that the species will occur at or near the Property Boundary during migration.

There is potential for two of the new priority species to occur in the Property Boundary.

The Significant Species and Habitats database (NSDNR 2012) was also reviewed for bird species, and all records within a 50 km radius of the Property Boundary were identified (Appendix F, Table F2). Of the 182 unique WLD (Nova Scotia Significant Habitats database identifier numbering system) number listings, there are 29 listings for the following seven priority species:

- Arctic Tern – "Red" (NSDNR 2010);
- Common Loon – "Red" (NSDNR 2010);
- Common Tern – "Yellow" (NSDNR 2010);
- Great Cormorant – "Yellow" (NSDNR 2010);
- Harlequin Duck – "Red" (NSDNR 2010), "Special Concern" (COSEWIC 2009a), "Special Concern" (SARA 2011), "Endangered" (NSESA 2007);
- Roseate Tern – "Red" (NSDNR 2010), "Endangered" (COSEWIC 2009a), "Endangered" (SARA 2011), "Endangered" (NSESA 2007); and
- Whimbrel (*Numenius phaeopus*) – "Yellow" (NSDNR 2010).

Each of these priority species was previously identified in the Significant Species and Habitats database prior to the original EA submission. These species were not observed during the 2004/05 nor the 2012 field season; however, the Harlequin Duck was observed within 5 km of the Property Boundary.

Significant species and habitat records within or around Canso are shown on Drawing 4.9

4.7.4 Field Survey

A field habitat survey was conducted in the Property Boundary in May 2012 during which all direct observations and vocalizations were noted. Sixteen species of birds were observed during the survey (Table 4.24).

Table 4.24: Bird Species Identified during the 2012 Field Survey

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
American Crow	*Corvus brachyrhynchos*	Green	Not Listed	Not Listed	Not Listed
Black-capped Chickadee	*Poecile atricapillus*	Green	Not Listed	Not Listed	Not Listed
Blue Jay	*Cyanocitta cristata*	Green	Not Listed	Not Listed	Not Listed
Boreal Chickadee	*Poecile hudsonicus*	Yellow	Not Listed	Not Listed	Not Listed
Canada Goose	*Branta canadensis*	Green	Not Listed	Not Listed	Not Listed
Dark-eyed Junco	*Junco hyemalis*	Green	Not Listed	Not Listed	Not Listed
Golden-crowned Kinglet	*Regulus satrapa*	Yellow	Not Listed	Not Listed	Not Listed
Gray Jay	*Perisoreus canadensis*	Yellow	Not Listed	Not Listed	Not Listed
Herring Gull	*Larus argentatus*	Green	Not Listed	Not Listed	Not Listed
Mourning Dove	*Zenaida macroura*	Green	Not Listed	Not Listed	Not Listed
Northern Flicker	*Colaptes auratus*	Green	Not Listed	Not Listed	Not Listed
Red-breasted Nuthatch	*Sitta canadensis*	Green	Not Listed	Not Listed	Not Listed
Red-tailed Hawk	*Buteo jamaicensis*	Green	Not at Risk	Not Listed	Not Listed
Ruffed Grouse	*Bonasa umbellus*	Green	Not Listed	Not Listed	Not Listed
White-throated Sparrow	*Zonotrichia albicollis*	Green	Not Listed	Not Listed	Not Listed
Yellow-rumped Warbler	*Dendroica coronata*	Green	Not Listed	Not Listed	Not Listed

[1] NSDNR, 2010; [2] COSEWIC, 2009a; [3] SARA, 2011; [4] NSESA, 2007

The following bird species, identified in the field, are considered priority species, as determined by the established criteria:

- Boreal Chickadee (*Poecile hudsonicus*) – "Yellow" (NSDNR 2010);
- Golden-crowned Kinglet (*Regulus satrapa*) – "Yellow" (NSDNR 2010); and
- Gray Jay (*Perisoreus canadensis*) – "Yellow" (NSDNR 2010).

The Boreal Chickadee prefers coniferous boreal forests, a habitat type that is prevalent in the Property Boundary. The Golden-crowned Kinglet and Gray Jay prefer similar, softwood dominated habitats. All of these priority species are considered possible breeders in the general Project Area, according to the MBBA (2011).

4.7.5 Future Work

In 2004 and 2005, the avifauna studies completed to support the EA registration were designed in consultation with CWS/DNR and met the requirements at the time. In the past six years, methodologies have changed significantly enough to require the proponent to review these methodologies and refresh the data with supplemental studies.

In addition to the need for more up to date data, several of the turbine locations have moved in to areas not previously considered part of the Study Area. The ability to extrapolate the 2004/05 data to the new locations would not meet best management practices.

Given the date of the original bird work (2004, 2005), and the changes in Provincial and Federal requirements around birds, the proponent intends to carry out further bird surveys in addition to the updated 2012 information given above, prior to construction of this Project.

A consultant has been asked to provide this service; details of the work will include:

- Ground trothing;
- Preliminary Assessment and survey plan;
- Autumn migration survey including acoustic monitoring;
- Winter survey;
- Spring migration and early breeding birds survey including acoustic monitoring; and
- Peak breeding survey.

4.7.6 Fog and Birds

Recently fog has become of interest where it is associated with wind farm siting. In May 2011 a large event involving birds occurred in Nova Scotia. Due to a long stretch of bad weather preventing birds from migrating at optimal times, the birds migrated during adverse weather conditions including heavy fog and strong winds. Mortalities of birds were reported around Nova Scotia and Atlantic Canada at several different types of facilities, including wind farms, ships and lighthouses (Mark Elderkin, Pers. Comm., 2011).

Specifically at Machias Seal Island, a Canadian migratory bird sanctuary off the coast of Grand Manan Islands in the Bay of Fundy, thousands of warblers were reported landing on the Island's lighthouse (Mark Elderkin, Pers. Comm., 2011).

The reasons for birds to divert their migratory path during adverse weather is not localized only to wind farms; however wind farm design needs to account for the potential for these events to occur.

Annually, in Canso, it is likely that up to 100 days could be foggy to some extent. The majority of these days, based on data collected at 5 weather stations around Nova Scotia, indicate that the foggiest time period is during the summer months. There is always the potential for adverse weather to occur at any time in Nova Scotia; bird mortalities associated with a wind farm during a fog event is as likely as with other facilities around coast.

Data seems to show that mortalities associated with fog events are much more likely to occur with consistent and bright lighting. The use of a minimum number of white flashing navigation lights of lowest available intensity on wind turbines is suggested by the Royal Society for the Protection of Birds (RSPB) in the UK to reduce the risk of bird collisions in bad weather (Drewitt and Langston, 2006).

Lighting in the Property Boundary would be strobed lighting as approved by Transport Canada. All other lighting will be "on-demand" to minimize the time these lights would be on.

4.7.7 Summary of Data

When the 2006 report was compiled, several potential turbine locations were suggested. Due to changes in Provincial and Federal requirements with regards to wildlife in Nova Scotia and comments received on the 2006 EA, some of these locations have been eliminated from the 2012 report.

Turbine locations 1, 6, 7 and 8 have been eliminated partially due to the rich bird life recorded there and their proximity to the coast.

Potential new locations have been identified for 2012, including 2, 4 and 6, which will undergo bird studies prior to construction.

4.7.8 Bats

The 2006 EA report did not include field work on bats; however, some anecdotal evidence was collected.

Local residents reported to AMEC that there are bats in Canso (AMEC, 2006). Little brown bats were identified by a local naturalist, though this identification was not confirmed (AMEC, 2006). The Children's Camp on Glasgow Head and Turf Bog (along the coastal road to Glasgow Head and west of the coastal drumlins) are other places where foraging bats have been reported at dusk (AMEC, 2006). Also, there used to be (and still may be) roosting bats at the local high school, taking advantage of an overhang at the building (AMEC, 2006).

There are no reports of hibernating bats, suggesting that all bats leave the area in the fall (AMEC, 2006).

In 2012, three species of bats found in Nova Scotia were listed by COSEWIC as Endangered, partially due to the spread of the White Nose Syndrome fungus.

Small-bodied bat species that winter in caves or mines are dying from White-nose Syndrome, which is caused by a fungus, *Geomyces destructans* (*Gd*). It is hypothesized to have originated in Europe (Pikula et al., 2012, Turner et al., 2011) and

was first detected in North America in 2006 (Lorch et al., 2011). It was detected in Canada during the winter of 2009-2010 and has been confirmed in Ontario, Quebec, New Brunswick and Nova Scotia (as recent as spring of 2011) (The Chronicle Herald, 2012).

The fungus grows in humid, cold environments, typical of caves where bats hibernate (Blehert et al., 2009). The fungus typically infects the bats while their body temperature (Turner et al., 2011) and immunity (Carey et al., 2003) is low. Mortality during winter is hypothesized to be caused by starvation through excessive activity. Insect-eating bats that would normally hibernate throughout the winter become active. Once out of their hibernating state, dehydration and starvation force bats to leave the caves in search of food and water but may die due to seasonal shortage. It has been typical to find bats either immediately outside the hibernacula entrance or within a short distance from where they are hibernating. Physiological processes associated with hydration and damage to wings may also be related to mortality (Cryan et al., 2010) (Cited in COSEWIC, 2012).

In Nova Scotia, permission to enter caves is restricted, and surveys have been limited to winter-time visits to the entrance of caves, collecting dead bats, and reports from the public of bats flying during winter.

A list of bat species at risk in Nova Scotia can be found in Table 4.25.

Table 4.25: Short List of Bat Species at Risk in Nova Scotia

Common Name	Scientific Name	COSEWIC[1]	NSDNR Status[2]	NSESA[3]
Little brown bat	*Myotis lucifugus*	Endangered	Yellow	Not, listed
Brown long-eared bat	*Myotis septentrionalis*	Endangered	Yellow	Not listed
Eastern pipistrelle / Tri-colored bat	*Perimyotis subflavus*	Endangered	Yellow	Not listed

[1] COSEWIC, 2009a; [2]NSDNR, 2010; [3]NSESA, 2007

Brown long-eared bat

The Northern myotis (also called Northern long-eared bat) is a common insect-eating bat found throughout much of southern Canada and the northern USA. Associated with boreal forest areas, approximately 40% of its global range is in Canada. Limited effort has been made to determine overall population size due to its relative commonness and widespread population.

Northern myotis uses riparian areas, coniferous, hardwood and mixed forest and woodland for foraging and nesting. Foraging typically occurs both above and below the forest canopy. They are also known to forage in forest clearings and occasionally over water.

This species of bat may be found roosting with other bat species, although they are much less social than other members of the genus *Myotis*. The sexes roost separately, with reproductive females forming small maternity colonies of less than 60 individuals (Altringham, 1996). In areas of North America, including Canada, bats choose maternity roosts in buildings, under loose bark, and in the cavities of trees.

Caves and underground mines are their choice sites for hibernating (Trouessart, 1999) (Cited in Arroyo-Cabrales and Ticul Alvarez Castaneda, 2008). Information on overwintering sites (hibernacula) are generally well known in central and eastern Canada but less so in western Canada where the species appears to be less common (COSEWIC, 2012b).

The area within the Property Boundary has habitat that would be attractive to this species for foraging and nesting. There is a potential for this species to be impacted by Project activities.

Tri-colored bat

The Tri-colored bat (formerly called Eastern pipistrelle) is an insect-eating bat found in southeastern Canada and the eastern USA. It is rare in Quebec and New Brunswick and uncommon in Nova Scotia and southern Ontario (Broders *et al*. 2001, 2003; van Zyll de Jong 1985) (Cited in COSEWIC, 2012c).

Tri-coloured bats use grassland, shrub land, orchards, woodland, hardwood and mixed wood for foraging. Foraging is also known to take place along the margins of lakes and streams.

The area within the Property Boundary has marginal habitat that would be attractive to this species for foraging and nesting. There is a potential for this species to be impacted by Project activities.

Little brown bat

The Little brown myotis (also called Little brown bat) is a common, insect-eating bat found throughout much of Canada and the USA. Approximately 50% of its global range is in Canada, occurring in every province and territory, and is considered to be the most common bat in Canada. Limited effort has been made to determine overall population size due to its relatively commonness and widespread population. Little brown bats live over a wide latitudinal and elevational range. (Havens and Myers 2006) (Cited in Arroyo-Cabrales and Ticul Alvarez Castaneda, 2008).

Little brown bats use bog/fens, forested or herbaceous wetland, riparian areas and hardwood forest for foraging and nesting. They often hunt over water or along the margins of lakes and streams. Typical food sources are flying insects (especially mosquitoes), midges, caddisflies, moths, various hoppers, smaller beetles, and sometimes spiders (COSEWIC, 2012a).

This species uses caves and hollow trees for roosting and hibernating but has also adapted to using human-made structures. Maternity colonies commonly are in warm sites in buildings and other structures. Some are also in hollow trees; however, this seems to be more infrequent (COSEWIC, 2012a).

In winter, a relatively constant temperature of about 40 F and 80% relative humidity is required for their optimal survival during hibernation. Hibernacula are typically caves, tunnels, abandoned mines, and similar sites (COSEWIC, 2012a).

The area within the Property Boundary has habitat that would be attractive to this species for foraging and nesting. There is a potential for this species to be impacted by Project activities.

Bat Hibernacula

The Meguma Group (a bedrock type within the area of Canso) can provide cave habitats, especially for hibernating bats (Museum of Natural History, 2012b). There is no evidence of caves in the Property Boundary. Caves in the Meguma rock structure are limited; most caves in Nova Scotia occur in gypsum and limestone (Museum of Natural History, 2012b).

The closest abandoned mine working is at West Cooks Cove (40 km from the Property Boundary) (NSDNR, 2012b).

It seems unlikely that a hibernacula would be in the Property Boundary or within 25km of the site. The likelihood of hibernating bats being affected by the Project is low.

The three species at risk discussed above have the potential to forage and nest in the Property Boundary and surrounding areas of the Town of Canso. There might also be a potential for migrating bats to be in the area during the spring and/or fall.

4.7.9 Future Studies

The data gathered in 2006 is not sufficient to determine the use of the area by any one of these species; therefore, the Proponent will complete a bat assessment upon the successful execution of a PPA for the Project. Assessment components will include acoustic monitoring, locating of any potential maternal colonies, as well as trapping and tagging of bats to determine their patterns of movement.

A biologist, specializing in bat data collection and interpretation, will be utilized to complete this scope of work.

4.7.10 Effects and Mitigation

The effects of a wind farm on birds are variable and depend on such factors as the development design, topography of the area, habitats affected, and the bird community in the wind farm area (Drewitt and Langston, 2006).

Similar to birds, bats are also affected by siting choices, including topography, design, and the habitats affected during construction.

Collision Mortality

The most overt potential effect of the Project on birds is direct mortality resulting from collision with Project infrastructure, namely turbine blades. Most evidence suggests that mortality levels resulting from turbine collisions are low (Drewitt and Langston, 2006), although many studies do not adequately consider carcass removal by scavengers into their mortality estimates. In a review of night migrant fatalities at wind farm sites in North America, Kerlinger et al. (2010) found fatality rates of less than 1 bird/turbine/year to approximately 7 birds/turbine/year, even with corrections made for scavenger removal and searcher efficiency. Furthermore, multi-bird fatality events, in which more than three birds were killed at a turbine site in a single night, were found to be rare and may have been related to lighting and/or inclement weather (Kerlinger et al., 2010). Lighting required for safety and security reasons, including outdoor lights and building lights as well as lights on turbines, may attract and/or disorient nocturnal migrants, increasing the risk of collisions (Kuvlevsky Jr. et al., 2007; Kerlinger et al., 2010).

Collision risk is greater on or near areas used by large numbers of foraging or roosting birds or in important migratory flyways (Drewitt and Langston, 2006). This risk can, therefore, be greatly reduced by incorporating knowledge of the area's bird community into

the design and placement of a wind power project. A few large-scale wind farms constructed in the 1980's, specifically at Altamont Pass and Tehachapi Pass in California, did not adequately consider local factors, and the result was the death of dozens of birds, with a high proportion of iconic raptor species (Kingsley and Whittam, 2005). The probability of raptor collision with wind turbines depends on the species, turbine height, and local topography (de Lucas, 2008); considerations which, when included in the planning stages, can reduce the risk of raptor collisions. Indeed, in the review by Kingsley and Whittam (2005), raptor collision rates were found to be quite low.

In summary, available research suggests that the probability of large-scale fatality events occurring at wind farms is extremely low (Kerlinger et al., 2010), and the observed mortality caused by wind energy facilities is low compared to other sources of human caused bird mortality (i.e. buildings, communications towers, vehicles, etc.) (Kingsley and Whittam, 2005). Baseline information gained from avian surveys can be combined with site specific considerations to greatly reduce the already low risk of bird collisions.

While bats are thought to collide with the turbines less than birds, the possibility of barotrauma (where the air pressure in the bats lungs increases with the change in air pressure near moving turbine blades) may result in their lungs exploding. This is thought to primarily affect migratory species (Baerwald et al., 2008).

Disturbance

Sensory disturbance to birds can occur during both the construction and operational phases of wind power projects and can be caused by the increased presence of personnel, vehicle movement, operation of heavy equipment, and the operation of the turbines themselves (Drewitt and Langston, 2006). It is thought that disturbance to birds may have a greater population impact than collisions themselves, although research is lacking in this area (Kingsley and Whittam, 2005). Primary concerns with regards to sensory disturbance are related to displacement and potential effects on key physiological processes such as breeding.

Some studies have shown that birds will exhibit avoidance behaviours post-construction, leading to a variable degree of displacement from previously used habitat (reviewed in Drewitt and Langston, 2006), which essentially amounts to habitat loss. In most cases, such displacement is on the scale of tens to hundreds of metres, which can lead to localized changes in bird densities (Leddy et al., 1999; Pearce-Higgins et al., 2009). However, while birds may avoid specific sites, the evidence does not suggest that they abandon the general area as a whole. Other research indicates that the presence of wind turbines has no effect on the distribution of the bird community (Devereux et al., 2008). The tolerance to Project related disturbance may be species specific but may also be related to the availability of alternative habitat (Kingsley and Whittam, 2005). Thus, careful

site selection for turbines to avoid unique habitat types will likely alleviate disturbance and/or displacement concerns, especially during the operational phase of the Project.

Bats can also be affected by disturbance and avoidance behaviours which may lead to the reduced use of feeding or roosting areas. However, provided some connectivity is maintained, bats are likely to return to the area once the construction phase has finished.

Potential effects to birds and bats during the different phases of the Project are summarized in Table 4.26.

Table 4.26: Potential Environmental Effects of the Project on Birds and Bats (Drewitt and Langston, 2006)

Effect	Source of Effect	*Phase Applicable to		
		C	M/O	D
Direct mortality	Collisions (and risk of barotrauma) with Project infrastructure.		✔	
Disruption to breeding and nesting	Noise, vibration, and/or visual disturbance from site personnel, equipment, and/or turbines; habitat loss	✔	✔	✔
Disruption to roosting and feeding	Noise, vibration, equipment, and/or turbines; habitat loss	✔	✔	✔
Displacement	Noise, vibration, and/or visual disturbance from site personnel, equipment, and/or turbines; alteration of migration flyways or local flight paths	✔	✔	
Habitat loss and fragmentation	Clearing of vegetation for Project infrastructure; hydrologic alterations leading to wetland loss	✔	✔	

**C – Construction phase M/O Maintenance/Operational Phase D – Decommissioning Phase*

The following measures will be implemented to minimize or eliminate impacts to birds and bats:

- Development and implementation of an EPP for the Project, which will include provisions for spill prevention, post-construction monitoring, timing of Project activities, lighting, and the protection of avifauna species;
- Clearing of site vegetation will be conducted outside of the breeding and nesting season (April to August). If clearing during nesting period is required, the Proponent with DNR and CWS will develop an appropriate mitigation plan to ensure that incidental take of species will not be possible, No activities which could result in incidental take will occur without the consultation of DNR and CWS;
- Use existing access ways to the greatest extent possible;
- All outdoor building lights are shaded and directed towards the ground;
- All outdoor building lighting to be “on demand” to avoid lights being on unnecessarily;

- Limit the use of lighting on turbine hubs and blades to the minimum as required by Transport Canada (2012); and
- Avoid placing Project infrastructure in habitats significant to bird species as identified through avian surveys.

Potential impacts to birds and bats will be further evaluated, as a VEC, in Section 8.

5. SOCIO-ECONOMIC CONDITIONS AND EFFECTS MANAGEMENT

5.1 Economy

The Property Boundary is located on land in Guysborough County, in close proximity to the Town of Canso. In September, 2010, the Town filed an application with the Nova Scotia Utility and Review Board (UARB) under the *Municipal Government Act* (1998) to dissolve the Town; a motion was granted January 2012. As of July 1, 2012, the Town of Canso will be amalgamated into the Municipality of the District of Guysborough.

Guysborough County has a population of 8,143, an 11% decrease from the 2006 recorded census population of 9,058. The most populous municipalities/towns in Guysborough County are the Municipality of the District of Guysborough (pop 4,189), Municipality of the District of St. Mary's (pop. 2,354), Canso (pop. 806) and Mulgrave (pop. 794) (Statistics Canada, 2011). The Property Boundary is approximately 1.9 km from the Town of Canso. The Municipality of the District of Guysborough will economically benefit from the Project through the generation of tax revenues, wind turbine land leases, job creation, and direct and indirect economic spinoffs throughout the area.

5.1.1 Demography

Since 2006, similar to the County, population has decreased 12% in the Municipality of the District of Guysborough and 13% in the Town of Canso – this trend is in contrast to a 4.5% population growth in the Halifax Regional Municipality (HRM) (Statistics Canada, 2011). Population decline in Guysborough is, in part, due to many factors, including rural-urban migration towards greater employment opportunities and the decline of the fisheries sector, notably within the Town of Canso. The dissolution of the Town of Canso is a tangible resulting factor of this trend. The low population density (2.0 per square kilometer) demonstrates that the Municipality is sparsely populated compared to the HRM (71.1) (Statistics Canada, 2011). Table 5.1 outlines demographic statistics for the Town of Canso and The Municipal District of Guysborough.

Table 5.1: Population in the Town of Canso and the MD of Guysborough, 2011

Population Statistics	Town of Canso	MD of Guysborough
Population in 2011	806	4189
Population in 2006	911	4681

Population change from 2011-2006 (%)	-11.5	-10.5
Total private dwellings in 2011	416	2827
Land area (square km)	148.8	2111.42
Population density per square kilometer	5.42	2.0

Source: Statistics Canada, 2011

The age distribution in the Town of Canso and the MD of Guysborough reveals an older population where the median age is 51.0 and 53.9 respectively, compared to the Province of NS in general (43.7) and the HRM (39.9) (Statistics Canada, 2011). Comparing rural and urban median age in Nova Scotia, younger demographics live where there are more employment opportunities (i.e. HRM). A breakdown of age distribution in Guysborough County and the MD of Guysborough is outlined in Table 5.2 below.

Table 5.2: Age in Town of Canso and MD of Guysborough, 2011

Age Statistics	MD of Guysborough	Town of Canso
0 - 14 years	450 (11%)	115 (14.2%)
15 - 64 years	2,600 (62%)	520 (69%)
65+ years	1,140 (27%)	175 (21.6%)
Total Population	**4,190 (100%)**	**810 (100%)**

Source: Statistics Canada, 2011

The average housing cost in the Municipal District of Guysborough is $97,515; this is $115,427 lower than that of HRM and $66,200 lower than the total provincial average (Statistics Canada, 2006a). Examining median earnings for full-time workers, the Town of Canso and the Municipality of the District of Guysborough fall below the provincial average, with median earnings of $28,252 and $33,672 respectively, compared to the provincial median of $36,917 (Statistics Canada, 2006a). Table 5.3 outlines the housing costs and median earnings for the areas of interest.

Table 5.3: Household costs (2006) and median earnings for full-time, full year earners (2005)

Jurisdictions	Average Housing Cost	Median Earnings
Canso	$55,681	$28,252
MD of Guysborough	$97,515	$33,672
Province of Nova Scotia	$158,000	$36,917

Source: Statistics Canada, 2006a&b

Lower housing costs and annual workforce earnings combined with population decline suggests less than ideal economic conditions in these areas. The Project could provide a boost to local construction employment, giving local labourers an opportunity to work close to home, as well as providing increased economic benefits to the county and municipality in the form of tax revenues, wind turbine leasehold rents, and economic spinoffs.