D. PROJECT SPECIFIC VALUED ECOSYSTEM COMPONENTS

a. Soils

The Project lands have undulating to steeply sloped topography. Although the Project is situated on the apex of North Mountain, a small serpentine ridge line runs east west along the Mountain. This ridge bisects the Project lands. The surface elevation of the various turbines ranged from 223m above sea level at Turbine 2 site to 260 m at Turbine 3.

The North Mountain is a ridge of basalt. The area is covered predominantly with a veneer of gravelly sandy loam glacial till derived from the underlying basalt. Inclusions of loam and clay loam tills derived from sedimentary sources are located in patches along the ridge. Raised beach and ice-contact stratified drift deposits of sand and gravel are found along the northern edge of the ridge adjacent to the Bay of Fundy.

Soils across the site are mostly moderately coarse and well-drained. Most of the Hampton Wind Farm Project area exists on Ecosection WMHO, well drained medium textured soil on hummocky terrain (NSDNR). This Ecosection also covers >56% of the North Mountain Ecodistrict. Proposed Turbine Site 9 is the only site located on Ecosection WMKK, well drained medium textured soil on hilly terrain. Turbine 4 is located near the local junction of WMKK, WMHO and WFHD, well drained fine textured soil on hummocky terrain.

Ecosection	Area (ha)	% Ecodistrict	Cumulative %
WMHO	55681	56.3	56.3
WMKK	15350	15.5	71.8
WMDS	9823	9.9	81.7
WFHO	7517	7.6	89.3
IMHO	5098	5.2	94.5

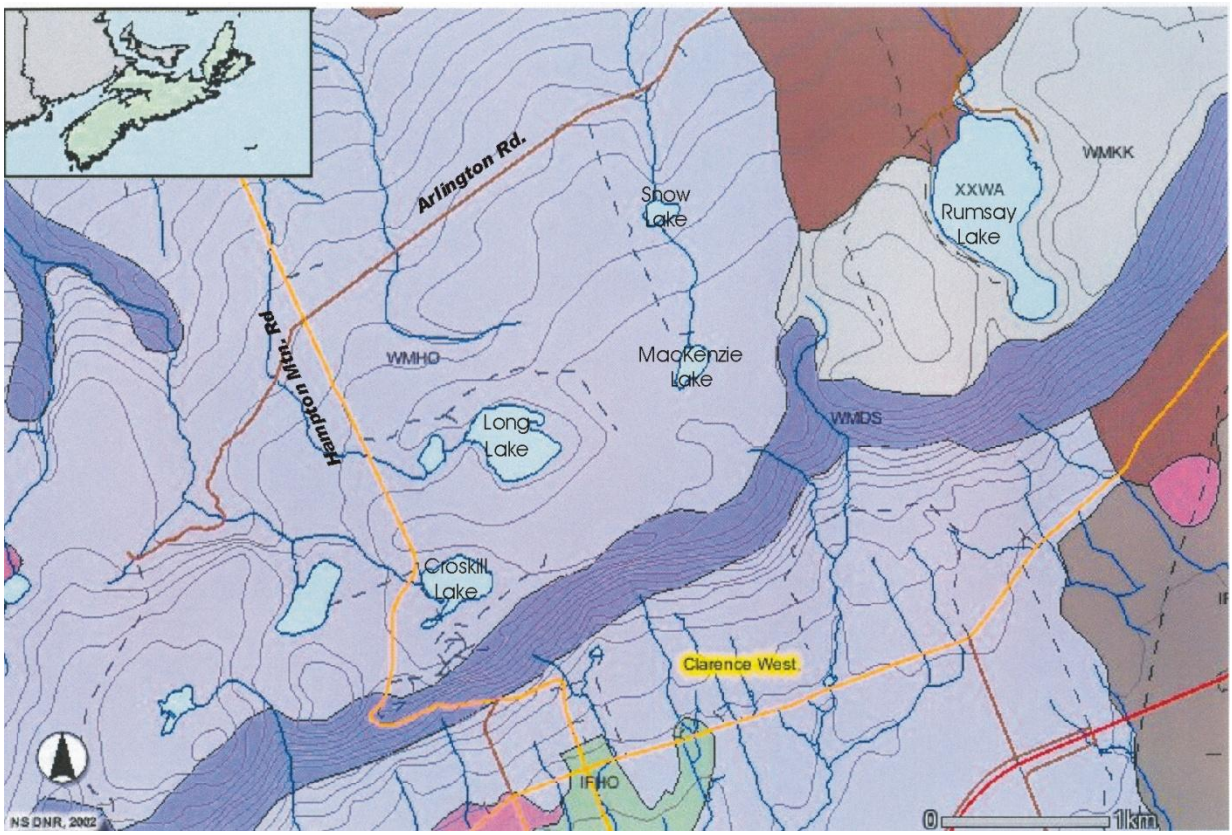


Figure 8. Nova Scotia Department of Natural Resources Ecosections

Bedrock exposures

The exposure of the basalt bedrock at various locations along the crest of the north mountain provides a habitat that is somewhat limited in the landscape. At several locations throughout the Project area, flat bedrock or small bedrock ledges are apparent. One such ledge between Snow Lake and Mackenzie Lake forms an effective barrier to fish migration between the two systems.

Near the southern crest of the mountain, basalt outcrops exist in a few locations. These were examined during field surveys for presence of species at risk or species that would be present only in this locally limited habitat. A chasm was identified in the southwest portion of the Project area, and a small cave was identified in the southeast portion of the Project area. Both are located several hundred metres from the nearest turbine site.

i. Effects of the Project

Three land actions were identified, which may contribute to effects on soils within the Project area. These actions are closely tied to those acting on vegetation. The three actions affecting soils may include:

1. Wind erosion of soils – risk relates to the potential for the soil to be mobilized by wind, particularly when disturbed through construction activities or a high degree of traffic. Loss of (or reduced) vegetative cover during activity can increase the risk for wind erosion. The highest risk for wind erosion tends to occur in areas with coarse-textured soils and sparse vegetative cover;

2. Water erosion along trails - risk relates to the potential for the soil to be mobilized by water, particularly when disturbed through construction activities or a high degree of traffic. The highest risk for water erosion tends to be associated with long or steep slopes (particularly those that are channeled or dissected), higher clay content and low vegetative cover. A combination of these factors tends to produce an extreme risk for water erosion. Compaction caused by excess traffic can increase overland flow, which can promote water erosion in channels or gullies;

3. Compaction along trails – caused by the continued use of equipment on designated minimal disturbance working areas. Compaction due to traffic will cause soil compaction on lease sites and along trails. Maintenance and operations traffic will contribute to this compaction over the life spans of the Project. There are a variety of methods available for compaction relief post operations which include aeration and subsoiling. Ultimately, reclamation will minimize the long-term effects.

ii. Mitigation

In order to mitigate effects to soils, effective soil stripping, storage, replacement, and reclamation will occur. In addition to the construction methods proposed, the Environmental Protection Plan developed for this Project (Appendix II) outlines numerous mitigation techniques to be used. Finally, following surveying of the access roads and turbine locations, an effective erosion and sedimentation control plan will be implemented.

The following summarizes how the Project will control erosion and sedimentation at the Project, and thus mitigate effects to Soils:

- All sediment control structures will be placed as construction proceeds;
- Sprott and/or Sprott appointed contractors shall be responsible for the upkeep of all sediment control structures during the Project;
- A visual check of erosion and sedimentation control structures will be conducted during the Project prior to and following large rainfall events;
- Maintaining existing vegetation cover is the best and most cost-effective erosion control practice;
- All vehicular traffic must stay within designated accesses. All suspected off Right-of-Way travel will be reported immediately to the Environmental Monitor/Construction Consultant;

- Avoid frequent or unnecessary travel over erosion prone areas;
- Continued inspection and maintenance of erosion and sedimentation control measures may be required after completion of construction. Regular inspections should be conducted on a weekly basis or as required with respect to storm events and snow melt. All maintenance preformed on erosion and sediment control measures will be recorded;
- Inspection and maintenance will continue until the erosion control is no longer required. The following circumstances and conditions will determine this outcome:
    a. Revegetation of bare soil was successful;
    b. No obvious erosion scour is observed;
    c. No obvious bedload of silt and sediment laden runoff is observed;
    d. Inspection and maintenance report indicates satisfactory performance;
- Check Dams will be installed in ditches at pre-determined intervals and locations. Because slopes throughout the Project area are small, the following schedule will be referenced in the field during construction and implementation:

Table 7. Check Dam Spacing

Slope Grade	Spacing
0-2%	40 m
2-4%	20 m
4-5%	16 m
5-6%	13 m
6-7%	11.5 m
7-8%	10 m
8-9%	8.5 m
9-10%	8 m
10-11%	7.25 m
11-12%	6.5 m

- Between check dams, ditch texturing will be used. Disturbed slopes shall be seeded as soon as possible following each stage of construction or vegetated with landowner approved vegetation (i.e. plantings);
- All soil stockpiles within 100 metres of a watercourse will have sediment control on the downslope side. Sediment control shall include swales and ditches if a natural vegetation buffer is present between the stockpile and nearest watercourse. If no natural vegetation is present, siltation fencing, ditches and swales shall be used. No stockpiles will be placed within 30 metres of a watercourse;

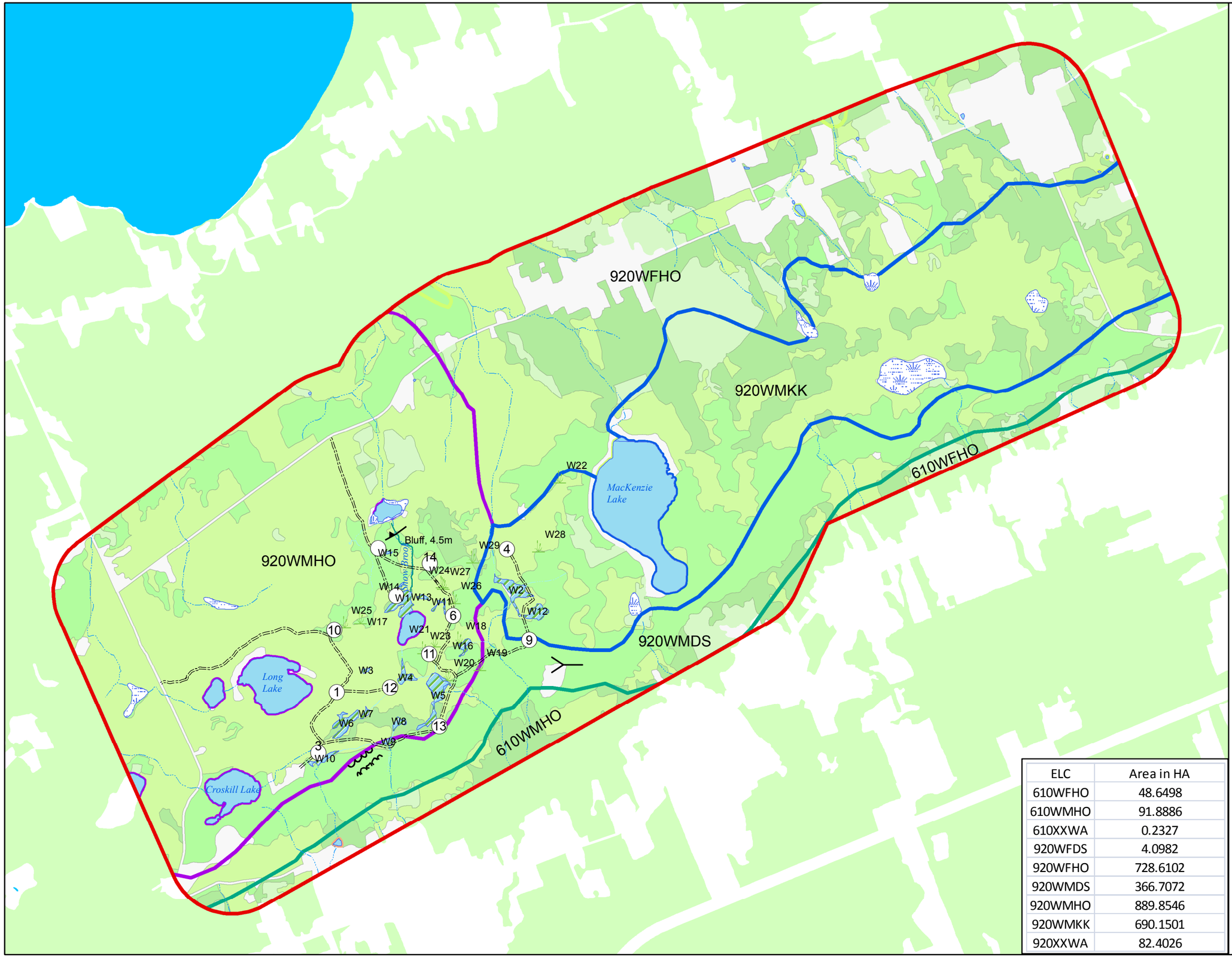
- Culverts will be installed along the road(s) to allow for general drainage of the upslope side of the road into naturally vegetated areas; and,
- On downslope sides of roads, ditches will be textured and off take ditches installed to allow for waterflows into adjacent naturally vegetated areas;

b. Vegetation

A complete inventoried species list is presented in Appendix X, and includes individual lists of species inventoried at each turbine location. Wetlands plants and habitats are discussed further within this document under the section titled "Wetlands".

The majority of the forest of the North Mountain Ecodistrict, within which the proposed Project is located, has been heavily harvested over the centuries. The current forest is a mixture of shade intolerant hardwood species, white spruce and balsam fir, with scattered occurrences of red spruce and white pine. The climax forest for the entire ridge of the north mountain likely consisted of both tolerant hardwood and softwood species. Beech was probably abundant at one time, but has been reduced to an understory species in most of the tolerant hardwood stands. However, there are still extensive areas on steep slopes overlooking the valley where beech, mostly low quality due to beech bark disease, is a dominant species. An example can be seen at the Valley View provincial park outside of Bridgetown (NSDNR 2010b), and across some of the Hampton Wind Farm Project area. These habitats, as well as wetland areas, are depicted in Figures 9 and 10.

Figure 9. Project Area Land Classification Map.



Grid North

1:28,000

Legend

Land_Features

- Cave
- Chasm
- Bluff
- Turbine and Number
- Windfarm Roads
- Field Verified Streams
- Field Verified Wetlands
- Hampton Boundary
- Field Verified Wetland
- Stream

Ecological Land Classifications

- 610WFHO
- 610WMHO
- 920WFHO
- 920WMDS
- 920WMHO
- 920WMKK

Cover Type

- Non-Forest
- Softwood
- Mixedwood
- Hardwood

ELC	Area in HA
610WFHO	48.6498
610WMHO	91.8886
610XXWA	0.2327
920WFDS	4.0982
920WFHO	728.6102
920WMDS	366.7072
920WMHO	889.8546
920WMKK	690.1501
920XXWA	82.4026

Ecological Land Classification
Region
610 - Annapolis Valley Region
920 - North Mountain Region
Ecosections
WFDS - Well drained, fine textured soil on steep slopes or canyons.
WFHO - Well drained, fine textured soil on hummocky terrain.
WMDS - Well drained, medium textured soil on steep slopes or canyons.
WMHO - Well drained, medium textured soil on hummocky terrain.
WMKK - Well drained, medium textured soil on hilly terrain.
XXWA - Inland water.

Data Oct 20th, 2010

GIS By: Nortek Resource Solutions Inc.

Figure 10. Project Footprint Land Classification Map.

Grid North

Legend 1:7,500

- Turbine and Number
- Contour
- Hampton Boundary
- Windfarm Roads

Land_Features

- Cave
- Chasm
- Bluff

Water

- Lake
- Field Verified Wetland
- DNR Swamp
- Field Verified Wetlands
- Field Verified Streams
- Stream

Cover Type

- Non-Forest
- Softwood
- Mixedwood
- Hardwood

Ecological Land Classifications

- 610WMHO
- 920WMDS
- 920WMHO
- 920WMKK

Ecological Land Classification
Region
610 - Annapolis Valley Region
920 - North Mountain Region
Ecosections
WFDS - Well drained, fine textured soil on steep slopes or canyons.
WFHO - Well drained, fine textured soil on hummocky terrain.
WMDS - Well drained, medium textured soil on steep slopes or canyons.
WMHO - Well drained, medium textured soil on hummocky terrain.
WMKK - Well drained, medium textured soil on hilly terrain.
XXWA - Inland water.

Data Oct 19th, 2010

GIS By: Nortek Resource Solutions Inc.

Consistent with the general Ecodistrict characterization, the woodlands on the North Mountain in within the Project boundaries consist primarily of mixed stands and hardwood stand communities. These areas have been harvested in the past, and fall within an estimated age class of fifty years. Occasionally, specimens can be observed that may be much older. These have escaped harvesting activities because of their inaccessibility by being either on steep slopes or in brook ravines. The well-drained south facing slope of the Project area is dominated by hardwood species such as Sugar Maple *(Acer saccharum)*, American Beech *(Fagus grandifolia),* Yellow Birch *(Betula allegheniensis),* White Ash *(Fraxinus americanus)* and Red Oak *(Quercus rubra)*, which enjoy the rich acidic soils. Together with the occasional White Pine *(Pinus strobus)* and Eastern Hemlock *(Tsuga canadensis)* this woodland is a good representation of the Acadian Forest that is found on the north mountain of the Annapolis Valley. Under this mature canopy a rich diversity of shrub and herbaceous species form the sparse understory. Shrubs such as Witch-hazel *(Hamamelis virginiana)*, Alderleaf Viburnum *(Viburnum lantanoid*es), Hepatica (*Hepatica nobilis*), and herbaceous plants such as Hooked Crowfoot (*Ranunculus recurvatus*), Downy Solomon's-Seal (*Polygonatum pubescens*), Starflower Solomon's-Plume (*Maianthemum stellatum*), Rosy Sedge, (*Carex rosea*) and Herb-Robert (*Geranium robertianum*) were found. Through much of the existing hardwood stands, the significant canopy closure keeps the understory layers sparse, except where an opening has been naturally created, or along trails.

Photo 5. An example of a hardwood stand on a steep slope within the Project area. Note the sparse understory that exists in most hardwood areas.

The mixed stands of coniferous and hardwood species within the Project boundaries are more often encountered on the north side of the mountain crest, which gradually slopes towards the Bay of Fundy. These woods are scattered with occasional treed swamps. Dominant species observed in these areas were Red Spruce *(Picea rubens)*, Balsam Fir *(Abies balsamea)* Red Maple *(Acer rubrum)* and Yellow Birch *(Betula allegheniensis).* White Spruce *(Picea glauca),* Trembling Aspen *(Populus tremuloides)* and Paper Birch *(Betula papyrifera)* are also commonly encountered. One of Nova Scotia's rarest native trees, Eastern White Cedar (*Thuja occidentalis)*, grows in a few locations near the southwestern end of the north mountain ridge, although it was

not encountered within the Project boundaries.

Two small, additional rocky habitats of interest exist on the Project area as shown in Figure 10 above. A talus/boulder slope is located at the southeast corner of the Project Site, some 250+ m south east of the proposed Turbine 9 site. This location provides habitat for the cyanolichen, *Spilonema revertens* and the fern species, Rusty Woodsia (*Woodsia ilvensis)* and Maidenhair Spleenwort (*Asplenium trichomanes)*. These ferns were two of sixty-one plant species, known as the Arctic-Alpine and Boreal Disjunct, that were first to migrate into the Atlantic Canada area under the cool climatic conditions following glaciation. These species now have a disjunct or scattered distribution. As climate conditions changed, the plants like Rusty Woodsia survived only in locations favourable to them, which include cool areas and deep ravines or shaded cliffs (Davis and Browne 1997). These two species, as well as the rare Squaw-root (*Conopholis Americana)* and Round-Lobe Hepatica (*Hepatica nobilis)*, were found in the limited rocky habitat located on the southern extent of the Project. The presence of these exposed rock outcrops, brook ravines and talus slopes on the southern most extent of the Project area provide unique habitats for rare bryophyte and lichen species. Similar south facing rocky outcrops can be found along the length of the north mountain from Cape Split to Digby Gut, although the size of boulders at the Project area talus slope provides potential for cavities that are not found at all other locations. As shown in the photos below, a deep rock crevice at a second site located on the south facing slope was observed on May 24, and found still to contain snow from winter. This site is located some 350m southwest of Turbine site 13.

Photo 6. A May 24 remnant snow patch in a in a chasm on the southwest extent of the Project Area.

Large Round-Leaved Orchid has two varieties, variety *macrophyllum* being the rarer of the two. A longer spur distinguishes this variety. It is known to occur in the Cobequids and Cape Breton as well as on the North Mountain. A single plant of the less rare version, with a 23mm spur, was found within the Project boundaries.

Hieracium paniculatum, commonly called Panicled Hawkweed, is identified by the Atlantic Canada Conservation Data Center as a Provincially ranked S3 species. It was found at turbine 13. The S3 ranking means that it is, "Uncommon throughout its range in the province, or found only in a restricted range, even if abundant in at some locations."

c. Rare, Sensitive and At-Risk Vegetation

For the purposes of this study, the same approximate boundaries as that of the North Mountain Ecodistrict (the crest of the North Mountain parallel to the shoreline of the Bay of Fundy and stretching for about 200 km from Cape Blomidon to Brier Island) were provided to the ACCDC to identify the species of conservation concern that would be most likely found in the habitats of the Hampton Wind Farm Project area. A complete table of the 173 observations of 73 taxa documented by the ACCDC is presented in Appendix VIII. A summary list of forty-three species of conservation concern (those documented species that are federally and/or Provincially Protected, or that are considered rare or sensitive under other Nova Scotia Provincial rankings, and that have been found in the habitats present on the top of the North Mountain) is presented in Table 8 below. These 43 species were then given particular consideration in design, implementation and assessment of field biological surveys. They are further discussed in the relevant "Rare, Sensitive and At Risk" sections of this report.

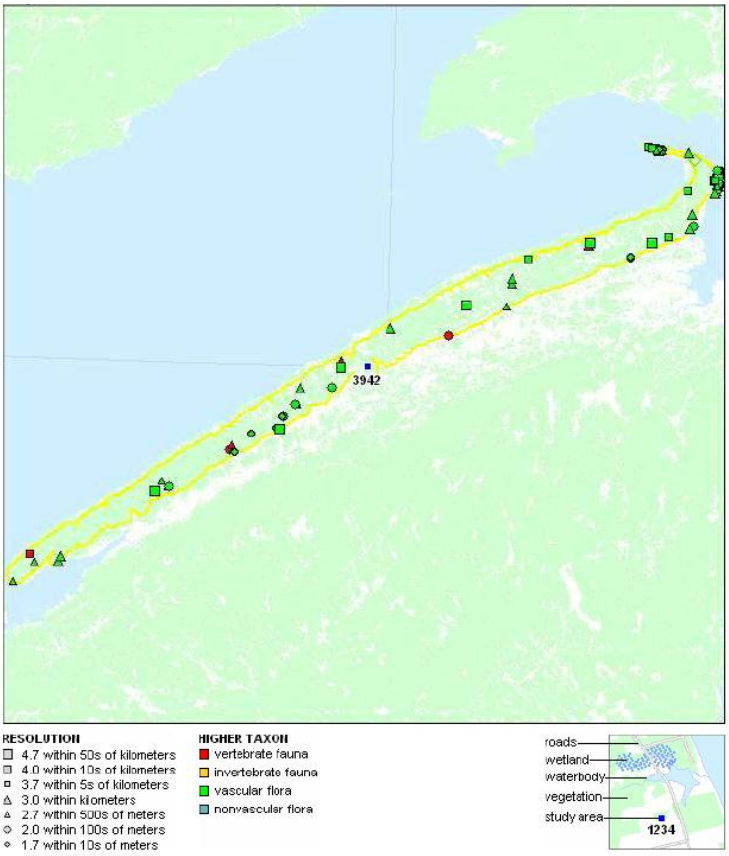


Figure 11. Species of Conservation Concern Known Locations

(An image of the Atlantic Canada Conservation Data Center observation records for the crest of the north mountain from Cape Split to Digby Gut used to identify potential species of conservation concern at the Project area. The proposed Hampton Mountain Wind Farm Project Site is indicated by the blue square numbered "3942".)

Table 8: Federally and Provincially protected species at risk documented along the North Mountain*.

Scientific Name	Common Name	Global Rank	National Protection	Provincial Rank	NS Protection	Dist to Project (km).
Chaetura pelagica	Chimney Swift	G5	T	S4B	Endangered	17 ±5
Chordeiles minor	Common Nighthawk	G5	T	S4B	Threatened	39 ±5
Falco peregrinus anatum	Peregrine Falcon anatum ssp	G4T4	SC	S1B	Vulnerable	41 ±10
Isoetes prototypus	Prototype Quillwort	G2G3	SC	S2	Vulnerable	16 ±0.1
Catharus bicknelli	Bicknell's Thrush	G4	T	S1S2B	Vulnerable	62 ±5
Glyptemys insculpta	Wood Turtle	G4	T	S3	Vulnerable	17 ±10
Thuja occidentalis	Eastern White Cedar	G5		S1S2	Vulnerable	4 ±10
Contopus cooperi	Olive-sided Flycatcher	G4	T	S4B		62 ±5
Wilsonia canadensis	Canada Warbler	G5	T	S4B		17 ±5
Cardamine maxima	Large Toothwort	G5		S1		59 ±0
Draba glabella	Rock Whitlow-Grass	G4G5		S1		64 ±0.1
Hepatica nobilis var. obtusa	Round-lobed Hepatica	G5T5		S1		17 ±10
Carex laxiflora var. laxiflora	Loose-Flowered Sedge	G5T5		S1		58 ±1
Allium tricoccum	Wild Leek	G5		S1		63 ±0.1
Malaxis brachypoda	White Adder's-Mouth	G4Q		S1		65 ±0.1
Conopholis americana	American Cancer-root	G5		S1S2		46 ±0
Carex hystericina	Porcupine Sedge	G5		S1S2		53 ±5
Festuca subverticillata	Nodding Fescue	G5		S1S2		64 ±0.1
Lobelia spicata	Pale-Spiked Lobelia	G5		S1S2SE		64 ±10
Huperzia selago	Northern Firmoss	G5		S1S3		58 ±5
Martes pennanti	Fisher	G5		S2		17 ±10
Osmorhiza longistylis	Smooth Sweet Cicely	G5		S2		64 ±1
Impatiens pallida	Pale Jewelweed	G5		S2		64 ±1
Arabis drummondii	Drummond's Rockcress	G5		S2		64 ±0.1
Cardamine parviflora var. arenicola	Small-flowered Bittercress	G5T5		S2		64 ±1
Draba arabisans	Rock Whitlow-Grass	G4		S2		58 ±1
Hudsonia ericoides	Pinebarren Golden Heather	G4		S2		27 ±1
Polygonum scandens	Climbing False Buckwheat	G5		S2		17 ±10
Anemone quinquefolia	Wood Anemone	G5		S2		17 ±10
Galium boreale	Northern Bedstraw	G5		S2		64 ±1
Saxifraga paniculata ssp. neogaea	White Mountain Saxifrage	G5T5?		S2		59 ±0.5
Eriophorum gracile	Slender Cottongrass	G5		S2		17 ±10
Cypripedium parviflorum var. makasin	Yellow Lady's-slipper	G5T4Q		S2		31 ±5
Asplenium trichomanes	Maidenhair Spleenwort	G5		S2		46 ±0
Rallus limicola	Virginia Rail	G5		S2B		62 ±5
Piranga olivacea	Scarlet Tanager	G5		S2B		17 ±5
Cardinalis cardinalis	Northern Cardinal	G5		S2B		50 ±5
Hedeoma pulegioides	American False Pennyroyal	G5		S2S3		25 ±0.5

Juncus marginatus	Grass-leaved Rush	G5		S2S3		4 ±10
Alopecurus aequalis	Short-awned Foxtail	G5		S2S3		64 ±5
Poa glauca	Glaucous Blue Grass	G5		S2S3		65 ±1
Ophioglossum pusillum	Northern Adder's-tongue	G5		S2S3		39 ±10
Sayornis phoebe	Eastern Phoebe	G5		S2S3B		17 ±5

*Includes Provincially rare (S2) and extremely rare (S1) species ridge from Cape Split to Digby Gut by the Atlantic Canada Conservation Data Center. This list of 43 species was used in the design, implementation, and assessment of biological field studies. The distance from the proposed Hampton Wind Farm Project area to the closest documented observation is noted.

Table 9 (below) is a list of thirty- one potential species of conservation concern from ACCDC for the Project area (i.e. Federally or Provincially listed or with a Provincial S1 or S2 Ranking) that have been found along the crest of the North Mountain between Cape Split and Digby Gut. In total the ACCDC had 120 records of 51 vascular, 0 records of nonvascular flora from this area (see Appendix VIII). Field inventories collected on the proposed Hampton Wind Farm Project area yielded one hundred and thirty-three (133) species of vascular plants, bryophytes, and lichens during the 2010 vegetation surveys.

A complete list of all plant species inventoried during 2010 field surveys of the Project Site is presented in Appendix X. As well, a complete list of species inventoried at each turbine location is provided in Appendix X. No Federally or Provincially listed Species at Risk were identified during these inventories. Furthermore, all plants found at all surveyed turbine locations and along the roadways are currently ranked by the Nova Scotia Department of Natural Resources as not at risk (having a General Status Rank of Green). However, a number of species ranked by the Atlantic Canada Conservation Data Center and the Nova Scotia Department of Natural Resources as species of conservation concern within Nova Scotia were identified at other locations within the Project area. These species are outside the construction footprint of the Project and will not be impacted.

Table 9: Thirty- one plant species of conservation concern*.

Scientific Name	Common Name	Global Rank	National Protection	Provincial Rank	NS Protection	Dist to Project (km).
Isoetes prototypus	Prototype Quillwort	G2G3	SC	S2	Vulnerable	16 ±0.1
Thuja occidentalis	Eastern White Cedar	G5		S1S2	Vulnerable	4 ±10
Cardamine maxima	Large Toothwort	G5		S1		59 ±0
Draba glabella	Rock Whitlow-Grass	G4G5		S1		64 ±0.1
Hepatica nobilis var. obtusa	Round-lobed Hepatica**	G5T5		S1		17 ±10
Carex laxiflora var. laxiflora	Loose-Flowered Sedge	G5T5		S1		58 ±1
Allium tricoccum	Wild Leek	G5		S1		63 ±0.1
Malaxis brachypoda	White Adder's-Mouth	G4Q		S1		65 ±0.1
Conopholis americana	American Cancer-root	G5		S1S2		46 ±0
Carex hystericina	Porcupine Sedge	G5		S1S2		53 ±5
Festuca subverticillata	Nodding Fescue	G5		S1S2		64 ±0.1

Lobelia spicata	Pale-Spiked Lobelia	G5		S1S2SE		64 ±10
Huperzia selago	Northern Firmoss	G5		S1S3		58 ±5
Osmorhiza longistylis	Smooth Sweet Cicely	G5		S2		64 ±1
Impatiens pallida	Pale Jewelweed	G5		S2		64 ±1
Arabis drummondii	Drummond's Rockcress	G5		S2		64 ±0.1
Cardamine parviflora var. arenicola	Small-flowered Bittercress	G5T5		S2		64 ±1
Draba arabisans	Rock Whitlow-Grass	G4		S2		58 ±1
Hudsonia ericoides	Pinebarren Golden Heather	G4		S2		27 ±1
Polygonum scandens	Climbing False Buckwheat	G5		S2		17 ±10
Anemone quinquefolia	Wood Anemone	G5		S2		17 ±10
Galium boreale	Northern Bedstraw	G5		S2		64 ±1
Saxifraga paniculata ssp. neogaea	White Mountain Saxifrage	G5T5?		S2		59 ±0.5
Eriophorum gracile	Slender Cottongrass	G5		S2		17 ±10
Cypripedium parviflorum var. makasin	Yellow Lady's-slipper	G5T4Q		S2		31 ±5
Asplenium trichomanes	Maidenhair Spleenwort**	G5		S2		46 ±0
Hedeoma pulegioides	American False Pennyroyal	G5		S2S3		25 ±0.5
Juncus marginatus	Grass-leaved Rush	G5		S2S3		4 ±10
Alopecurus aequalis	Short-awned Foxtail	G5		S2S3		64 ±5
Poa glauca	Glaucous Blue Grass	G5		S2S3		65 ±1
Ophioglossum pusillum	Northern Adder's-tongue	G5		S2S3		39 ±10

* Documented within similar habitat along the top of the north mountain to the Hampton Wind Farm Project area by the Atlantic Canada Conservation Data Center. The closest documented observation of each species to the Project area is noted where multiple observations exist.
**Species confirmed within the Project Area during 2010 field surveys.

Two species from the ACCDC list of potential plant species of conservation concern (see Table 9 above) and five others that either have not been previously documented with the ACCDC or that have a NSDNR Status Rank of Red or Yellow but not an ACCDC S1 or S2 ranking were identified during 2010 field surveys of the Project area. These seven plant species of conservation concern are presented in Table 10. Of the seven species identified, all are within the Project area but fall outside the proposed construction footprint, with the exception of the *Sphagnum spp.* and *Leptogium saturninum*.

Table 10: Plant species identified during field inventories that have been designated as rare or sensitive.

None of these species are Federally or Provincially listed Species at Risk.

Scientific Name	Common Name	ACCDC Prov. Rank	NSDNR Gen. Status
Hepatica nobilis	Round-Lobe Hepatica	S1	**Red**
Conopholis americana	Squaw-Root	S1S2	**Red**
Spilonema revertens	A lichen	SNR	**Red**
Asplenium trichomanes	Maidenhair Spleenwort	S2	**Yellow**
Leptogium saturninum	A lichen	SNR	**Yellow**
Sphagnum wulfianum	A peatmoss	S2S3	**-**
Sphagnum subsecundum	A peatmoss	S2S3	**-**

Within the Project area, Squaw-Root is limited to the east side of an extensive open talus slope and rock outcrop on the south facing slope of the North Mountain. This site is approximately 270 m away from any proposed Project activities. It is associated with Red Oak (*Quercus rubra*) in an area dominated by mature hardwoods including Sugar Maple (*Acer saccharum*) and White Ash (*Fraxinus americanus*). There are at least fifteen mature Red Oak each having several colonies of Squaw-Root in an area of approximately fifty square meters. At the time of the visit, several of the colonies had been dug up, possibly by porcupine that live in the neighboring rock outcrop. This activity has exposed the Red Oak roots permitting observations of the parasitic nature of the Squaw-Root.

Round-Lobe Hepatica is a spring ephemeral, flowering in early May before trees leaf out. Flowers range in colour from pale blue to pink and white. The ACCDC notes four records of Round-Lobe Hepatica *(Hepatica nobilus)* along the top of the north mountain. All were found between the late 1980's and 2007. Although the most recent observation was found approximately 17km from the proposed Hampton Wind Farm, the others were located approximately 60km away. However, all were found on the southern slope of the north mountain, as were the plants inventoried within the Project area during 2010. At the time of the survey, flowering had passed. Only one location was found for this species during the vegetation survey. The plants are located in shallow soil on a rocky outcrop with a southern exposure where there is little competition with other herbaceous species. There are approximately 160 plants in an area of six square meters. All plants appear to be very healthy and vigorous. The canopy is composed of Sugar Maple (*Acer saccharum*), White Ash (*Fraxinus americanus*) and Beaked Hazelnut (*Corylus cor*nuta). The tree species are small due to the poor growing conditions. This site compares with two other known sites on the North Mountain in Annapolis County in being very small and isolated. Although other similar rock outcrops and habitat were observed in the area of the survey, no additional Round-Lobe Hepatica was found. The site is located 340m from the nearest, and over 100m from the nearest proposed road.

Two rare lichens were recorded during the survey. *Leptogium saturninum* was found on Red Maple located at the edge of Wetland 1 east of turbine 7, and as such is protected by the setbacks from all watercourses. S*pilonema revertens* was found on rock located 275 m from the nearest

site of proposed project activity. The latter species has only been found in Annapolis County on talus slopes and exposed outcrops in the vicinity of the proposed Project.

Very few records exist for the peat moss, *Sphagnum wulfianum* in Nova Scotia. It was found along an intermittent stream some 300+ m from the nearest proposed turbine site. The stream is flowing through the rich deciduous woods, characteristic of the south facing slope of the North Mountain. *Sphagnum subsecundum* was found in a wet depression associated with an old woods road in the north east portion of the Project Site. This site is 130+m from the nearest proposed project activity.

There are four documented observations of Maidenhair Spleenwort (*Asplenium trichomanes*) along the top of the North Mountain within the ACCDC database. The plants observed within the Project area were found near a talus slope in the southeast corner. Along with the commonly found Rusty Woodsia, Maidenhair Spleenwort appears part of a scattered distribution of plants known as the Arctic-Alpine and Boreal Disjunct. Both were found on the same talus slope.

The closest ACCDC documented plant species of conservation concern is the Provincially vulnerable Eastern White Cedar (*Thuja occidentalis)*. Despite targeted surveys in and around wetland habitats in or near the construction footprint of the Project, where this species would most apt to be found, none were observed. Approximately 5,000 cedar seedlings grown at the Tree Breeding Centre in Debert in the late 1990's from native seed sources were given to the Irving Company and planted near Rumsey Lake (Newell, 2005) in the eastern half of the Project area. Most provincially known cedar populations exist within Annapolis County, both on the north and south mountains as well as across the valley floor.

The Prototype Quillwort (*Isoetes prototypus)* has been noted as a Federal species of Special Concern and a Provincial Vulnerable species protected by legislation. It is a perennial aquatic plant that lives 1.5 – 2 m below the surface of the water. The ACCDC has indicated that a record exists within 16km of the proposed Hampton Wind Farm Project area. The fact that the Quillwort lives in nutrient poor spring fed lakes suggests that Mackenzie Lake may provide appropriate habitat. The lake was not surveyed for aquatic plants, nor would the proposed project be anticipated to influence aquatic plants at the lake in any manner.

i. Effects of the Project

There are two small areas of the Project area that hold a number of species of conservation concern as outlined previously. In particular, the talus slope in the southeast portion of the Project area is arguably the most significant habitat in the area because of the presence two Red and one Yellow ranked species. Although the talus slope will not be directly impacted by the proposed project activities, the potential exists that it may become more accessible as a result of road development. Given that lichen species such as *Spilonema revertens* attach to the boulders, and the fern species Maidenhair Spleenwort and the parasitic Squaw Root are relatively fragile ground species, means they are susceptible to human traffic. The top of the talus slope is currently a viewpoint periodically visited by people, primarily traveling on ATV's. Increasing

such traffic could have a detrimental impact on the unique plant community found in and around the talus slope.

ii. Mitigation

As no species of special conservation concern, or those listed as being at risk will be impacted by the Project, no mitigation will be employed. However, as a result of the potential for increased traffic to the talus slopes, a sign will be placed in the area warning people of their potential to impact the species. This sign will be developed in cooperation with NSDNR.

d. Herptofauna

A search of the ACCDC database for records within the North Mountain Ecodistrict from Cape Split to the Digby Gut resulted in 53 records of 22 vertebrate, and zero (0) records of invertebrate wildlife. These search results provide a list of potential wildlife species that might be found in habitats located within the Project Area. The complete list of these species observation records is presented in Appendix VIII. This list includes eleven species of conservation concern, including Wood Turtle and Peregrine Falcon. Herptofuana (amphibians and reptiles), avian (birds), and mammalian species have been addressed in the following sections of this report, and the species of conservation concern are addressed in each relevant section.

Herptofuana were inventoried at the Project area through both targeted searches of appropriate habitats and through incidental observations. Assessed habitats included deadfall within hardwood areas, south facing rocky outcrops, and aquatic habitats such as wetlands, streams, lakeshores, and vernal pools across the landscape. A list of herptofuana confirmed within the Project area is presented in Table 11. No Herptofaunal Species at Risk or species of conservation concern where found within the Project area during 2010 field surveys.

Table 11: Herptofaunal species inventoried at the proposed Hampton Wind Farm Project area during 2010 field surveys.

Scientific Name	Common Name	ACCDC Prov. Rank	NSDNR Gen. Status
Rana sylvatica	Wood Frog	S5	**Green**
Rana palustris	Pickerel Frog	S5	**Green**
Rana clamitan	Green Frog	S5	**Green**
Bufo americanus americanus	American Toad	S5	**Green**
Ambystoma maculatum	Yellow Spotted salamander	S5	**Green**
Notophthalmus viridescens	Red-spotted newt	S5	**Green**
Thamnophis sirtalis	Maritime Garter Snake	S5	**Green**

The Project area provides limited, but relatively high quality, Herptofaunal habitat. The limitation for many turtle and amphibian species is the lack of open water habitats, particularly

associated with wetlands. Although there are a number of wetlands across the site, there is very little vernal pool and open channel habitat at any of them. In those wetland areas where there is limited open water habitat, it is extremely unlikely that fish are present, and therefore predation would be low. Species that may use intermittent stream channel habitats are more likely to find adequate habitat within the Project area. Wood Frog *Rana sylvatica* and Pickerel Frogs *Rana palustris*, which reproduce in running water and ephemeral bodies of water, were observed quite commonly and widespread over the Project area. In contrast, Green Frogs *Rana clamitans* require deeper and more permanent water bodies for reproduction (Acadia University, 2010) and would more likely be found within the area around Mackenzie Lake, as little other such habitat exists. Smallmouth bass in Mackenzie Lake would be expected to provide predation pressure on amphibian species within the lake. Observations of Green frogs were relatively more limited across the Project.

Round globular masses of 1cm diameter eggs were identified on the bottom of a shallow pool of water on May 19th, 2010 at wetland area 1, north of Mackenzie Lake (see report section titled "Wetlands" for mapping of these features). Given the timing of year and submerged location, these slightly green tinged eggs were most likely from a Yellow Spotted salamander *Ambystoma maculatum*, although they may have been late season Wood Frog eggs. Adult Green Frog and Pickerel Frogs were also observed at the same site, and unidentified tadpoles were observed along the beaver dam flooded outlet channel from Mackenzie Lake.

Other visually confirmed herptofauna on the proposed Hampton Wind Farm Project area include Maritime Garter Snake (*Thamnophis sirtalis)* and American Toad *(Bufo americanus)*. Garter snakes were observed at two locations near Mackenzie Lake and larger wetlands. South facing rocky habitats at the southern extent of the Project area would likely provide appropriate basking and for various snake species. However, no snakes were observed at these habitats during 2010 field surveys. A juvenile Red-spotted newt (*Notophthalmus viridescens)* mortality was observed on a roadway adjacent to the Project area.

No turtles were observed within the Project area, likely due to the lack of appropriate nesting areas. Appropriate habitats for nesting would include areas of sand, gravel or cobble, typically in the form of exposed river bars, beaches, and road, railroad or bridge embankments (Acadia University, 2010). Although no turtles were observed, it is possible that a limited number of common species such as Eastern Painted turtle or Common Snapping turtle, which are widespread in Southwestern Nova Scotia, may exist in association with the lakes in and around the Project area. However, only a single basking log was observed in association with Mackenzie Lake, and the densely shrubbed shoreline covers any other potential basking sites that might exist. The lack of appropriate habitat for Nova Scotia's two turtle Species at Risk, Blandings Turtle *(Emydoidea blandingii)* and Wood Turtle (*Glyptemes insculpta)*, makes it highly unlikely either would be encountered within the Project area.

	
Pickerel frogs were common and widespread across the Project area.	Maritime Garter snake observed on a piece of deadfall at the Turbine 11 site.

Photo 7. Herptofauna observed.

e. Rare, Sensitive, At-Risk Herptofauna

One herptofaunal species of conservation concern was identified as having been documented within approximately 17 km of the Project area, as shown in Table 12. This record from the ACCDC for a Wood Turtle (*Glyptemys insculpta*) is the only documented observation for the mountain ridge between Cape Split and Digby Gut. Wood Turtles prefer sandy habitats, open fields, slow moving broad rivers. Alder thickets and alder swale have been identified as the preferred or most-used habitats in numerous locations, including Nova Scotia (COSEWIC 2007b). Preferred food sources might include a number of species such as strawberries, blackberries, cinquefoil, violets, algae, moss, willow, as well as alder leaves and grasses (MacGregor and Elderkin 2003). Both of the habitats and forage species of plants are not common to, or even characteristic of, the proposed Project area, and the observation of a Wood turtle on the site would not be expected. No turtles of any species were observed during 2010 field surveys of the Project area.

Table 12: Herptofuanal species of conservation concern

Scientific Name	Common Name	Global Rank	National Protection	Provincial Rank	NS Protection	Dist to Project (km).
Glyptemys insculpta	Wood Turtle	G4	T	S3	Vulnerable	17 ±10

Perhaps the most probable herptofaunal species of conservation concern that might be found on the North Mountain would be the Four Toed Salamander (*Hemidactylium scutatum)*. The closest documented observation of this species, held by the ACCDC, is some 25km from the Project area. This salamander is closely associated with sphagnum areas bordering streams and in

sphagnum bogs during spring breeding season. During summer, adults have been found in woodland habitats (NS Museum 2010). As such the habitats of the project site might be considered appropriate. This is the least common species of salamander in the Province, and although it not a Species at Risk and is not ranked by the ACCDC as rare, it is considered a species known to be, or believed to be, particularly sensitive to human activities or natural events by the Nova Scotia Department of Natural Resources. No Four toed salamanders were observed on the Project area during the 2010 field surveys.

i. Effects of the Project

Minimal negative effects on the herptofaunal community within the Project area are anticipated. Wetlands, a primary herptofuaunal habitat, have been avoided to the maximum extent possible.

ii. Mitigation

A small area of proposed wetland alteration will fall under the Nova Scotia Wetland Alteration Approval process, and compensation will be developed in association with that process. All other wetland areas, lakes and streams have been given a minimum 30m buffer in the design of the Project activities in order to maintain values associated with those habitat features, including mitigation of impacts to herptofuana that may use such habitats.

f. Large Mammals

Incidental observation of mammal species was documented during all field survey activities during 2010. No species at risk or species of conservation concern were noted during field studies. Table 13 outlines those species that were confirmed on the Project area either visually or by sign (scat, footprints, etc.).

Table 13: Confirmed mammalian species during 2010 field surveys.

Scientific Name	Common Name	ACCDC Prov. Rank	NSDNR Gen. Status
Odocoileus virginianus	White Tailed Deer	S5	Green
Ursus americanus	Black Bear	S5	Green
Procyon lotor	Raccoon	S5	Green
Canis latrans	Coyote	S5	Green
Erithizon dorsatum	American Porcupine	S5	Green
Tamiasciursus hudsonicus	American Red Squirrel	S5	Green
Castor canadensis	American Beaver	S5	Green
	UI mole/shrew		

Ungulate species expected to inhabit the vicinity of the Project were established by examination

of distribution maps, comparison of preferred habitat with that in the vicinity of the proposed location and field assessments. Ungulate species expected or observed within the Project lands appear to be limited to white-tailed deer **(***Odocoileus virginianus)***.** Optimal habitat for deer species occurs within young aspen forest stands and riparian and shoreline areas within drainage systems within the Project lands. White-tailed deer forage on grasses, forbs and shrubby browse. They require large amounts of easily digested food (Buckmaster et al., 1999). Although much forage is available for deer only a few kilometers both north and south of the Project area, preferred grasses and forbs are not as widespread on the Project area as they are in the adjacent agricultural areas. Locally, deer can be commonly observed in open agricultural fields and south facing slope, particularly early in the spring when snow cover may remain significant within areas on top of the mountain like the proposed project site. In late fall and throughout the winter, white tailed deer browse on numerous species of deciduous trees and shrubs and coniferous trees (Buckmaster et al., 1999). Deer are primarily considered generalist foragers, but are often discriminatory with regard to the species of browse consumed. Preferred species in Nova Scotia have been listed as red maple (*Acer rubrum*), aspen (*Populus* sp.), witch hazel (*Hamamelis virginiana*), wild raisin (*Viburnum cassinoides)*, and red oak (*Quercas rubra*). Litterfall and mast crops such as acorns, beechnuts, and berries are also important for deer (NSDNR 2010). Many of these species can be found on the Project area. Patterson *et al.* (1999 cited in NSDNR 2010) found that deer in southwestern Nova Scotia (Queen's County) migrated to wintering yards much less frequently than deer in the northeast of the Province. This is probably because southern deer are not as restricted by snow depth, temperature, or energetic requirements.

Black bear (*Ursus americanus)* are common throughout Nova Scotia. They are observed on occasion on the North Mountain, but less frequently than in the southern interior of the Province. Grasses, apple and corn crops within the Annapolis Valley are often targeted by bears as forage. Bear scat was observed on one occasion within the Project area during 2010 field surveys. A mosaic of forest cover and clearings or early successional habitat represents the most suitable habitat for black bears. Black bears will use dense cover and/or trees to escape from threats, and commonly bed in dense shrub communities (Buckmaster et al., 1999). Such habitats are quite limited within the Project Site where relatively mature stands of trees with limited shrub layer exist. Male black bears have very large home ranges, and females have smaller, more defined home ranges. Based on the estimated typical density of 0.1 bears/km^2, (Buckmaster et al., 1999) the Hampton Project area (1517 ha = 15 km^2) may support a genetic effective population of 1.5 individuals.

Raccoon and coyote sign were regularly observed within the Project area. Coyote scat was widespread , and particularly along the hardwood ridge in the southern extent. Other common carnivore/omnivore species such as Red fox *(Vulpes vulpes),* Bobcat (*Lynx rufus),* American mink (*Mustela vision),* Striped skunk (*Mephitis mephitis)*, Short-tailed weasel (*Mustela erminea)* are expected to inhabit the Project area, at least periodically. The characteristics of the Project area may also support the less common species, American Marten (*Martes americana).*

The presence of habitat that supports prey species of the above noted carnivores may result in occurrences within the area. Carnivores are typically solitary and usually become habituated to

man when habitats are encroached. The acceptance of man in a particular area may be linked to specific sites (i.e. garbage dumps) and encounters with man in different environments (i.e. backcountry) may result in completely altered behaviours (Shank, 1979). It is expected that the presence of existing human activities associated with farming practices, homesteads, and roads, likely have resulted in habituation within the assessment area.

The characteristics of the vegetation, in addition to numerous game trails, indicates that abundant food sources are present in the area and a unknown population of browsing ungulates presently utilizes the Project lands. Most of the shrub species found within the Project lands are considered palatable to wildlife.

g. Small Mammals

Based upon habitat preferences and known occurrences of species within Nova Scotia, the following small mammals are expected within the Project lands:

- Star nosed mole
- Masked shrew
- Smoky shrew
- American water shrew
- Short-tailed shrew
- Ermine
- Eastern Chipmunk
- American Red Squirrel
- Red-backed vole
- Hare species
- Southern Bog Lemming
- Deer mouse
- White footed mouse
- Woodland jumping mouse
- Beaver

Raccoon prints were observed in soft mud at number of vernal pools associated with ATV trails across the Project. It is likely they feed on invertebrates and amphibians found at these locations. Porcupine feed on the bark of young trees, and commonly den in rock outcrops on the sunny south face of the North Mountain. Browsing evidence of porcupines was observed in a number of locations. Observed beaver activity around MacKenzie Lake included a relatively recent dam across the outflow and an older den along the north shoreline of the lake.

The relative abundance and distribution in varying habitats and land uses and the population density by habitat type and land use will likely be consistent with previous studies and will be predictable based on the abundance of those habitat types in the Project area.

h. Rare, Sensitive, At-Risk Mammals

No mammalian Species at Risk or Species of conservation concern were observed within the

Project Area during the 2010 field surveys. No sign (scat, footprints, etc.) of such species was observed. However, it is possible that the existing habitats support species of conservation concern. The Fisher is a Yellow ranked species in the Province of Nova Scotia, and the ACCDC ranks it as an S2 for the Province. These rankings suggest the species is both rare and sensitive to human or natural disturbance. The ACCDC indicates there are two documented observations of a Fisher within 17 km of the project site, although the date is not known. The NSDNR has undertaken a trans-relocation program to try and establish a viable population in western Nova Scotia, and since January 2001, 23 Fisher have been re-located to locations in Halifax, Hants, and Kings Counties. Mixed wood forests and rock piles, both found on the Project area, are appropriate habitats for the Fisher.

Table 14: Mammalian species of conservation concern.

Scientific Name	Common Name	Global Rank	National Protection	Provincial Rank	NS Protection	Dist to Project (km).
Martes pennanti	Fisher	G5	-	S2	-	17 ±10

i. Avian Use Assessment

Avian use by habitat type monitoring program was developed based on a number of guidance documents (CWS 2006 and 2007, NSE 2009a, b) per discussions with NSDNR, and as discussed in this report (Section 3C - Environmental Assessment Methodologies). The assessment included monitoring and evaluating bird use in various forest habitats and seasons. Figure 12 displays the location of 10- Minute Point Counts, 500m Stopover Count surveys, and the various site habitats assessed during General Area Search surveys.

Figure 12. Avian survey locations and confirmed locations for bird species of conservation concern within the Project Area.

1:10,000

Legend

- Point Count Location
- Boreal Chickadee
- Canada Warbler
- Turbine and Number

Land_Features

- Cave
- Chasm
- Bluff
- 500m Stopover Count
- Contour
- DNR Swamp
- Field Verified Wetlands
- Field Verified Wetland
- Hampton Boundary

Water

- Lake
- Stream
- GPS Streams

Cover Type

- Non-Forest
- Softwood
- Mixedwood
- Hardwood

Date: Oct 25th, 2010

GIS By: Nortek Resource Solutions Inc.

Two primary forest ecotypes, mixed wood forest and hardwood forest, have been identified on the site and surveyed for bird use. Point counts and 500m stopover counts in these two habitats provide some quantification bird abundance within the different habitats. In comparing the mixed wood to hardwood point count locations during the breeding season, they both had a relatively consistent average of 5.6 species observed during each count, but there was a slightly greater abundance of birds observed at the mixed wood locations (11.3 birds/10 min point count) relative to the hardwood locations (9.3). This observation is a reversal to the higher number of birds observed during 500m stopover counts in hardwood locations during spring migration, and may reflect better nesting and cover offered in the mixed wood stands relative to the hardwood stands that generally have very little understory. There was no apparent consistency in point count results at each mixed wood site over time, as, at some sites, observations and diversity went up between visits and at other sites they went down. Better consistency over time was observed at the hardwood point count sites both in terms of species diversity and total number of observations made. Anecdotally, it appeared that edge habitats along existing access roadways around Crosskill Lake, Long Lake, and from Arlington Road toward MacKenzie Lake may have had greater diversity and abundance of bird species than the more uniform survey areas within either the mixed wood or hardwood forest stands.

Surface water features, including a number of small, previously unmapped wetlands and intermittent streams provide avian habitat, but are limited in their value to waterfowl and other species associated with open water. All wetlands are predominantly treed in nature with no significant open water. A limited number of the wetlands provide a small number of vernal pool habitats. MacKenzie Lake provides limited waterfowl habitat because of both its size and lack of physical structural features. Water bird observations on MacKenzie Lake were limited to a few Double Crested Cormorant (*Phalacorcorax auritus)* observations and a short term observation of a single pair of American Black Duck (*Anas rubripes)*. To the west of the Project area, lie Crosskill Lake and Long Lake. These lakes are moderately larger than MacKenzie, and avian use of Crosskill was regularly observed. Although not a high use area, waterfowl with young were observed on Crosskill Lake, including American Black Duck, Ring-Necked Duck (*Aythya collaris)*, and Canada Goose (*Branta canadensis)*. To the north of the Project area lays the very small Snowy Lake, which like MacKenzie, likely offers limited waterfowl habitat, although no specific assessment was made of this lake. To the east is the moderately large Rumsey Lake. Large numbers of waterfowl are regularly observed along the shores of this Lake.

A number of wetlands within the Project Area of the Project area were regularly assessed during General Area searches. Additionally, General Area searches were specifically conducted at six of the larger wetlands (wetlands W1, 2, 5, 6, 7, 8) within the Project Area. These wetland specific searches yielded only a few new species to the species list, suggesting that the regular General Area searches that ran adjacent and through smaller wetlands were also capturing most of the species diversity associated with wetlands on the Project area. Of significance were the presence of provincially sensitive Canada Warbler (*Wilsonia canadensis)* and Boreal Chickadee (*Poecile hudsonicus).* These species are discussed further in this report under the section titled "Rare, Sensitive and At Risk Birds".

Avian use of the project area was also assessed by season, including Spring Migration, Breeding Season, and Fall Migration. The following is a discussion of seasonal use by species and the significance of the observations made. A complete species list, summarized by seasonal use, is presented in Appendix IX.

Two large ecotypes, mixed wood forest and hardwood forest, have been identified on the site and boundaries mapped. Surface water features have been identified and are being mapped, including a number of small, previously unmapped wetlands. All wetlands are treed bog areas with no significant open water other than small vernal pools.

i. Spring Migration

Field assessments were completed twice a week during the period from May 1 to May 31, 2010 to observe spring avian migration patterns. Species diversity remained consistent with 18-22 species observed per day over the survey period, and a total of 44 different species were identified during the spring migration period. Daily bird counts ranged from 60 on May 7 to a peak of 178 on May 23. The hardwood habitat areas consistently produced a greater number of bird observations, and each 500m hardwood stopover count path produced slightly more than twice the number of birds per meter as the mixed wood stopover count path. However, no greater species diversity was observed in hardwood stands when compared to mixed wood.

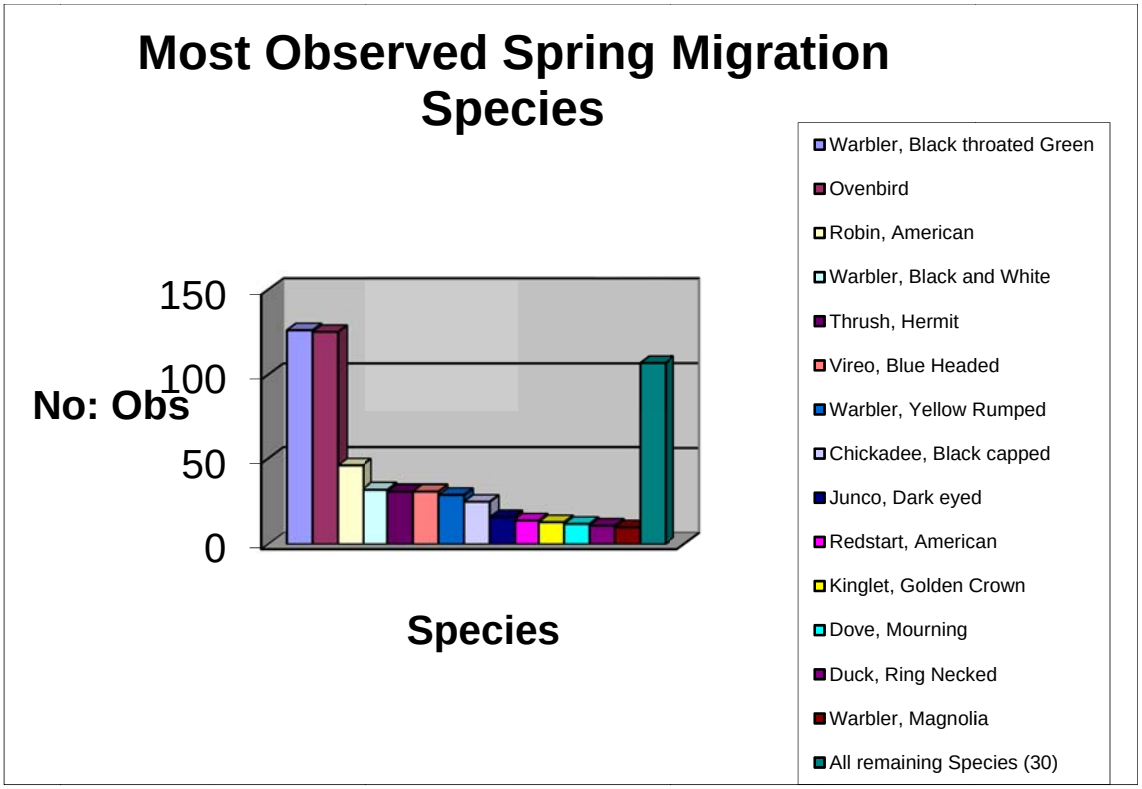


Figure 13. Spring Migration Species

A total of 628 observations were documented during the spring migration period across the Project site. As shown in Figure 14, the Black Throated Green Warbler (*Dendroica virens)* and Ovenbird (*Seiurus aurocapillus)* were the most commonly observed species, accounting for nearly 40% of the total observations made during spring migration. The Ovenbird was more apt to be heard or spotted in the hardwood habitats, while the Black Throated Green Warbler was relatively common in both hardwood and mixed wood habitats. Histograms of the seasonal observations for these two species demonstrate their early and strong presence on the Project area. The fourteen most observed species, including the Ovenbird and Black Throated Green Warbler comprised 83% of the spring migration bird records (total count/species >10), while an additional 30 species made up only 17% of the observations. The dry upland slopes large tract of contiguous forest area are favoured Ovenbird habitat (Dunn and Garrett, 1997), and this species would be observed in relatively high numbers throughout the survey season. Figure 14 demonstrates significant early season numbers, presence during breeding season, and considerably lower fall migration observations.

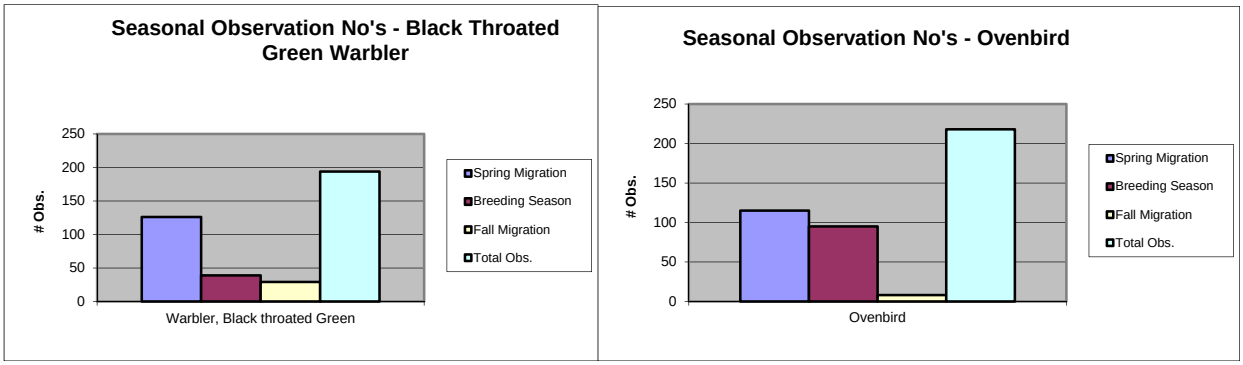


Figure 14: Seasonal observation of Black Throated Green Warbler and Ovenbird

Species observed during the spring migration period that should be considered true migrants through the Hampton Wind Farm Project area by the conspicuous lack of presence later during the breeding season included: Boreal Chickadee, Ring Necked Duck, Purple Finch (*Carpodacus purpureus)*, Northern Flicker (*Colaptes auratus)*, Yellow Bellied Flycatcher (*Empidonax flaviventris)*, Northern Parula (*Parula americana)*, Song Sparrow (*Melospiza melodia)*, Palm Warbler (*Dendroica palmarum)* and Yellow Warbler (*Dendroica petechial)*. Not all of these species are migrants to Nova Scotia, but they do appear to have migrated through the area. It should be noted that the Ring Necked Duck observations were on Crosskill Lake. In comparison, the lack of observations of this species at MacKenzie Lake may suggest the habitat is not appropriate for waterfowl. The most likely reasoning would be that the small size of the lake provides a lack of nesting opportunities.

Behavioral indicators were documented when observed. During the first week of May, both American Robin (*Turdus migratorius)* and Boreal Chickadees were exhibiting nest building activity. The Chickadees were not observed again until two brief observations in early September, while Robins were a regularly observed species during the breeding season. In the

third week of May, Black Throated Green and Yellow Warblers were exhibiting courtship activity, while Ovenbirds behaved in an agitated manner, likely protecting territory. During the final week of May, an Ovenbird nest with eggs was encountered, Canada Geese with three fledged young were observed at Crosskill Lake west of the Project area, and agitated Canada Warblers were visually confirmed at wetland 6.

ii. Breeding Birds

During each breeding season field visit between June 01st and August 31st, observations documented 2-10 species/10min point count and 3-20 total bird observations/10min point count. Comparing the mixed wood to hardwood point count locations, they both had a relatively consistent average of 5.6 species observed during each count, but there was a slightly greater abundance of birds observed at the mixed wood locations (11.3 birds/10 min point count) relative to the hardwood locations (9.3). This observation is a reversal to the higher number of birds observed in hardwood locations during spring migration, and may reflect better nesting and cover offered in the mixed wood stands relative to the hardwood stands that generally have little understory. There was no apparent consistency in point count results at each mixed wood site over time, as, at some sites, observations and diversity went up between visits and at other sites they went down. Better consistency over time was observed at the hardwood point count sites both in terms of species diversity and total number of observations made.

Recent tree cutting at and around Turbines 10 and 1 during the course of field surveys was observed, and likely affected the species composition both in the short term and longer term at these locations. On August 2, late in the breeding season, a pair of Pileated woodpeckers (*Dryocopus pileatus)* were observed in hardwood north of wetland 5. A Cormorant was incidentally observed on MacKenzie Lake during August 13th lake surveys, the first of the monitoring program.

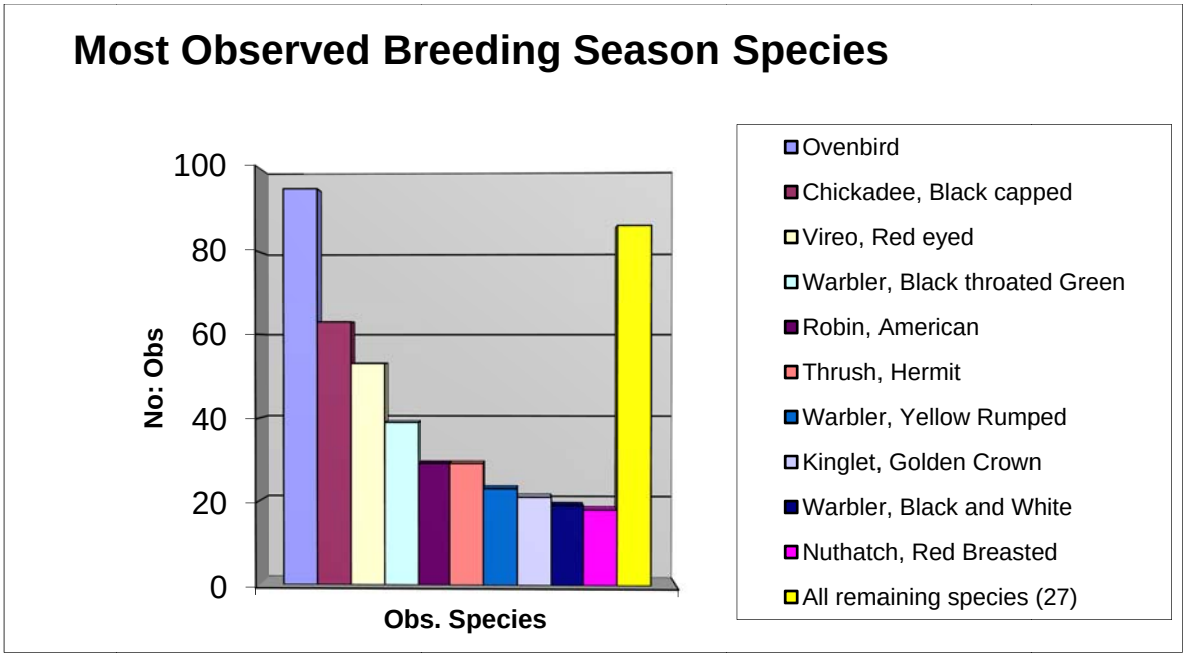


Figure 15. Species abundance during breeding season

There were 475 observations of 37 separate species documented during the breeding season surveys of the Project area conducted on eight separate days, as shown in Figure 15. These numbers are below those observed during spring migration despite greater total effort over the longer breeding season. These numbers suggest that the number of birds that pass through the area is higher than those that stay at the Project area to breed. There were ten species for which greater than 10 observations were made during the breeding season. Ovenbirds, Black Capped Chickadees (*Parus atricapillus)*, and Red eyed Vireo's (*Vireo olivaceus)* were prominent in the breeding season. Black throated Green Warblers, American Robin, and Hermit Thrush (*Catharus guttatus)* also were regularly observed.

As shown in the histogram in Figure 16, Red eyed Vireo was predominantly observed during the breeding season . This observation reflects the typical timing of its arrival in mid to late May, and the likely departure of this species by early to mid September. The presence of significant numbers during breeding season reflects the species preference for deciduous hardwoods such as maple (NS Museum, 2010).

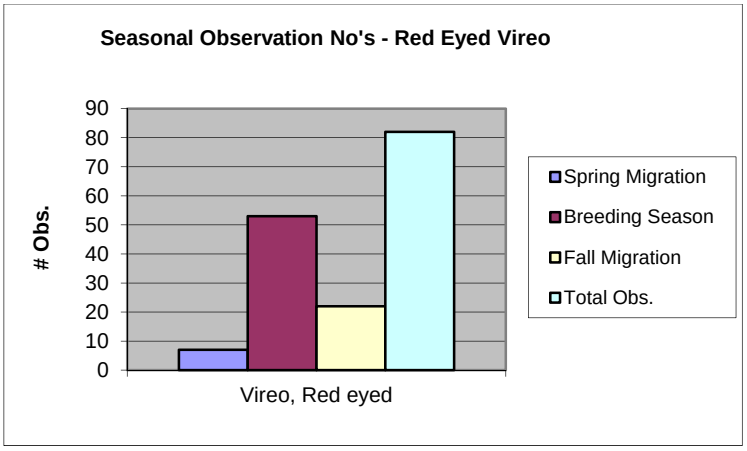


Figure 16: Seasonal observations for Red Eyed Vireo.

Several behavioural notes were made during the breeding season field assessments. Yellow Rumped Warblers were observed feeding young in the mixed wood 500 metre stopover count survey area during early June. During the third week of June, Ovenbirds were seen with food and behaving agitated at a number of locations. Both Black and White Warblers and Black Throated Greens were noted to be feeding young during the same week. By the first week of July, Yellow Rumped Warblers were further noted with food, and fledged Ovenbirds were documented. During the middle of July, Hermit Thrush and Blue Headed Vireo (*Vireo solitaries)* were noted to be feeding young. Immature plummed Dark-eyed Junco (*Junco hyemalis)* and Common Yellowthroat (*Geothlypis trichas)* were observed in the third week of August. Loose flocks of birds were observed by the middle of August, as were many immature birds as evidenced by their plumage.

iii. Fall Migration

Fall avian migration was assessed from September 1 to September 30, 2010. A total of 509 observations of 40 different species were document. There were 15 species for which greater than 10 observations were made during the fall migration period. These species accounted for approximately 87% of all observations made. As with the spring migration, Ovenbirds were the most observed species, while Blue Jays made their first significant appearance during the fall migration time period. Other species that did not appear numerous during the breeding season, but that were moderately numerous during fall migration, included Evening Grosbeaks (*Coccothraustes vespertinus)* and Palm Warblers. In terms of fall migration timing, the greatest number of species (21) and total observations (111) was made on September 19th, 2010. However, it can only be suggested that peak migration may have occurred near this date, as surveyed habitats and total effort varied somewhat by survey day.

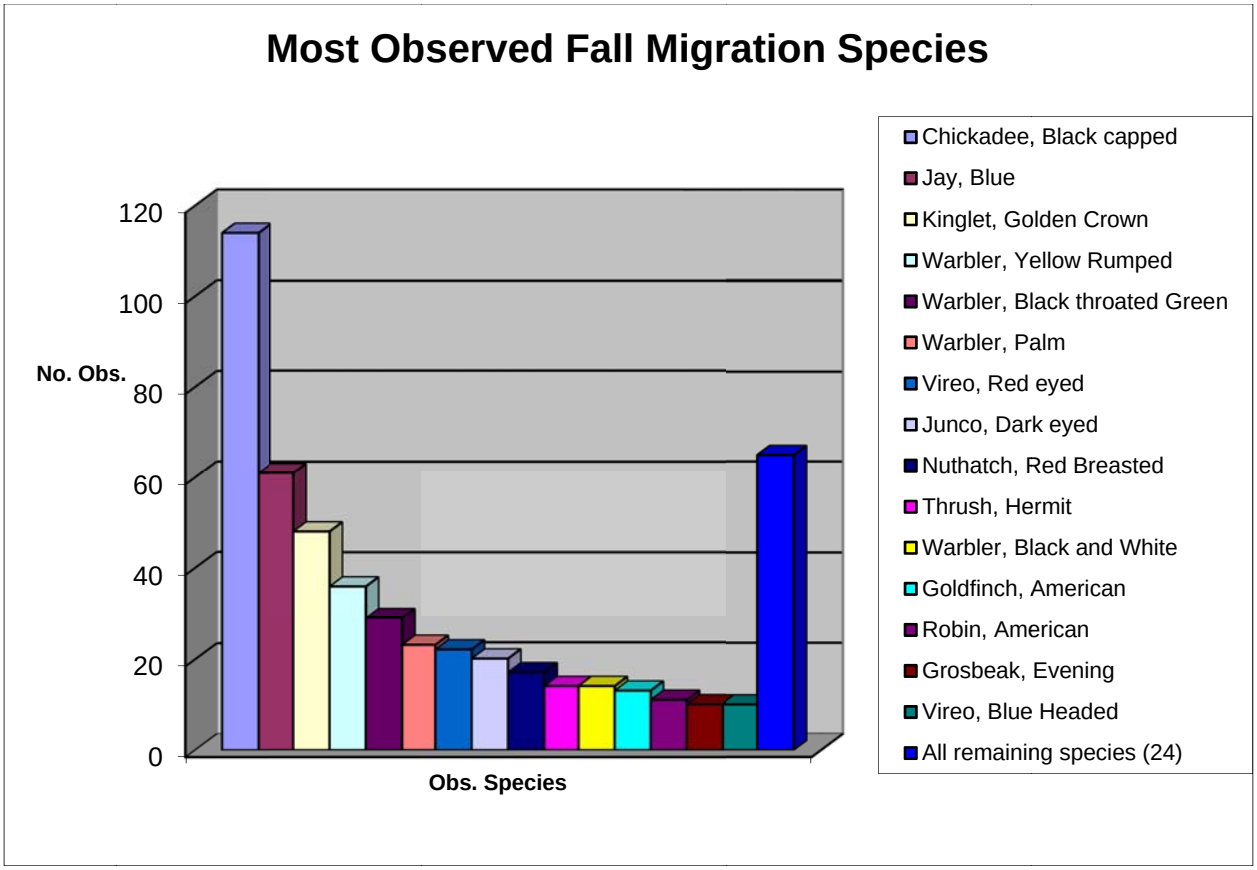


Figure 17. Species abundance during Fall migration.

Figure 17 demonstrates that Black capped Chickadee and Blue Jay show a strong fall presence. The Blue Jay is resident in Nova Scotia year round, but there is some southward movement in the fall and winter (NS Museum, 2010), and this may be reflected in the seasonal observations for that species. It is also attracted to corn fields later in the season, many of which are present within the valley. The chickadees are another resident species to Nova Scotia. However, the increased fall observations likely reflect emigration from other areas, which is more pronounced in some years than in others (NS Museum, 2010).

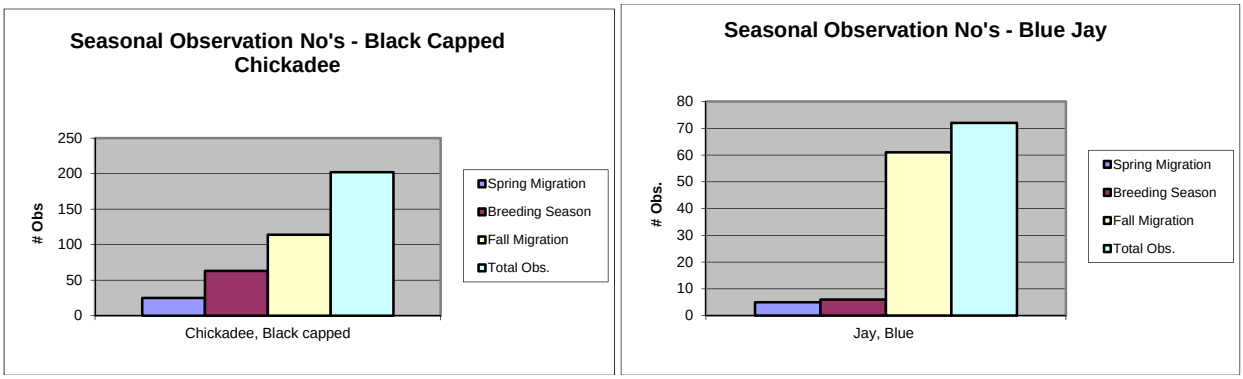


Figure 18: Seasonal observations of Black capped Chickadee and Blue Jays.

Conversations with NSDNR indicated there may be significant fall raptor migration along the crest of the mountain and across the Project area. Fall avian surveys were dedicated to making specific observations of raptors on three September dates. In addition, staff at the local fire observation tower immediately adjacent to the Project area were asked to note any observations of raptors in the area. A summary of all observations is presented in Tables 15 and 16. Of the observations documented none were made for birds flying above the height of the Fire Tower, which stands approximately 30 m above the ground. Many of the birds appear to be riding thermal currents along the southern crest of the north mountain, adjacent to the valley. This is particularly true of Turkey Vultures (*Cathartes aura)* and Bald Eagles *(Haliaeetus leucocephalus)*. On August 28th, a Peregrine Falcon (*Falco peregrinus anatum)* was observed.

Table 15: Raptor observations made from the NSDNR Fire Observation Tower.

Date	**Time**	**Bird Count & Type** (#)	**Direction Heading**	**Height** (Tree top, tower height, well above tower)
July 19	4:15 PM	5 Turkey Vulture	W along mtn	Tree top
Aug 9	3:15 PM	2 Turkey Vulture	W along crest mtn	Tree top
Aug 9	3:30 PM	2 Bald Eagle	W along mtn	Tree top
Aug 9	4:17 PM	1 UI Falcon	SW to valley	Tower Height
Aug 9	4:25 PM	1 Turkey Vulture	E along mtn	Tower Height
Aug 16	2:07 PM	1 Bald Eagle	W along mtn	Tower Height
Aug 28	5:30 PM	1 Peregrine Falcon	N along mtn	Tower Height
Aug 29	12:10 PM	1 Osprey	W along mtn	Tower Height
Sept 2	12:28 PM	1 Osprey	W along mtn	Tree Top
Sept 20	3:45 PM	1 UI Hawk	SW to valley	Tower Height
Sept 20	5:32 PM	1 Bald Eagle	E along mtn	Tree Top

It was noted that a butcher in the community of Clarence dumps offal about 300m south of the tower and many eagles and vultures are sighted in that area. This factor may also have influenced some of the raptor observations made along the top of the mountain near the tower.

Several owls were documented during general area counts, and a number of hawks were observed during three specific raptor survey days during the fall migration period. (Table 16) The most significant was a second documentation of a Peregrine Falcon, made on September 9th. This is further discussed in the following report section, Rare, Sensitive, and At Risk Birds. In general, raptor use appears to be more concentrated along the southern extent of the Project area, adjacent to the south slope of the north mountain. Raptors can periodically be seen riding thermal updrafts along the ridge of the mountain in this area. However, such observations are not statistical in nature and may be the result of better view planes in these areas relative to the heavy forest cover in other areas of the Project area.

Table 16: Raptor observations near the NSDNR Fire Tower.

Date	Time	Bird Count & Type (#)	Observation
May 14	Morning	1 Barred Owl	Observed during general area count of hardwood
May 30	Morning	1 Barred Owl	Observed during general area count of wetlands 5,6
Jul. 6	Morning	1 Barred Owl	Observed in hardwood near Turbine Site 001 during a 10min point count
Sept. 9	Morning	1 Peregrine Falcon	Incidental. In flight over open area near tower
Sept. 22	Morning	1 Sharp Shin Hawk	In flight over road near tower
Sept. 22	Morning	1 Red Tailed Hawk	In flight over road near tower
Sept. 24	Morning	None observed	
Sept. 30	Morning	1 Sharp Shin Hawk	In flight W of tower flying N
Sept. 30	Morning	2 UI Hawk	Flying over MacKenzie Lake area at treetop

j. Rare, Sensitive and At Risk Birds

Through appropriate desktop research of all provincial and federal legislation and ranking systems for bird species that are rare, sensitive or at risk, nine species of bird were identified as potentially being present within the Project area (Table 17). Three of these species were confirmed during 2010 field assessments; Canada Warbler, Peregrine Falcon and Eastern Phoebe. The Boreal Chickadee, a species not previously documented by the ACCDC along the top of the mountain, but considered Provincially sensitive, was also observed on the Project area.

Table 17. Avian species of conservation concern documented along the top of the north mountain*

Scientific Name	Common Name	Global Rank	National Protection	Provincial Rank	NS Protection	Dist to Project (km).
Chaetura pelagica	Chimney Swift	G5	Threatened	S4B	Endangered	17 ±5
Chordeiles minor	Common Nighthawk	G5	Threatened	S4B	Threatened	39 ±5
Falco peregrinus anatum	Peregrine Falcon anatum ssp**	G4T4	Special Concern	S1B	Vulnerable	41 ±10
Catharus bicknelli	Bicknell's Thrush	G4	Threatened	S1S2B	Vulnerable	62 ±5
Contopus cooperi	Olive-sided Flycatcher	G4	Threatened	S4B		62 ±5
Wilsonia canadensis	Canada Warbler**	G5	Threatened	S4B		17 ±5

Rallus limicola	Virginia Rail	G5		S2B		62 ±5
Cardinalis cardinalis	Northern Cardinal	G5		S2B		50 ±5
Sayornis phoebe	Eastern Phoebe**	G5		S2S3B		17 ±5

*Atlantic Canada Conservation Data Center. The closest documented observation to the Project area is noted.
** These species were confirmed within the proposed Hampton Mountain Wind Farm Project area during 2010 field surveys

Canada Warbler (*Wilsonia Canadensis*), a Yellow status species by NSDNR (Federal G5, Provincial S3B) was identified at three wetland locations across the Project site. The ACCDC had indicated six records for this species between 1986 and present along the top of the North Mountain between Cape Split and Digby Gut. The closest observation was approximately 17km from the proposed Project Site, while the remaining were 40-60km away. Virtually all observations noted confirmed or probable breeding activity for this species, which is also listed Federally as Threatened. Within the Project Area, it was confirmed both visually and audibly a number of times. This bird typically arrives in Canadian breeding grounds in late May and leaves before the end of August (Stewart et al., 2009). 2010 survey data of the Project Area documented their presence from May 30th until June 10th, as shown in Figure 19.

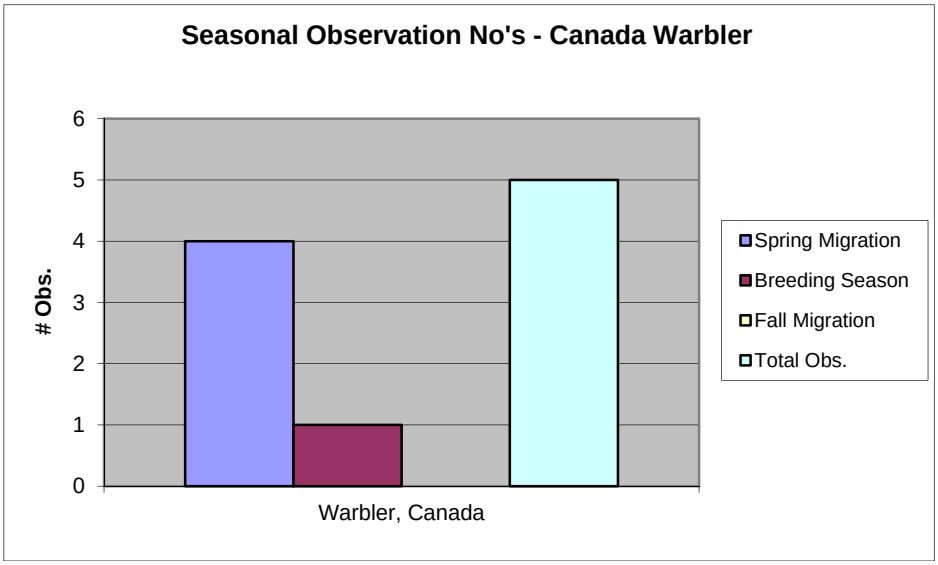


Figure 19: Seasonal observations of Canada Warbler (May 30th and June 10th, 2010).

The Canada Warbler uses a wide range of deciduous, coniferous and mixed forests, with a well-developed shrub layer and a structurally complex forest floor (COSEWIC, 2008). All Canada Warblers observed were found in treed bogs surrounded by mixed wood forest (wetlands W1,5,6). This is likely because the wetland areas tend to have a more complex shrub layer than the surrounding forest within the Project area. During the breeding season, the species forages in both conifers and hardwood trees. They nest on or near the ground where the shrub layer is dense shrub (Stewart et al., 2009). The observations made at two separate locations on May 30th

documented agitated behaviour with the birds, which is sometimes an indication that nesting activities have been initiated. The special significance of this species is that eighty-five percent of the global breeding population of Canada Warbler occurs in Canada (COSEWIC, 2008). Canada Warbler adults, nests and eggs are protected in Canada under the *Migratory Birds Convention Act, 1994* (COSEWIC 2008). No nests were confirmed during field surveys.

Trends for Canada Warbler in Nova Scotia show declines on the long (1968-2007, -3.1%/yr) and short (1997-2007, -20%/yr) term scales. The Canadian Breeding Bird Census (BBC) suggests that the highest densities are in the eastern parts of the range. In Nova Scotia, breeding densities have ranged from 0.25/ha in the Annapolis Minas Lowlands to 0.04/ha along the Fundy Coast (COSEWIC 2008).

In April 2007, the Peregrine Falcon was re-assigned as a Species of Special Concern by COSEWIC after having been previously Endangered and Threatened. This reassignment reflects an improving trend in the population size of this bird since the 1970's up to near historical numbers (COSEWIC, 2007). This species is further protected under the Nova Scotia Endangered Species Act as a Vulnerable species. Habitat in Atlantic Canada consists primarily of cliff ledges for nesting, and they may use the same specific area for decades. One such site exists on the shoreline of the Bay of Fundy approximately 3.5 km north or the Project area. It was first noted in 1995 (McCurdy, pers. com. 2010). NSDNR staff indicated the potential for the bird (s) from this known shoreline site to hunt birds on the Belleisle Marsh in the Annapolis Valley, and pass over the proposed Project area during forage excursions (Elderkin pers comm.. 2010). Local resident observations suggest that inland movements from a known nesting location on the Bay of Fundy shoreline is predominantly in a either southwest direction (toward the Annapolis Valley and Belleisle Marsh) or in a northeasterly direction (toward Cape Blomidon) (McCurdy Pers. comm., 2010).

The Atlantic Canada Conservation Data Center had one documented observation of a Peregrine Falcon along the top of the North Mountain. This observation was made about 40km from the proposed Project area in 2006. During the 2010 assessments, a Peregrine Falcon/Falcons was/were observed flying over the Hampton Wind Farm Project area on two occasions. The first was on August 28th, at 5:30 pm when the bird was traveling past the Fire Observation Tower in a northerly direction at the elevation of the Fire Tower. A second observation was made on the morning of September 09th when a Peregrine was observed flying across an open area near the Fire Tower. It cannot be confirmed if this was the same bird.

Boreal Chickadee is a species of conservation concern. This Provincially ranked S3 species is also Yellow listed in Nova Scotia, although it maintains a G5 ranking nationally. Its Yellow General Status Rank indicates that it is known, or believed to be, particularly sensitive to human activities or natural events. Two Boreal Chickadees were observed on May 7, early in the spring migration period, but not observed again until September 9th when two more birds were observed (Figure 20). The Boreal Chickadees observed on May 7th, 2010 also exhibited nest building activity that day at an area just north of wetland 6. Similar observations have been made in the past, although they typically have been in late May to late June in Nova Scotia (NS Museum,

2010). Despite the same location being covered on several subsequent survey dates no other observations of Boreal Chickadee were made in the initial mixed wood area. The September observations were in a hardwood stand on the southeast portion of the Project Area. They commonly associate with Golden-crowned Kinglets, Black-capped Chickadees and Red-breasted Nuthatches (NS Museum 2010), all species commonly documented during field surveys.

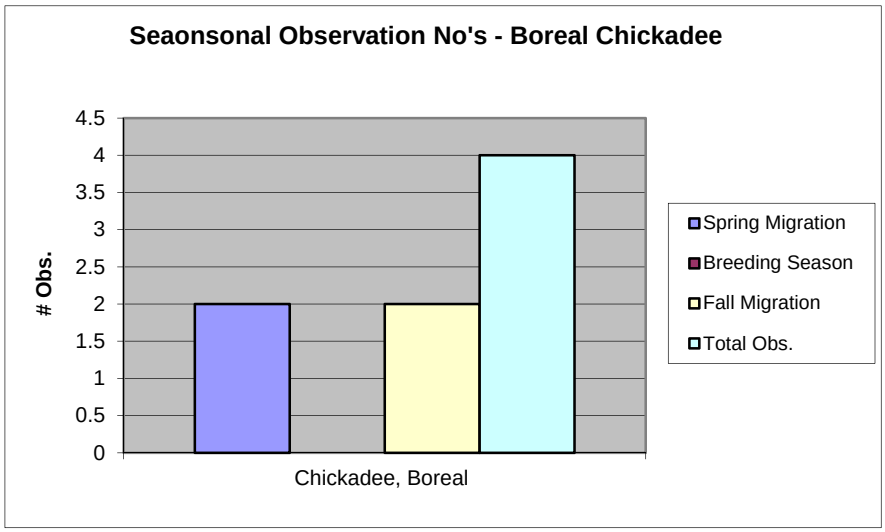


Figure 20. Seasonal observations of Boreal Chickadee.

A single observation of an Eastern Phoebe was documented with the ACCDC in 2006 at a location about 17km from the proposed Project. T his is the only record documented with the ACCDC for the north mountain ridge from Cape Split to Digby Gut. The species is considered rare to uncommon as reflected by its Provincial S2S3 Rank assigned by the ACCDC. Field staff confirmed a second observation during 2010 Project area field surveys with a late September observation of a single bird. Although this species has been widely documented across Nova Scotia it remains uncommon. It is one of the last species of flycatcher to leave the province each year (NS Museum, 2010).

As shown in Table 17, other species of conservation concern that have been observed within the North Mountain Ecodistrict between Cape Split and Digby Gut and documented by the ACCDC include the Chimney Swift, Common Nighthawk, Bicknell's Thrush, Olive Sided Flycatcher, Northern Cardinal, and Virginia Rail. The preferred habitats for these species are not found, or found in limited quality/quantity within the proposed Project area. For example, Chimney Swift is a migrant, and the only significant nesting in Nova Scotia has occurred in Wolfville area of Kings County. Common Nighthawk tends to nest in clearings and barren outcrop areas in forested land, habitats that are extremely limited within the Project area. Although significant congregations of Nighthawk may occur during fall migration, none were observed, further suggesting they do not utilize the habitats on a regular basis. The Northern Cardinal was observed nesting nearby within the Town of Bridgetown during 2010. The Virginia Rail is a

marshland bird predominantly (NS Museum, 2010), and the habitats of the Project area are not appropriate for these species. Bicknell's Thrush is known to breed primarily in regenerating forests at high elevation (>600m), and therefore its primary habitat in Nova Scotia has been within Cape Breton Highlands. It prefers dense conifer stands (COSEWIC, 2009), which are not found on the Project. The Olive Sided Flycatcher breeds in mixed wood forests (NS Museum, 2010), and might be expected within the Project area. However, their preference for openings, meadows, rivers, and post fire landscapes (MTRI, 2008) would not be particularly suited to the habitats of the Project. Due to reasons stated above, noted species presence is not expected to be common, nor are the habitats present within the Project area particularly favoured by these species. It is likely that the lack of observation of any of these species during the 2010 field season is due in part to the lack of, or limited, appropriate habitats.

i. Effects of the Project

In general, there does not appear to have been a significant migration of hawks through the Project Area during the fall of 2010 based on field surveys and incidental observations. Given targeted "hawk watch" surveys from open viewpoints at the edge of the forested Project area, and as many as 25 days of incidental observation from wooded survey locations and the NSDNR Fire Tower in the southwestern portion of the Project area during the month of September, few observations were made. In total, eleven raptors were observed between August 28th and Sept. 30th, 2010. It would appear, based on 2010 observations that the risk of wind turbine impacts on raptor populations would be small given the location and number of birds observed.

A Peregrine falcon was observed on two separate occasions, traveling at about 30m elevation (based on NSDNR Fire Tower height of 30m) across the Project area. Local resident observations suggest that inland forage excursions are often observed as occurring slightly above tree level, or near 30m (McCurdy pers. comm. 2010). Although it is difficult to suggest the frequency with which Peregrine falcon may pass over the air space of the Project, it would appear that it is not a regular occurrence given the level of effort relative to the number of observations made. It would seem probable that Peregrine from the Fundy coastline in the vicinity of the Project area would make foraging trips to the Annapolis Valley, and perhaps the Belleisle Marsh, where prey species may be more plentiful. However, it would not appear that the Project area is a direct or frequent route between the coastal nesting location and these foraging destinations. As such it would not seem likely that the establishment of a wind farm on the Project area should be particularly detrimental to this species. However, Peregrine Falcon do exist in very limited numbers on the adjacent Fundy shoreline to the Project area, and loss of a single bird from any cause could have a significant negative impact on the viability of the species within the immediate vicinity. Local resident observations have noted the successful reestablishment of a pair following the death of one bird from the adjacent Bay of Fundy nest in the past (McCurdy pers comm. 2010).

Based in part on their flight height characteristics and mean use (relative abundance), waterfowl (during both spring and fall) and passerines (fall) are the species groups with the highest turbine collision exposure indices. It should be noted that having the highest collision exposure index,

does not allow us to predict which species are most prone to collision, as species specific behaviours may make them more or less prone to turbine collision. For example, despite their high exposure index, waterfowl have been shown to avoid turbine collision due to their obstacle avoidance behaviour (Erickson et al. 1999; Erickson et al. 2000; Strickland et al. 2001; Johnson et al. 2003; Strickland et al. 2003). MacKenzie Lake, the closest open water feature to the proposed turbine locations, was observed during 2010 for waterfowl use. A very limited number of such birds were observed on the lake, despite numerous multi season observations. Such observations would suggest that the lake provides limited waterfowl habitat, and that risks associated with waterfowl turbine interactions in this area are also, therefore, limited. Verification of collision impacts could only be confirmed through post-construction mortality monitoring. Furthermore, no species (or species group) has a particularly high risk of turbine collision at the Project when compared to other wind resource areas.

While not included in the calculation of the exposure index, the flight direction of birds within the RSA may have an affect on their probability of collision with a turbine. If prevailing winds are inline with the most common flight direction, birds flying within the RSA will approach turbines perpendicular to the blades, resulting in a larger possible surface area to collide with. However, little conclusions can be made at this time about how flight direction can affect exposure indices.

The development plans for the Hampton Wind Farm Project have been developed to avoid all wetlands to the extent possible, and none will be drained to eliminate the associated habitat. The Canada Warbler exhibits a certain degree of adaptability to human disturbances such as forest harvesting (COSEWIC 2008). Although road and turbine footprints will reduced the available forest habitat, the creation of edge habitat should promote growth within the shrub layer that could positively affect the quality of Canada Warbler habitat in the Project Area where the shrub layer generally lacks complexity. This response has been observed in post-harvest forests, presumably because the shrub layer peaks during early regeneration stages. Canada Warblers also appear to be relatively tolerant of the habitat fragmentation that results from forest harvesting (COSEWIC 2008). Therefore, it is anticipated that post construction forest habitat of the Project Area may benefit the Canada Warbler within the immediate vicinity.

In contrast to the Canada Warbler, Ovenbirds were plentiful within the Project area. This species has a well-documented requirement for relatively large forest tracts (>2500 ha), but is typically rare or absent in smaller forest patches (250 – 2,250 ha). It would thus appear to be quite fragile to forest fragmentation (Dunn and Garrett 1997). Although the proposed Project will not fragment the forest cover in the same manner as a large clearcut might, road and turbine openings will effectively diminish the forest continuity. The impact of this forest alteration on species like the Ovenbird is not known. However, it may be anticipated that Ovenbird use of the Project area might decrease post development. The Ovenbird is considered common, and is not a species of conservation concern.

Overall, based on the findings of the various wildlife surveys, in addition to a myriad of research on the interaction of birds with turbines, it appears that there are no major constraints to affect development within the Project lands but bird mortality will be expected.

ii. Mitigation

To avoid destroying nesting or breeding species during breeding timeframes, clearing of vegetation will occur prior to April 15, 2011.

A follow-up monitoring program will be implemented after construction and will be designed in accordance with Canadian Wildlife Service and/or NSDNR requirements. The purposes of the follow-up monitoring are:

- to determine rates of mortalities occurring and, if so, to identify any possible mitigation measures;
- to obtain quantitative information on the impacts of the project using carcass searches;
- to inform future decisions about development or placement of wind turbines for the second phase of the Project.

If it appears that a high number of direct fatalities are occurring, attempts will be made to determine the nature of the fatalities, specific timing or seasonality, weather related effects at the time, so that mitigation such as modifications to turbine operations may be designed (i.e. change to cut-in wind speeds for turbine operation; change to lighting; other).

If a moving blade appears to be causing high bird mortality along a particular flight path, the turbine can be shut down during time periods, or weather conditions when risks are particularly high, to reduce the number of direct hits.

Mortality studies will be focused on the following animals and time frames:

1. Spring bird migration (April to 1st week of June);
2. Autumn bat migration (mid-August to early October);
3. Autumn bird migration (mid-August to late October);

The timing of the carcass searches for both birds and bats is based on the baseline studies for this wind farm. After obtaining the required permits from federal and provincial agencies, searches will take place during the time frames given above. Searches will be more or less frequent depending on the results of the scavenger trials. Periodic searches may take place in the summer and winter periods to confirm the absence or low levels of mortality during these periods. Carcass searches will follow the protocols recommended by the Canada Wildlife Service (Environment Canada 2007b).

Similarly, scavenger trials will also follow the recommendations of the Canadian Wildlife Service (Environment Canada 2007b). These trials estimate the time it takes for large scavengers

such as foxes, raccoons, and ravens to remove dead birds or bats from the area surrounding the turbine base.

k. Bat Use

An assessment of bat species composition and activity for the Hampton Wind Farm was completed by Dr. Hugh Broders of Saint Mary's University. The following is a direct summary of his assessment and findings, taken from directly from the report. The complete report is presented in Appendix XI.

----------Report Findings----------

Consistent with the requirements as set out by the NS Dept. of Environment and Labour (NSDEL, 2007, updated September 2009) the following four objectives were established for the proposed Hampton Wind Farm project:

(1) To review of the potential impacts of wind turbine developments on bats;
(2) To provide a summary of the ecology of the bat species that are likely to be present in the area that is relevant to the proposed development;
(3) To assess whether there are any known bat hibernacula within 25 km of the proposed development site;
(4) To conduct a survey to determine local species richness and assess the level of bat activity levels at the site;

In Nova Scotia there are occurrence records for seven bat species (Broders et al., 2003; van Zyll De Jong, 1985), and each have been documented to have experienced fatalities at wind turbine sites. Nova Scotia is at, or near the periphery of the current known range for each of these species, with the exceptions of the northern long-eared bat and the little brown bat (van Zyll De Jong, 1985). These two species, as well as the tricolored bat, appear to be the only bat species with significant populations in Nova Scotia (Broders et al., 2003; Farrow, 2007b). Little brown bats and northern long-eared bats are widespread in Nova Scotia while the population of tri-colored bats in Nova Scotia appears to be restricted to southwestern region (Broders et al., 2003; Farrow, 2007b; Rockwell, 2005). The low number of echolocation recordings of migratory species (i.e., red, hoary and silver-haired bats; 15 out of 30,000 echolocation sequences) by Broders (2003) and other unpublished work suggests there are no significant populations or migratory movements of these species in southwest Nova Scotia.

Table 18: A list of all bat species documented as having occurred in Nova Scotia.

Bat Species – common name, *scientific name*	
Big brown bat, *Eptesicus fuscus*	Northern long-eared bat, *Myotis septentrionalis*
Silver-haired bats, *Lasionycteris noctivagans*	Little brown bats, *Myotis lucifugus*
Hoary bats, *Lasiurus cinereus*	Tri-colored bat, *Perimyotis subflavus*
Eastern red bats, *Lasiurus borealis*	

Table 19: Most probable area bat species at the Project.*

Common Name	Scientific Name	Overwintering Strategy	Global Rank	ACCDC Status
Little brown bat	*Myotis lucifugus*	Resident hibernator (NS and NB)	G5	S4
Northern long-eared bat	*Myotis septentrionalis*	Resident hibernator (NS and NB)	G4	S2
Tri-colored bat	*Perimyotis subflavus*	Resident hibernator (NS and NB)	G5	S1?

***Including their overwinter strategy, and Global/Provincial rank status, indicating the Northern long-eared and Tri-colored bat as rare and extremely rare respectively.**

A total of 3008 bat-produced ultrasonic sound files were recorded (2845 on the ground and 163 on the tower). The average number of bat passes recorded on the ground-based detector from 19 July until 25 August 2010 was 75 per night. For context, in 129 nights of monitoring along 5 forested edges from June-August 13 1999 in the Greater Fundy National Park Ecosystem, the average number of sequences per night was 27 (SD = 44) (Broders unpublished data). The level of activity found at the Hampton Mountain site was therefore higher than the nightly magnitude of activity found during the summer in southern New Brunswick.

Most of the recorded sequences (>99%) at the proposed Hampton Wind Farm Project area were attributable to the two common *Myotis* species found throughout Nova Scotia. Although, there was no attempt to identify these sequences to species because of the difficulty in achieving defensible identifications, several of the recorded echolocation sequences that had characteristics of *Myotis* species. This is supportive of the expectation that both species are present in the area. The majority of the sequences recorded at all locations likely represent the little brown bat because the northern long-eared bat has low intensity calls and is thus not recorded as well as the little brown bat (Broders et al., 2004; Miller and Treat, 1993). Further, the northern long-eared bat is a recognized forest interior species (Henderson et al., 2008; Jung et al., 1999a), and is less likely to use open areas for foraging and commuting (Henderson and Broders, 2008). As expected, a number of sequences that were attributable to the tri-colored bat were recorded. This species is likely only abundant in southwest Nova Scotia and the proposed development area is on the periphery of the species range (Broders et al., 2003; Farrow, 2007a). The incidence of 2 echolocation sequences that attributable to either silver-haired or big brown bat is not too surprising. There are a number of records of migratory bats in the province but it is believed that the province does not have a significant population of either (Broders et al., 2003). In our survey we did not record any sequences that were attributable to hoary bat or red bat. Current data would suggest that these species do not occur in the area in large numbers but it will be not be surprising for these species to occur in the area irregularly, especially during the migration season.

Additionally, a number of echolocation sequences that were attributable to tricolored bats and 1 sequence on each of the ground- and tower- based systems that were attributable to either silver-haired bat or big brown bat were also recorded. The tri-colored bat is likely only abundant in

southwest Nova Scotia and the proposed development area is on the periphery of the species range (Broders et al., 2003; Farrow, 2007a). It has been ranked by the ACCDC as an S1 species, meaning that it is extremely rare throughout its range in the province and may be especially vulnerable to extirpation. In Nova Scotia, work done in Kejimkujik National Park suggests that this species roosts is spp. lichen and forage over waterways (Poissant, 2009), neither of which is particularly abundant within the Project Area based on aquatic and vegetative surveys conducted.

Potential for hibernacula in project area

The guide to wind development prepared by the Nova Scotia Department of Environment and Labour (NSDEL, 2007, updated September 2009) states that wind farm sites within 25 km of a known bat hibernaculum have a 'very high' site sensitivity. Based on published literature, only one site (Vault Cave) which is approximately 25 kms from the proposed development site, was known to have the potential to be a hibernacula in the area (Moseley, 2007).

During the swarming period this fall, we conducted a systematic trap survey at this site and our results suggests this site has the potential to be a major hibernacula with 234 bats captured at the entrance of the cave (Randall and Broders, unpublished). In our experience of conducting similar surveys at tens of other sites in Nova Scotia, this result is suggestive of a significant hibernation site. No investigation of the inside of the cave was conducted.

Additionally, there are at least 29 government records of abandoned mines within 25 kms of the proposed development site with 3 near Slokum brook and the remaining 26 near Torbrook. Although there is only scant data available on these sites it would appear that each of the 3 sites at Slokum brook would be unsuitable as the maximum original depth indicated is 6 m. Of the remaining 26 sites at Torbrook, 2 have original depths listed as 50 and 55m, all others are <10m. Therefore, based on the available data, the potential for there to be hibernacula in abandoned mines within 25 kms of the proposed development site is low.

i. Effects of the Project

Myotis bats are relatively new to the list of bat fatalities at wind turbine sites. The first large scale wind developments were located in western North America typically in agricultural and open prairie landscapes (reviewed in Johnson, 2005). Fatalities of these non-migratory species were largely absent from these sites. It is likely that this reflects the location of these wind development sites in open non-forested landscapes. These species may be under represented in the bat communities in these open areas due to an association with forested landscapes. More recently however, evidence of Myotis fatalities from wind turbines have been noted at sites in eastern North America (reviewed in Arnett et al., 2008; Jain et al., 2007b; Johnson, 2005). Therefore, although documented fatalities of Myotis are fewer than for migratory species there is still some risk to these species.

Other than bat mortality directly as a result of turbines, there is also a high likelihood that disruption of the forest structure (removal and fragmentation of trees for road building and

deployment of turbines, etc.) for the development will degrade the local environment for colonies/populations that reside in the area during the summer. This can occur by the elimination of roost trees, the isolation of trees left standing, as well as the elimination or degradation of foraging areas. This negative aspect will almost certainly occur and will add to the cumulative effect of loss of bat habitat that is occurring throughout the range of these species.

ii. Mitigation

Minimize project footprint – Minimize the direct loss of bat habitat resources (e.g., wetlands, riparian areas, mature deciduous-dominated forest stands) and minimize the extent of bat habitat affected.

Retain undeveloped key bat habitat - Undeveloped bat habitat should be identified and retained in the project area to continue to support existing summer colonies/populations. Retention of these bat habitat resources should be in a spatial manner that provides connectivity in the project area and larger landscape to ensure foraging and roosting areas remain well connected. Consideration of the potential of fragmentation to bat habitat resources should also be given to the development of road networks and transmission lines in the project.

Follow up on effects and adaptive management – Conduct a post-construction monitoring program to document any bat fatalities. Ideally this should be conducted for an entire season (April to October), but especially during the fall migration season from mid-August to late-September to fully understand and characterize the temporal patterns of fatalities. Should fatalities be found, these should be assessed with respect to spatial distribution of fatalities, turbine lighting, weather conditions and other site specific factors which can then be analyzed and operations adjusted in an adaptive management framework. In this manner, mitigation can be focused on any identified high risk areas/infrastructure to minimize any more such fatalities. These data are also essential for assessing potential risks at future developments in the region. Results of these surveys should to be reported.

Remain up to date with current research - There is presently an abundance of on-going research aimed at determining the impacts of wind energy developments on populations of bats. Other studies are focusing on a number of potential mitigation methods, including the effects of weather on activity patterns and collisions, various mitigation treatments (Baerwald et al.) or possible deterrents (including acoustic and radar emissions). As these are active areas of research it is essential that the most current guidelines and studies are used to guide management and development plans for wind projects.

iii. Project Response to Recommended Mitigation

Minimize project footprint – As per the discussions regarding how constraints analysis and field assessments were used for Project layout – refer to Section 3 (above) of this report, this mitigation strategy has been employed from initial Project stages.

Retain undeveloped key bat habitat – The Project has included methods for constraints analysis and field assessments in order to incorporate this mitigation strategy. Any further assessments of potential Phase II components of the Project will continue to incorporate this mitigation strategy.

Follow up on effects and adaptive management – A post-construction monitoring program to document any bat fatalities will be completed as per Canadian Wildlife Services and/or DNR requirements and results will be made available to the appropriate parties.

Remain up to date with current research – Data collected from the Project will be made available to interested researchers to assist in future determination of the potential impact of windfarms based on real time data.

l. Wildlife Habitat

Habitat is as described in previous sections above and dominant overstory structure is a mixture of intolerant hardwood species, white spruce and balsam fir, with scattered occurrences of red spruce and white pine. The climax forest for this area likely consisted of both tolerant hardwood and softwood species. Beech was probably abundant at one time, but has been reduced to an understory species in most of the tolerant hardwood stands. However, there are still extensive areas on the steep slope overlooking the valley where beech, mostly low quality, is a dominant species. The habitat supports the thermal, cover and security requirements for wildlife species listed in previous sections.

Ground truthing, aerial photo interpretation, and GIS analysis of the north mountain indicate that the distance from the mountain face, on the southern edge of the Project, to the Shore Road is approximately 3.7 kms. (Figure 23) Within this span, there are continuous mixedwood forest canopies throughout (with similar characteristics to those identified in the previous paragraph) and aerial photography indicates that within this area, habitat with less than 30% fragmentation encompasses approximately 2050 hectares. Existing disturbances within this area include the north/south Hampton Mountain Road, Arlington Road, numerous homes, a gravel pit, agricultural lands, and existing disturbances as noted in this EA. This habitat appears to be relatively continuous in an east/west direction, and the Hampton Mountain Road appears to be the single largest risk and/or barrier to east/west movement of wildlife along the mountain.

i. Effects of the Project

How wildlife are affected by habitat availability, use, or fragmentation is determined by species habitat requirements (i.e. thermal, cover, security) and rates of movement through various habitats. (With & Crist, December 1995) Fragmentation of a particular species habitat implies a loss of habitat, reduced patch size and/or increasing distance between patches. However,

fragmentation may also suggest an increase of new habitat. (Andren, H. 1994) Then, the effect of habitat fragmentation on a species (population) would be primarily through not only habitat loss, but habitat changes. Habitat patches are parts of the landscape mosaic and the presence of a species in a patch may be a function not only of patch size and isolation, but also of the neighboring habitat. (With & Crist, December 1995) In landscapes with more than 30% of suitable habitat, fragmentation is primarily habitat loss. (With & Crist, December 1995) Habitat generalists may survive in very small patches because they can also utilize resources in the surroundings. Furthermore, the total species diversity across habitats in a given landscape may increase when new patches of habitat are created within the continuous habitat, since new species may be found in these new habitats, even if they are human-made. (Andren, H. 1994)

Habitat selection by wildlife is primarily a response to security, thermal comfort and forage needs. Wildlife must balance these conflicting requirements. Habitat selection is species-specific and choices will depend on physiological constraints and social needs of the species. Literature in conservation biology indicates that maintenance of movement corridors of suitable habitat between population centres is fundamental to wildlife health. (Bentz et al., 1994)

Although security and thermal cover are important, habitat selection is strongly influenced by relative foraging opportunities. (Renecker and Hudson 1991) Diet and habitat selection in wildlife results from the differential scaling of metabolism and digestive capacity which forces smaller animals to feed more selectively. (Renecker and Hudson 1991)

Requirements for security vary seasonally and are greatest when animals feel threatened. Wildlife is vulnerable at parturition and when accompanied by neonates, a condition that is exacerbated when the mother is in poor condition. To off-set this disadvantage, wildlife select habitats consistent with their physical attributes and cryptic coloration. For example, escape cover is forests for a white-tailed deer. (Renecker & Hudson, 1988)

The thermal environment is defined by ambient temperature, short-wave and long-wave radiation, wind and humidity. The operational environment which integrates these meteorological parameters is modified by habitat structure in complex ways. (Renecker & Hudson, 1991) Closed canopy forests reduce cold stress during winter but shade provided by poplar and aspen forests during late spring is attractive during periods of high ambient temperatures. (Renecker & Hudson, 1991)

Studies completed by Buckmaster et al. (1999) indicate that wildlife populations may be expected to disperse from the area during periods of construction. Assuming wildlife species are displaced from the Project lands, all the way from the south face of the mountain, to Arlington Road, this will reduce the available habitat from 2051 hectares to 1321hectares, (Figure 23) with a north/south reach of 1.7 km. However, this displacement is generally of short temporal disturbance as most cases reveal that wildlife have returned rapidly after human activity has ceased (Shank 1979).

Based upon the vegetation characteristics in adjacent areas, and the conclusions of previous

studies cited above, it is expected that displacement of populations will be temporary. Development of the Project is expected to increase forage potential as grass and forb species re-establish during interim reclamation. Loss of thermal and security cover is unavoidable however surrounding vegetation is expected to maintain these requirements.

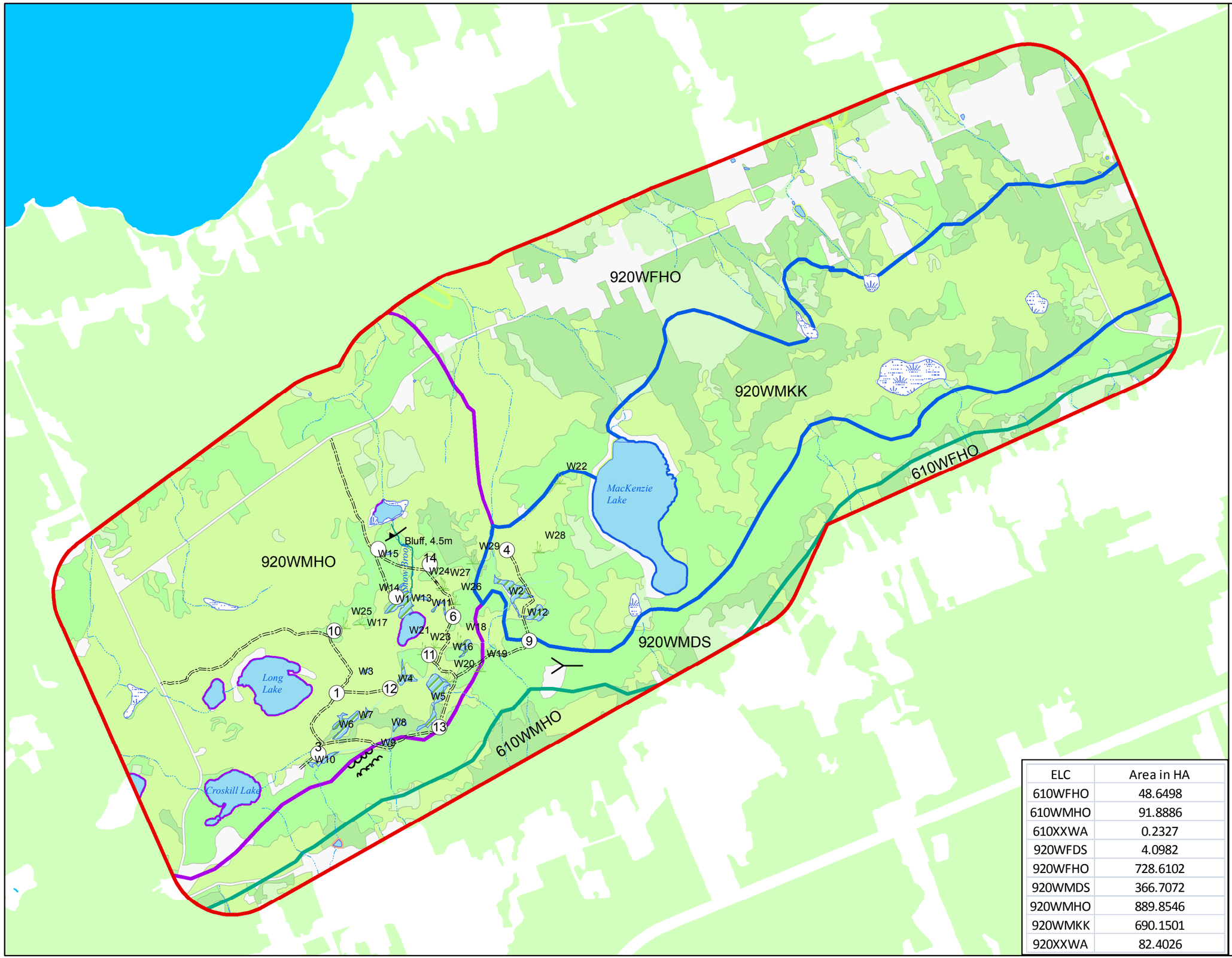
Habitat fragmentation will occur but remaining habitat areas are expected to provide suitable travel corridors along the north mountain during construction for travelling species.

ii. Mitigation

Management actions that limit disturbing activities, through careful future planning and coordination with landowners to integrate disturbances into existing and future land uses has been done through exhaustive constraints and field verifications. This ensures best management practices across all lands to conserve the biological resources and maintain the ecological integrity of the area.

Further mitigation for habitat loss will include reducing the footprint of disturbance associated with the Project. For example, although roads will be surveyed to 20 metres, attempts will be made to minimize disturbance such that a 20 metre right-of-way is neither cleared nor needed. In some cases (TBD), road clearings widths may be reduced (i.e. along straight stretches) to further reduce impacts.

Figure 21. Project Area Land Classification Map.



Grid North

1:28,000

Legend

Land_Features

- Cave
- Chasm
- Bluff
- Turbine and Number
- Windfarm Roads
- Field Verified Streams
- Field Verified Wetlands
- Hampton Boundary
- Field Verified Wetland
- Stream

Ecological Land Classifications

- 610WFHO
- 610WMHO
- 920WFHO
- 920WMDS
- 920WMHO
- 920WMKK

Cover Type

- Non-Forest
- Softwood
- Mixedwood
- Hardwood

ELC	Area in HA
610WFHO	48.6498
610WMHO	91.8886
610XXWA	0.2327
920WFDS	4.0982
920WFHO	728.6102
920WMDS	366.7072
920WMHO	889.8546
920WMKK	690.1501
920XXWA	82.4026

Ecological Land Classification
Region
610 - Annapolis Valley Region
920 - North Mountain Region
Ecosections
WFDS - Well drained, fine textured soil on steep slopes or canyons.
WFHO - Well drained, fine textured soil on hummocky terrain.
WMDS - Well drained, medium textured soil on steep slopes or canyons.
WMHO - Well drained, medium textured soil on hummocky terrain.
WMKK - Well drained, medium textured soil on hilly terrain.
XXWA - Inland water.

Data Oct 20th, 2010

GIS By: Nortek Resource Solutions Inc.

Figure 22. Project Footprint Land Classification Map.

Grid North

Legend 1:7,500

- Turbine and Number
- Contour
- Hampton Boundary
- Windfarm Roads

Land_Features

- Cave
- Chasm
- Bluff

Water

- Lake
- Field Verified Wetland
- DNR Swamp
- Field Verified Wetlands
- Field Verified Streams
- Stream

Cover Type

- Non-Forest
- Softwood
- Mixedwood
- Hardwood

Ecological Land Classifications

- 610WMHO
- 920WMDS
- 920WMHO
- 920WMKK

Ecological Land Classification
Region
610 - Annapolis Valley Region
920 - North Mountain Region
Ecosections
WFDS - Well drained, fine textured soil on steep slopes or canyons.
WFHO - Well drained, fine textured soil on hummocky terrain.
WMDS - Well drained, medium textured soil on steep slopes or canyons.
WMHO - Well drained, medium textured soil on hummocky terrain.
WMKK - Well drained, medium textured soil on hilly terrain.
XXWA - Inland water.

Data Oct 19th, 2010

GIS By: Nortek Resource Solutions Inc.

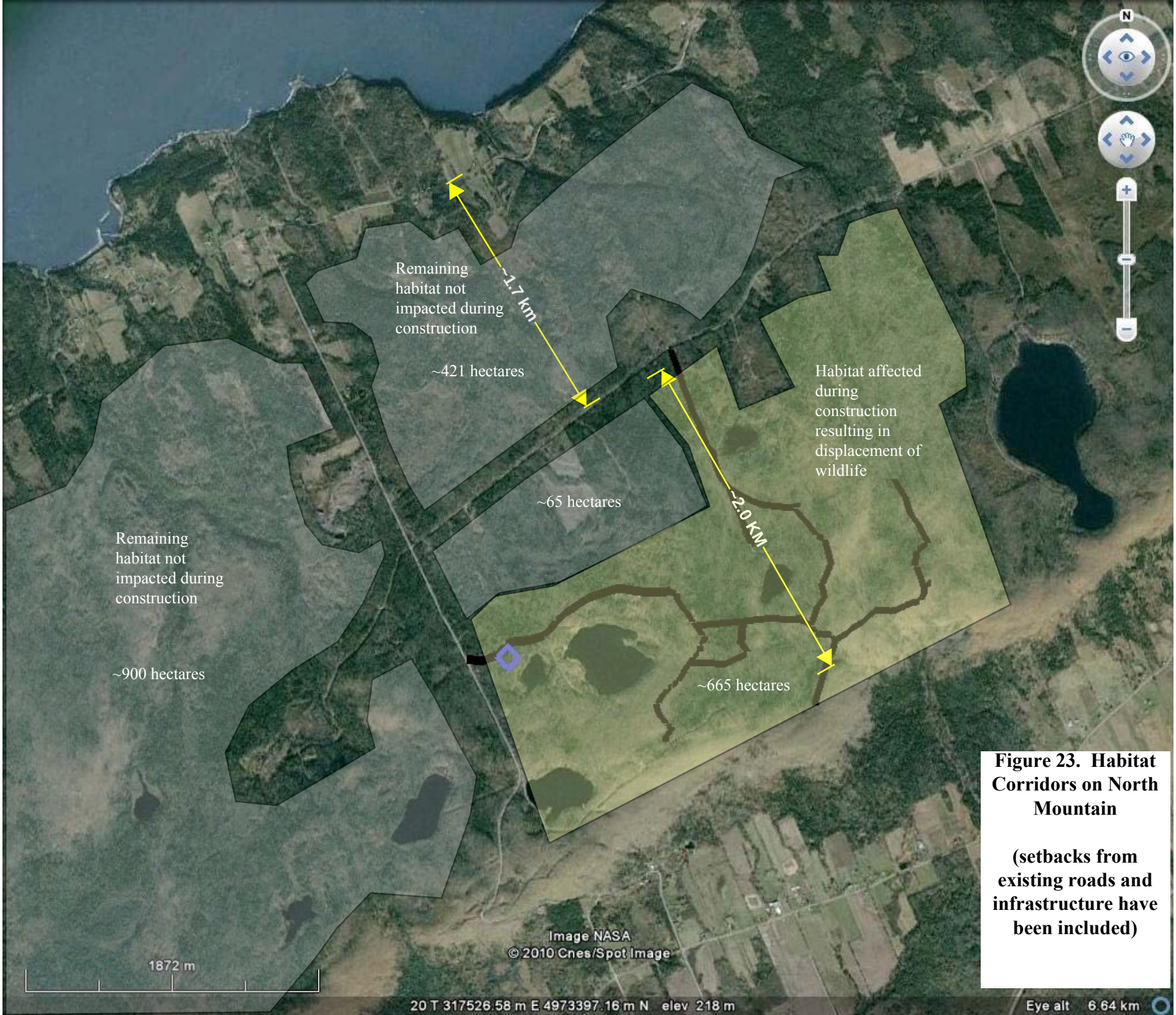


Figure 23. Habitat Corridors on North Mountain

(setbacks from existing roads and infrastructure have been included)

m. Aquatic Habitats/Fisheries

There are a number of aquatic habitats within the Hampton Wind Farm Project Area including a number of wetlands, intermittent and permanent streams, and four Lakes. Only two of these features (Mackenzie Lake and Snow Lake) were assessed to determine habitat values and functions as in the first phase of this Project, only these 2 lakes are within the footprint of development.

Little to no background data existed on any of these aquatic features within Provincial Government records. Therefore, all information presented here has been collected as part of this Environmental Assessment process, and is discussed in the context of the area and relevant literature. The total freshwater area of the North Mountain ecodistrict, within which the Project Site is found, is 372 hectares or 0.4% (NSDNR 2010b). However, GIS calculations of total exposed surface water area, indicates approximately 91 hectares of open water is present within the Project area (including Rumsey Lake, Snow Lake, MacKenzie Lake, Long Lake and Crosskill Lake).

i. <u>Mackenzie Lake</u>

MacKenzie Lake appears to be the most significant fish habitat within the Hampton Wind Farm Project Area. This small clear water lake is approximately 270 m east to west and 160 m north to south, or 3.6 ha of total surface area. Nearly the entire lake is fringed with wetland shallows. Turbidity analysis across a range of depths and locations produced 0 NTU, further highlighting the clear nature of the water. During an August 13 limnological assessment of the lake, temperature, dissolved oxygen, turbidity, pH and conductivity was measured at one metre depth intervals using a hand held Quantas Hydrolab multimetre. It would appear from the limited survey that a shallow flat exists to the south west, and in the north where the outlet through Snow Brook is located. Much of the rest of the lake appears to be 2-3 m deep within <5m of the shoreline. All of the shoreline is well vegetated and the substrate appears to be silty mud in most areas. Given the color of the lake, the very small drainage area, and lack of a defined inlet channel, it is expected that the lake is fed predominantly by spring water. It also appears that, at very high water levels such as existed in 2010 when beavers had damned the outlet channel; MacKenzie Lake may periodically feed southwards into wetland area 4 which flows south to the Annapolis Valley. This remains a secondary outlet to the main Snow Brook Channel that flows north to Snow Lake and the Bay of Fundy.

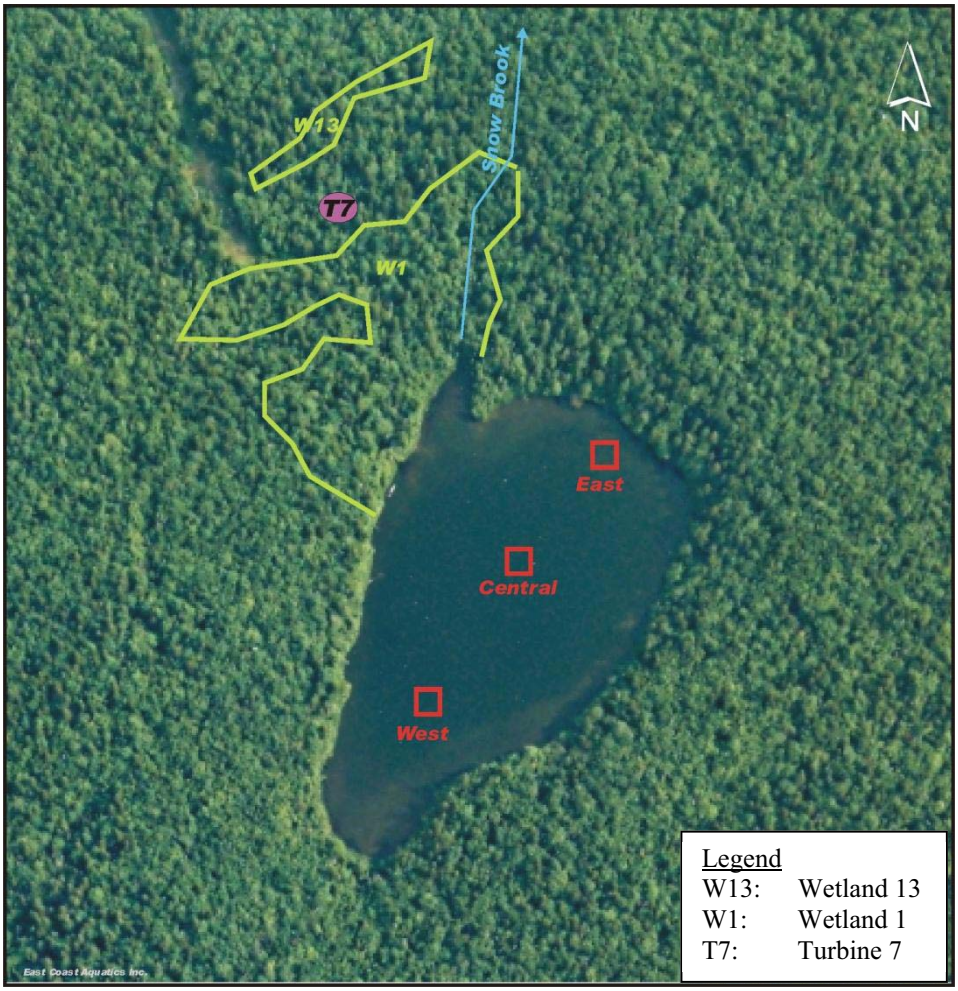


Figure 24. Approximate location of MacKenzie Lake water quality sampling stations, and associated project features.

On August 13, surface water temperatures at MacKenzie Lake exceeded 22°C, mirroring the air temperature of the day. Lake water temperature at 40cm below the surface was documented at 25 °C on August 2. During the more comprehensive August 13 assessment, dissolved oxygen levels dropped to near 6 mg/L at 2-3 m depth, and dropped even more rapidly in the shallows closer to the shoreline. It is not known if these low oxygen conditions were typical of the lake, or a product of the apparent elevated water levels resulting from a beaver dam at the outlet. Elevated water and flooding of vegetation could consume significant oxygen through plant decay. The Canadian Water Quality Guidelines for the Protection of Aquatic Life indicated minimum freshwater oxygen levels of 5.5-9.5 mg/L (CCME 2006). Levels below this are detrimental to the survival and reproduction of salmonids, including Brook Trout (*Salvelinus fontinalis)* that might be anticipated to be found in MacKenzie Lake. Similarly, temperatures above 19 °C are not favourable for trout production in Nova Scotia (MacMillan and Crandlemere 2005).

A local landowner who has utilized MacKenzie Lake for many years indicated that Smallmouth bass (*Micropterus dolomieu)* were introduced to the lake at some time in the past, and that these were the only fish species ever caught in the lake. There is no record of Smallmouth bass for the lake (J. McMillan pers com. 2010, LeBlanc 2010). Fish sampling by angling was conducted at MacKenzie Lake on two occasions, and only Smallmouth bass were captured. The size range of fish captured (17-22cm) suggest a limited number of age classes. Data from other locations in Nova Scotia would further suggest that all fish were 2-3 years old, although Smallmouth have been aged to 14 years in Nova Scotia (MacMillan et al. 2002). A large number of fish were visually observed on other dates. Of note was the observation of a relatively large number of fish within the flooded treed wetland at the outlet of the Lake. Although this area has likely always been a wetland, the amount of standing water at depths of over 1m is likely to have been enhanced significantly by the construction of a beaver dam on Snow Brook near MacKenzie Lake. Aggressive behaviour of the fish observed, and subsequent findings regarding the systems, would suggest that these were spawning Smallmouth bass. Smallmouth bass typically spawn in late May to early June in Nova Scotia once water temperatures exceed 16-18 ^{o}C (McNeill 1995). On the day of observation, MacKenzie Lake surface water temperatures were 15^{o}C, so it is conceivable that the shallow outlet area was warmer.

Table 20. Fish Sampling in MacKenzie Lake

Date Sampled	Sampling Method	Species	Total Length (cm)
May 19th	angling	SMB	18
May 19th	angling	SMB	22
Aug. 13th	angling	SMB	20
Aug. 13th	angling	SMB	17.5
Aug. 13th	angling	SMB	21.5
Aug. 13th	angling	SMB	23
Aug. 13th	angling	SMB	17
Aug. 13th	angling	SMB	19
Aug. 13th	angling	SMB	19.5
Aug. 13th	angling	SMB	21

SMB – small mouth bass

The ten Smallmouth bass captured during 2010 at MacKenzie Lake were captured in about 80 minutes of angling, or 1.33 rod hours. This equates to a catch per unit effort (CPUE) of about 7.5 bass per rod hour. Fish were regularly observed feeding near the shoreline and the shallow aquatic and overhanging vegetation.

A beaver house was identified on the north shoreline of MacKenzie Lake, and the active dam on the outlet to Snow Brook highlights the presence of *Castor Canadensis* at the lake. Rarely were any waterfowl observed on the Lake. One pair of unidentified ducks was noted several times

early in the summer in Wetland Area 1 associated with the outlet of MacKenzie Lake, and a Double Crested Cormorant (*Phalacrocorax auritus)* was observed on the Lake in mid-August.

ii. Snow Brook

For the purposes of this assessment, the stream channel that flows from MacKenzie Lake northward to Snow Lake and then further north to the Bay of Fundy is being referred to as Snow Brook. A portion of Snow Brook between MacKenzie Lake and Snow Lake falls within the Project Area. Snow Brook is the most dominant and persistent stream feature within the entire Project area. It is the only stream that was not intermittent in 2010 during the dry season of August. All other stream features are smaller and all were dry for some extended period of time during the dry season of 2010.

Snow Brook, as observed within the Project area, is a channel of some 1.2m bankfull width, and 0.4 m bankfull depth. The stream appears to maintain a baseflow during the annual August low flow period, although it was minimal and not measureable due to the very shallow water level and multiple channels through the boulder controlled stream. Given the early dry season of 2010, similar conditions were observed on site as early as May 19 when the wetted depth of Snow Brook downstream of MacKenzie Lake was only 10cm.

Snow Brook does have a few small pools, despite its boulder control of morphology, which results in a number of multiple channel stream sections. Residual pool depths in the reach below MacKenzie Lake were measured to be 0.20 m. Heavy moss growth exists across the boulder substrate of the channel, further indicating low base flows. However, this growth also indicates the channel has been stable over a long period of time, and a mature hardwood forest provides good riparian cover within the Project area.

During the 2010 field season, a beaver dam was located on Snow Brook 230m below MacKenzie Lake. This structure was about 1.3m high, and effectively flooded Wetland Area 1 back and into MacKenzie Lake. The structure is likely to have existed for a number of years given the apparent dieback of large trees within the wetland area. However, the presence of branches and twigs on these trees would suggest that the flooding effect of the dam has not extended much beyond one or two seasons. This structure is currently a barrier to fish passage across most flow ranges. Approximately 680 m downstream of MacKenzie Lake on Snow Brook there is a permanent barrier to fish migration. The presence of a 4-5 m high basalt bluff a short distance upstream of Snow Lake prevents migration of all fish at all flow ranges, and effectively isolates MacKenzie Lake from any other surface water areas and fish habitat.

Photo 8. Snow Brook

No active fish sampling was conducted in Snow Brook. However, no small bodied fish were observed in any of the shallow water pools during field surveys. The entire 840 m length of Snow Brook between MacKenzie Lake and Snow Lake was walked during field surveys.

There are a number of small intermittent streams within the Project area. Generally they all headwater in a wetland and usually flow between wetlands before dropping along much steeper gradients either north or south from the mountain top.

A small intermittent channel flowing from Wetland Area 7 to Wetland Area 4 has a bankfull width of 1.5m. Exiting Wetland 4, the channel widens to 1.95m, and has a bankfull depth of 0.3m, but remains intermittent despite carrying significant flow early in the year. During a May 07 survey, the pH of the water in this channel was 5.8. The channel then flows south down the mountain face and into Solomon Chute Brook on the valley floor below. No defined channel exists through any of the wetland areas, but hydrologically the intermittent stream segments link each wetland. A small channel that flows northward into the west end of Snow Lake was assessed on May 19. The channel quickly becomes intermittent upslope of Wetland 11, although it has a bankfull width of 1.5m and bankfull depth of 0.3 m between Wetland 11 and Snow Lake. The water in this channel had a pH of 5.0.

MacKenzie Lake is considered a fish bearing lake, due to the presence of Smallmouth Bass. Other than the potential for fish in Snow Brook during high water events, none of the watercourses encountered within the Project boundaries are fish bearing. No navigable waters are encountered and no applications to the Coast Guard for crossing approvals are associated with the proposed Project.

During constraints mapping, known watercourses and/or waterbodies were mapped and a 100 metre setback imposed as a buffer. However, during final siting of turbine locations and access roads, all waterbodies will be assessed to determine if a relaxation of setbacks can occur (only if necessary).

n. Water Course Crossings

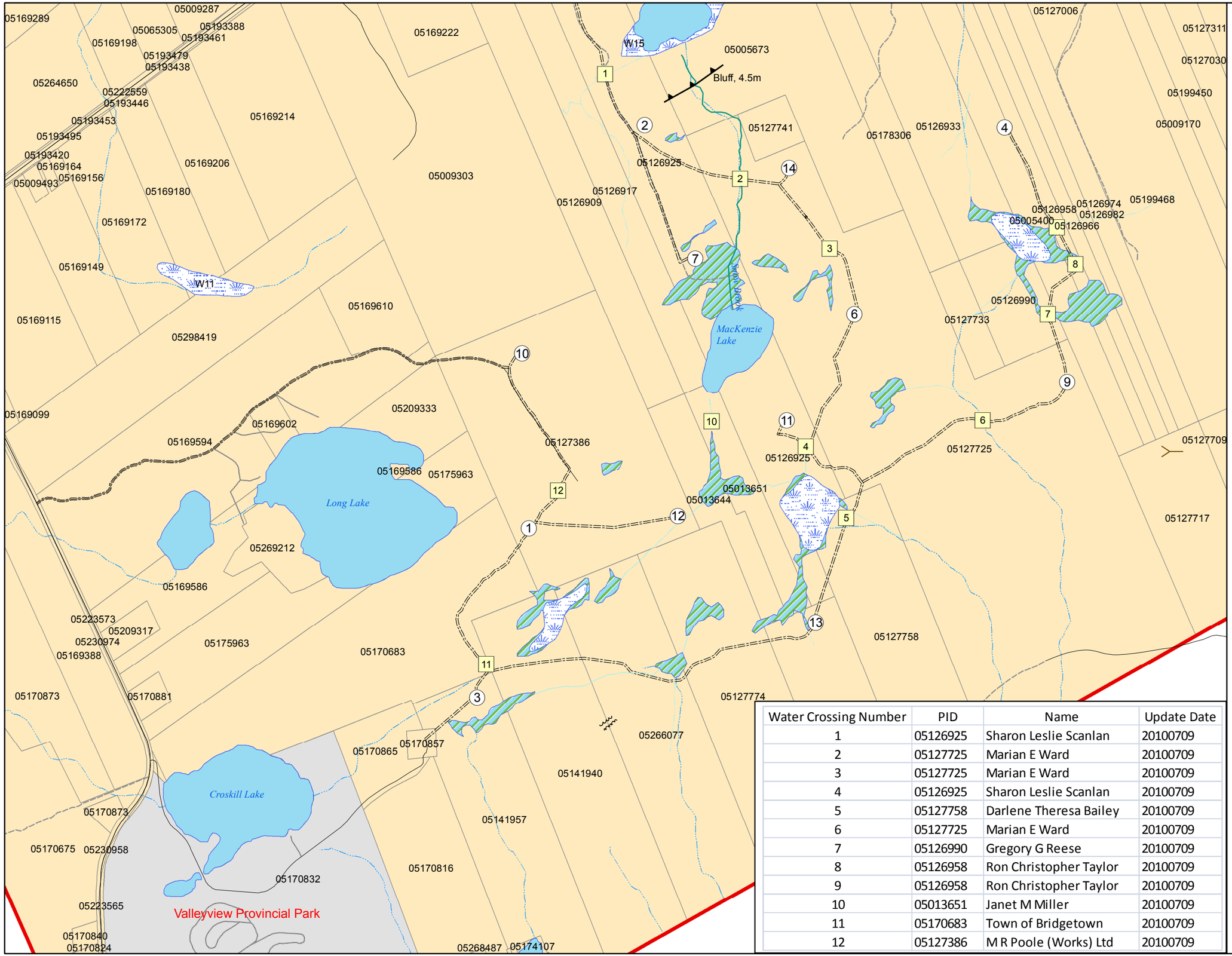
Within Phase I of the Project, twelve (12) watercourses may be crossed by access roads. Watercourses include intermittent and permanent streams, ephemeral drainages, and areas of low relief resulting in standing water. Excluding Snow Brook (see below), all watercourses were dry for some extended period of time during the dry season of 2010. The following outlines characteristics of each crossing location. Each watercourse crossing requires approval from NSDOE under the Watercourse Alteration Application and Approval process. At the time of this EA submission, application for crossing 11 of the 12 water courses using temporary bridges had been applied for. However, water crossing number 10 (Figure 25) is not currently part of the Project lands and will not be used unless an agreement is reached with the landowner.

The purpose of these applications is to construct temporary bridges over watercourses to allow access by timber cutting, and subsequently geotechnical drilling equipment. Upon completion of the geotechnical investigation, all watercourse crossings will be removed. New applications for culverts will be made upon Project approval in anticipation of road construction.

Please note that not all crossings within the Project are currently being applied for. For example, Crossing 1 (refer to diagram titled “Hampton Study Area Water Crossing Map”) is an existing culvert that will require replacement during access road construction.

Figure 25. Watercourse Crossing Locations and PID Map.

1:10,000



Water Crossing Number	PID	Name	Update Date
1	05126925	Sharon Leslie Scanlan	20100709
2	05127725	Marian E Ward	20100709
3	05127725	Marian E Ward	20100709
4	05126925	Sharon Leslie Scanlan	20100709
5	05127758	Darlene Theresa Bailey	20100709
6	05127725	Marian E Ward	20100709
7	05126990	Gregory G Reese	20100709
8	05126958	Ron Christopher Taylor	20100709
9	05126958	Ron Christopher Taylor	20100709
10	05013651	Janet M Miller	20100709
11	05170683	Town of Bridgetown	20100709
12	05127386	M R Poole (Works) Ltd	20100709

Legend

- Water Crossing & Number
- Turbine and Number
- Windfarm Roads
- Provincial Park
- Property Boundaries
- Hampton Boundary

Land_Features

- Cave
- Chasm
- Bluff

Water

- Lake
- DNR Wetlands
- Field Verified Wetlands
- Stream
- Field Verified Streams

** NOTE **
Water Crossing Numbers on the map are only used to match the water crossing to the corresponding person in the spreadsheet and should be used for no other purpose.

Date: Oct 22nd, 2010

GIS By: Nortek Resource Solutions Inc.

Crossing 2. New Installation

Name of Watercourse:	Snow brook (between McKenzie Lake and Snow Lake)
Our Crossing Label:	2
PID	05127725
Coordinates:	Easting: 318709.44 Northing: 4973344.00
Drainage Area	10 ha = 10 ha/100 = 0.1 km^2
Design Flow (Q m^3/sec)	1.5 x 0..1 km^2 = 0.1572 m^3/ sec.
Channel depth (at crossing)	40 cm
Channel width	1.4 m (bank to bank width)
Opening (r x s) = a	=1.4 * 0.4 = 0.56 m2
Velocity = Q/a	=0.157/0.56 = 0.28 m/s which is < 1.8 m/s
Bridge size	450 mm (rise over water) x 3000mm (length)
Channel bottom	See Section 5d(ii) above for description

Crossing 3. New Installation

Name of Watercourse:	Low seasonal drainage between upslope of McKenzie Lake
Our Crossing Label:	3
PID	05127725
Coordinates:	Easting: 318958.49 Northing: 4973174.72
Drainage Area	0.8846 ha = 0.8846ha/100 = 0.0088 km^2
Design Flow (Q m^3/sec)	1.5 x 0.0088 km^2 = 0.0133 m^3/ sec
Bridge size	450 mm (rise over water) x 3000mm (length)
Channel bottom	muck, vegetation, bedrock. No defined channel development.
Channel depth (at crossing)	0-5 cm
Channel width	0.3 m (bank to bank width)
Opening (r x s) = a	=.45 * 3 = 1.35
Velocity = Q/a	=0.133/1.35 = 0.0098 m/s which is < 1.8 m/s
Comments	Headwaters in a wetland, and flows north between wetlands before dropping along much steeper gradients to the north.

Crossing 4. New Installation

Name of Watercourse:	Low seasonal drainage which drains small area located to north of wetland upslope of Chute Brook
Our Crossing Label:	4
PID	05126925
Coordinates:	Easting: 318892.71 Northing: 4972618.65
Drainage Area	2.3615 ha = 2.3615a/100 = 0.02 km^2
Design Flow (Q m^3/sec)	1.5 x 0.02 km^2 = 0.035 m^3/ sec.
Bridge size	450 mm (rise over water) x 3000mm (length)

Channel bottom	muck, vegetation, bedrock. No defined channel development.
Channel depth (at crossing)	5 cm
Channel width	0.3 m (bank to bank width)
Opening (r x s) = a	=.45 * 3 = 1.35
Velocity = Q/a	=0.035/1.35 = 0.0262 m/s which is < 1.8 m/s
Comments	No defined channel or banks but vegetation clearly indicates a drainage channel at crossing location. Drainage drains a small shoulder to the north.

Crossing 5. New Installation

Name of Watercourse:	Low seasonal drainage between upslope wetland and Chute Brook
Our Crossing Label:	5
PID	05127758
Coordinates:	Easting: 319007.13 Northing: 4972419.06
Drainage Area	23.23 ha = 23.23ha/100 = 0.23 km^2
Design Flow (Q m^3/sec)	1.5 x 0.23 km^2 = 0.3485 m^3/ sec.
Bridge size	450 mm (rise over water) x 3000mm (length)
Channel bottom	muck, vegetation, bedrock. No defined channel development.
Channel depth (at crossing)	30 cm
Channel width	1.95 m (bank to bank width)
Opening (r x s) = a	=.3 * 3 = 0.9
Velocity = Q/a	=0.3485/0.9 = 0.387 m/s which is < 1.8 m/s
Comments	This channel widens to 1.95m, and has a bankfull depth of 0.3m, but remains intermittent despite carrying significant flow early in the year. During a May 07 survey, the pH of the water in this channel was 5.8. The channel then flows south down the mountain face and into Solomon Chute Brook on the valley floor below.

Crossing 6. New Installation

Name of Watercourse:	Low seasonal drainage between upslope wetland and Chute Brook
Our Crossing Label:	6
PID	05127725
Coordinates:	Easting: 319389.99 m E Northing: 4972698.91 m N
Drainage Area	49.018 ha = 49.0148ha/100 = 0.49 km^2
Design Flow (Q m^3/sec)	1.5 x 0.49 km^2 = 0.7353 m^3/ sec.
Bridge size	450 mm (rise over water) x 3000mm (length)
Channel bottom	muck, vegetation, bedrock. No defined channel development.
Channel depth (at crossing)	30 cm
Channel width	1.5 m (bank to bank width)

Opening (r x s) = a	=.45 * 3 = 1.35
Velocity = Q/a	=0.7353/1.35 = 0.5446 m/s which is < 1.8 m/s
Comments	This channel widens to 1.5m, and has a bankfull depth of 0.3m, but remains intermittent despite carrying significant flow early in the year. The channel flows south down the mountain face and into Solomon Chute Brook on the valley floor below.

Crossing 7. New Installation

Name of Watercourse:	Seasonal drainage channel between two adjacent wetlands
Our Crossing Label:	7
PID	05126990
Coordinates:	Easting: 319569.56 Northing: 4972991.48
Drainage Area	20 ha = 20 ha/100 = 0.20 km^2
Design Flow (Q m^3/sec)	1.5 x 0.20 km^2 = 0.3 m^3/ sec.
Bridge size	450 mm (rise over water) x 3000mm (length)
Channel bottom	muck, vegetation, bedrock. No defined channel development.
Channel depth (at crossing)	5-10 cm
Channel width	30 cm (estimated)
Opening (r x s) = a	=.45 * 3 = 1.35
Velocity = Q/a	=0.3108/1.35 = 0.232 m/s which is < 1.8 m/s
Comments	No defined channel or banks but vegetation clearly indicates a drainage channel at crossing location. Drainage drains a small wetland to the south, to a larger wetland to the north west. That wetland ultimately drains south toward crossing 6.

Crossing 8. New Installation

Name of Watercourse:	Seasonal drainage channel at south edge of wetland
Our Crossing Label:	8
PID	05126966
Coordinates:	Easting: 319644.13 Northing: 4973149.34
Drainage Area	8 ha = 8 ha/100 = 0.080 km^2
Design Flow (Q m^3/sec)	1.5 x 0.08 km^2 = 0.126 m^3/ sec.
Bridge size	450 mm (rise over water) x 3000mm (length)
Channel bottom	muck, vegetation, bedrock. No defined channel development.
Channel depth (at crossing)	5-10 cm
Channel width	30 cm (estimated)
Opening (r x s) = a	=.45 * 3 = 1.35
Velocity = Q/a	=0.126/1.35 = 0.0938 m/s which is < 1.8 m/s
Comments	No defined channel or banks but vegetation clearly indicates a drainage channel at crossing location.

Crossing 9. – New Installation

Name of Watercourse:	Seasonal drainage channel that enters adjacent wetland and drains a ridgeline and small plateau to the east
Our Crossing Label:	9
PID	05126966
Coordinates:	Easting: 319590.46 m E Northing: 4973231.08 m N
Drainage Area	6.67 ha = 6.67 ha/100 = 0.060 km^2
Design Flow (Q m^3/sec)	1.5 x 0.06 km^2 = 0.101 m^3/ sec.
Bridge size	450 mm (rise over water) x 3000mm (length)
Channel bottom	muck, vegetation, bedrock.
Channel depth (at crossing)	30 cm
Channel width	1 metre
Opening (r x s) = a	=.45 * 3 = 1.35
Velocity = Q/a	=0.101/1.35 = 0.0741 m/s which is < 1.8 m/s
Comments	Small drainage channel with seasonal influences only. No permanent water in water course.

Crossing 10. New Installation

Name of Watercourse:	Seasonal drainage channel that enters adjacent wetland and drains a ridgeline and small plateau to the east
Our Crossing Label:	10
PID	05013651
Coordinates:	Easting: 318628.49 m E Northing: 4972668.91 m N
Drainage Area	5.198 ha = 5.19 ha/100 = 0.052 km^2
Design Flow (Q m^3/sec)	1.5 x 0.05 km^2 = 0.078 m^3/ sec.
Bridge size	450 mm (rise over water) x 3000mm (length)
Channel bottom	muck, vegetation, bedrock.
Channel depth (at crossing)	5-10 cm
Channel width	10-30 cm estimated by vegetation
Opening (r x s) = a	=.45 * 3 = 1.35
Velocity = Q/a	=0.078/1.35 = 0.0578 m/s which is < 1.8 m/s
Comments	Small drainage channel with seasonal influences only. No permanent water in water course. Receives some overflow drainage from MacKenzie Lake.

Crossing 11. New Installation

Name of Watercourse:	Seasonal drainage channel that drains a wetland located to the east/north east and acts as tributary to Croskill Lake
Our Crossing Label:	111
PID	05170683
Coordinates:	Easting: 317994.80 m E Northing: 4972009.67 m N

Drainage Area	4.4594 ha = 4.45ha/100 = 0.045 km^2
Design Flow (Q m^3/sec)	1.5 x 0.045 km^2 = 0.0669 m^3/ sec.
Bridge size	450 mm (rise over water) x 3000mm (length)
Channel bottom	muck, vegetation, bedrock.
Channel depth (at crossing)	5-10 cm
Channel width	10-30 cm estimated by vegetation
Opening (r x s) = a	=.45 * 3 = 1.35
Velocity = Q/a	=0.0669/1.35 = 0.0495 m/s which is < 1.8 m/s
Comments	Small drainage channel with seasonal influences only. No permanent water in water course.

Crossing 12. New Installation

Name of Watercourse:	Low seasonal drainage that drains a small shoulder area towards Long Lake.
Our Crossing Label:	12
PID	05127386
Coordinates:	Easting: 318197.27 Northing: 4972497.14
Drainage Area	2 ha = 2 ha/100 = 0.02 km^2
Design Flow (Q m^3/sec)	1.5 x 0.02 km^2 = 0.03 m^3/ sec.
Bridge size	450 mm (rise over water) x 3000mm (length)
Channel bottom	muck, various sized rock and bedrock
Channel depth (at crossing)	5-10 cm
Channel width	0.5 m (estimated by vegetation)
Opening (r x s) = a	=.45 * 3 = 1.35
Velocity = Q/a	=0.03/1.35 = 0.0224 m/s which is < 1.8 m/s
Comments	Small drainage channel with seasonal influences only. No permanent water in water course.

i. Effects of the Project

Provided all standard watercourse alteration mitigation strategies are integrated into design, all necessary NSDOE approvals are acquired, and crossing structures are sized according to 1:2 year design flow characteristics (temporary structures) and 1:100 year design flow characteristics (permanent structures) limited or no effects resulting from Project development should be expected.

ii. Mitigation

- All temporary structures will be designed to meet, and installed in accordance with the requirements of the NS Watercourse Alteration Specifications;
- No fording of the crossing will occur during installation;
- All work will occur in the dry. Machinery used will be properly maintained and checked for any leaks/ maintenance issues prior to beginning work on the crossing activities;
- All temporary bridges will completely span the watercourse with abutments placed approximately 0.5 metres back from the bank and/or water edge;

- All bridges will only be constructed to allow passage of a single vehicle;
- Deck height on all temporary structures will be at least 250 mm above the bank height;
- During installation and removal, temporary bridges will be lifted in place and removed by the same method;
- Approach roads on both sides will be stabilized against erosion and to prevent rutting using Brush mats to a minimum distance of 30 metres from either side of the crossing;
- All temporary bridges will be constructed to prevent material from dropping through the bridge into the watercourse. Plastic sheeting will be placed between the bridge deck and bottom structures to prevent this;
- Any soils/debris on the surface of the bridges will be removed with shovels; brooms; etc to prevent material from falling into watercourses;
- Bridges will have vertical posts on either side to allow for skidding of salvaged timber over the bridge and to prevent timber from sliding/falling into the watercourse;
- The watercourse will not to be disturbed outside the footprint of the access boundaries;
- At no time will equipment be allowed to enter the watercourses;
- Sediment and erosion control structures will remain in place and intact until permanent vegetation has been established or the site is otherwise stabilized;
- Upon completion, all material used for bridge support will be removed and disposed of without entering watercourse (excavated soil, wood debris, excess rip rap);
- Upon removal of the bridges, brush mats will be left in place to maintain effective erosion control.

o. Wetlands

Wetlands are defined as "a swamp, marsh, bog, fen or other land that is covered by water during at least three consecutive months of the year." Wetland functions are the natural processes associated with wetlands and include water storage, pollutant removal, sediment retention and provision of nesting/breeding habitat. Functions may also include values and benefits associated with these natural processes and include aesthetics/recreation, cultural values, and subsistence production (Environment Canada, 2000). The discussions of wetlands presented herein primarily uses terminology associated with the Canadian Wetlands Classification System (Warner and Rubec 1997) or with the Nova Scotia methods for wetland delineation (MCFT 2009).

Under the Canadian Wetland Classification System (National Wetlands Working Group, 1997), wetlands in the Project boundaries are defined as Marshes – a wetland that has shallow water, and has levels that usually fluctuate daily, seasonally or annually due to evapotranspiration, groundwater recharge, or seepage losses. Marshes may experience water level drawdown's which will result in portions drying up and exposing the sediments. Marshes receive their water from the surrounding catchment as surface runoff, stream inflow, precipitation, storm surges, or groundwater discharge. Marshes dependent upon surface runoff usually retain less permanent water than sites supplied by groundwater. The water table usually remains at or below the soil

surface, but soil water remains within the rooting zone for most of the growing season, except in years of extreme drought.

The wetlands within the Project boundaries are Basin Marshes, and include isolated, discharge, and linked basin marshes. They are ombrogenic wetlands that are recharged seasonally by precipitation. They are characterized by semi-permanence, changing from pre-dominantly open water ponds in spry to drying basins covered by interspersed or closed stands of vegetation by late summer. Changes in water levels allow the colonization of many annual pioneering and perennial vegetation species.

The discussions of wetlands presented herein primarily uses terminology associated with the Canadian Wetlands Classification System (Warner and Rubec 1997) or with the Nova Scotia methods for wetland delineation (MCFT 2009).

Desktop Review: Methodology and Results

The NSDNR Significant Species and Habitats Database (SSHD) (NSDNR 2010a) was consulted and, based on the information in this database, no wetlands are identified from that source within the immediate Project Area. However, three wetlands are identified near the Project Area by the SSHD. A 1.07 ha marsh is identified on the western perimeter of Long Lake that lies to the immediate east of the Project Area. A 2.34 ha treed swamp lies around the perimeter of Snowy Lake to the immediate north of the Project Area, and a 0.68 ha tall shrub swamp lies to the immediate north northeast of the Project Area.

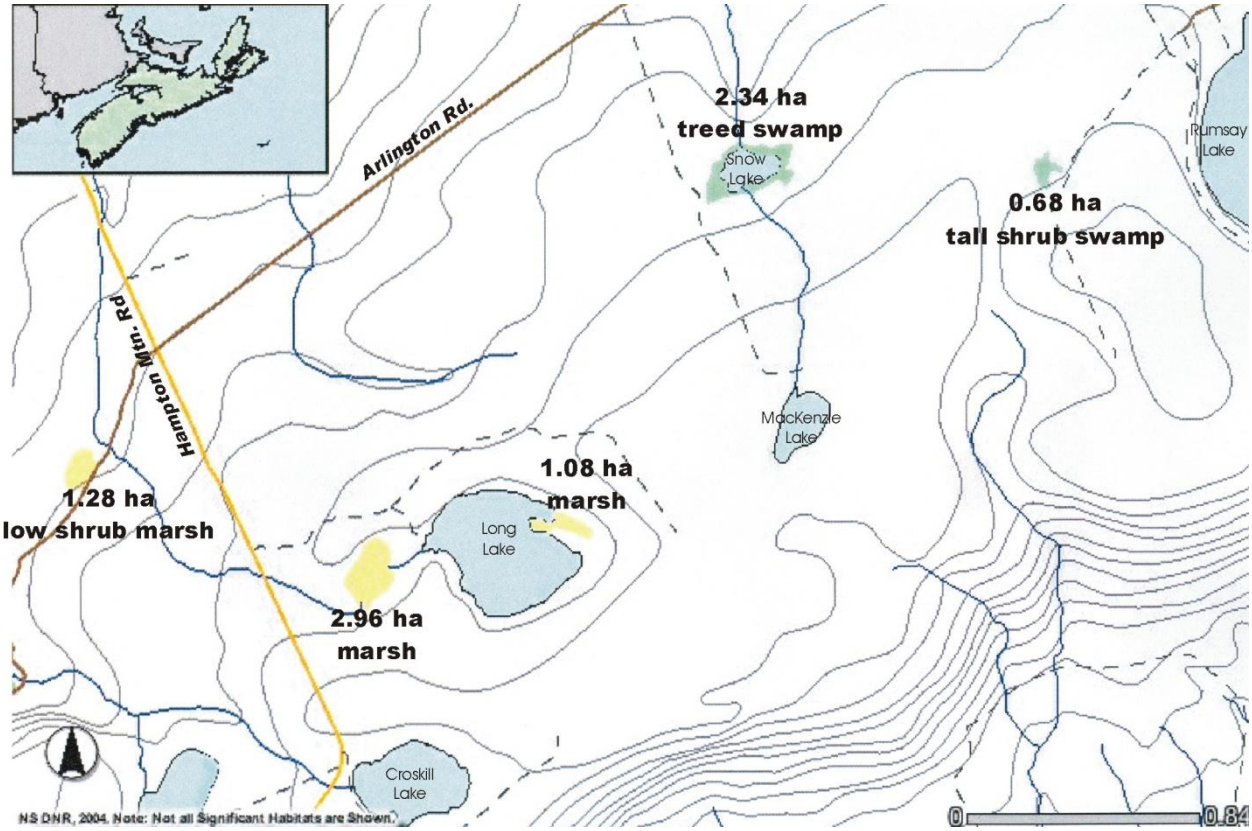


Figure 26. Wetlands identified in the NSDNR Significant Species and Habitats Database.

Wet Areas Mapping (NOVA WAM 2010) for the Province was also consulted. The database indicated very limited areas where the depth to the water table was likely to be 0-0.5m below the ground within the Project Area. Typically, water tables that occur to within 0.3 m or less of the ground surface throughout the year will form wetlands, so the NOVA WAM is often a good predictor of where wetlands may be located.

Based on this desktop review, no wetland habitat had been documented on the Project site, and the NOVA WAM did not suggest that significant wetland habitat to be present across the Project area. Once field surveys began a number of wetland features were identified and subsequently mapped. Vegetation surveys, avian surveys, soil profile surveys, and surface hydrology assessments were completed on various wetland features such that they could be better included in project constraints planning.

The seventeen (17) field identified wetlands for which perimeters were mapped are presented in Table 21 below. They are individually shown in Figures in previous sections. Although the largest wetlands approach 3ha, most are considerably less than one hectare in area, reflecting the character of their formation. Inventories of wetland vegetation were completed for seven separate wetlands, the results of which are presented in Appendix X. No Provincially or Federally protected Species At Risk, or Provincially Ranked S1 or S2 species were identified

during the wetland surveys. Such species would be considered rare to extremely rare species. Those found during field inventories at the proposed Project area predominantly fall within the "usually to demonstrably widespread" categories and have therefore been assigned an S4 or S5 ranking by the Atlantic Canada Conservation Data Center (ACCDC). Two Sphagnum species (Wulfianum and Subsecundum) are ranked by the ACCDC as S2S3, meaning they are considered uncommon to rare. These species have been further discussed within this report under the section titled "Rare, Sensitive and At Risk Plants".

Table 21. Field identified wetlands within the proposed Hampton Wind Farm Project Site.

Wetland	Preliminary Wetland Classification	Approximate Area (ha)	Description
1	Treed Swamp/Bog	2.34	Tree and shrub coverage. Outlet from MacKenzie Lake. Currently flooded over a large extent by a beaver dam, which provides some open water areas with depths to an estimated 1m. It is unlikely this is a typical scenario, and standing water may not be a regular feature of this wetland. The footprint of this wetland does not appear significantly altered by the current beaver influenced ponding. Throughflow lentic hydrology from lake to MacKenzie Brook. The western portion is more typical bog and appears primarily influenced by rainfall. In this bog area the shrub layer is denser. The Yellow listed Canada Warbler was identified in this wetland. Apparent bass spawning was taking place in beaver impounded areas.
2	Treed Swamp	2.35	Intermittent streams influence the hydrology of this system, including small seasonal springs from the high slope to the east, and a poorly defined surface drainage channel from the north. Along with wetland 5, this wetland forms a headwater for Solomon Chute Brook. Mixed wood treed swamp with some shrub layer. Very limited vernal pool areas.
3	Treed Bog	0.14	Some graminoid species, but predominantly a softwood treed bog.
4	Treed Swamp	0.90	Mixed wood treed swamp. Collects surface runoff from upslope areas and a small intermittent channel that drains wetlands 6 and 7. Appears that at extreme high water events, as currently exists in MacKenzie Lake with the presence of the beaver dam at the outlet, intermittent drainage from Mackenzie Lake may contribute surface water to wetland 4. Moderate sized, but intermittent stream drains the wetland into wetland 5 and eventually Solomon Chute Brook.
5	Shrub swamp	2.92	Yellow listed Canada Warbler was identified in this

			wetland. This is a relatively large and diverse wetland with graminoid and treed areas, although predominantly is a shrub swamp. Some limited open water areas. Headwater drainage to Solomon Chute Brook.
6	Tall shrub bog	1.62	The Yellow listed Canada Warbler was identified in this wetland. Predominantly treed/tall shrub bog, although limited gramminoid area exists. Flows into wetland 7 through a wetland corridor.
7	Treed bog	0.26	Flows into wetland 4 through a wetland corridor and poorly defined channel Treed bog.
8	Treed bog	0.49	Treed bog that discharges through a wet corridor to wetland 9.
9	Treed swamp	0.34	Treed swamp. Discharges to the valley and eventually Solomon Chute Brook.
10	Treed swamp	0.62	Treed swamp. Appears to discharge both to wetland 9 and directly to the valley during higher flows.
11	Shrub swamp	0.005	Small swamp influenced from intermittent flow west of the Project area.
12	Treed bog	0.07	Hardwood treed bog in depression. Shallow bedrock.
13	Treed bog	0.10	Hardwood treed bog in depression. Shallow bedrock.
14	Treed bog	0.22	Hardwood and softwood treed bog. Source water is from surface rain, poor discharge toward MacKenzie Lake
15	Treed bog	0.28	Hardwood and softwood treed bog. Source water is from surface rain, poor discharge toward MacKenzie Lake, better defined discharge channel to northeast.
16	Treed bog.	0.56	Source water is from surface rain, and possibly some seeps along the toe of a steeper slope that bounds the southwest. Obvious slope toward the point of discharge. Hardwood and softwood treed bog.
17	Treed bog	1.32	Source water is predominantly surface sheet flow. Discharges to wetland 2 through a short defined channel, and forms a headwater to Solomon Chute Brook. Hardwood and softwood treed bog.

Virtually all of the wetlands identified have terrene landscape position, meaning they are located high in a watershed and serve as part of the headwater system. Field assessment suggests that the wetlands are typically formed in areas where rain and minimal surface flow collects in shallow depressions with bedrock located a short depth below the soil layers, creating a "perched" water table. The water source for most of the wetlands is seasonal channels or surface sheet flow that results from rainfall. Most of the small wetland areas are ombotrophic in nature, receiving their water and nutritents primarily from precipitation, or seasonal surface drainage channels that have no mineral soil influence due to their vegetated nature. Although, Wetlands 2, 4, 5 and 9 are likely to be classed as minerotrophic due to the better defined ephemeral channels flowing into the wetlands, the nutrient regime is likely to be generally poor (minerotrophic-oligotrophic) due

to the short distance of the upslope channels and the seasonal nature of flow through these channels.

Wetlands at the Project area are all similar in that they have limited to no open water areas, are generally treed with minimal sapling/shrub understory, and have some depth of peat layer. The exceptions to this generalization are Wetland 2 and Wetland 5, which have small vernal pools and Wetland 4, which has a poorly defined through-flow channel. The wetlands are all well treed although some have moderate amounts of tall shrub coverage. In a limited number of cases, low shrub or even small gramminoid patches of wetland vegetation exist. However, they all lack a clear diversity of wetland classifications necessary to be considered a wetland complex.

The wetlands scattered throughout the Project area and provide habitat for a diverse number of vascular plants and bryophyte species. Open bogs dominated by peat mosses such as *Sphagnum girgensohnii, S. palustre, S. fallax, S. subsecundum,* and *S. Magellanicum* with an overstory of Red Maple and Balsam Fir and an understory of Cinnamon and Royal Ferns are frequent. Wet deciduous woods provide a habitat for more shade tolerant species such as Lady-Fern (*Athyrium filix-femina),* Woodland Horsetail*, (Equisetum sylvaticum),* Heartleaf Twayblade (*Listera cordata), and* Northern Blue Violet (*Viola septentrionalis).*

Photo 9 & 10: Treed bog and treed swamp wetlands typical of the Project area.

SOILS: Wetlands 2 and 5

Typically, soil characteristics were not assessed on site for the various wetlands as formal wetland delineations (MCFT 2009) were not generally required. However, soils were assessed at two Project locations for which wetland alterations were considered in order to access proposed turbine locations. As shown in Tables 22 and 23, soils within the wetlands consisted of a relatively shallow organic peat layer underlain by a mineral layer. The wetlands assessed (wetlands 2 and 5), were both tall shrub/treed swamps that had relatively small and intermittent inflow water sources, no open channel through the wetland, and intermittent discharge south toward the Annapolis Valley and Solomon Chute Brook. At quite shallow depths (<0.5m) rock prohibited further hand excavation of soil test pits. Bedrock is visible at the surface in many areas of the Project area, and likely influences a shallow water table. Despite the August 22

sample date, and dry inflow and outflow channels to the assessed wetlands, standing water was found at 9 and 18cm depth.

Table 22: Soil profile for Wetland 2 located on the east portion of the Project area.

				Redox Features				
Depth (cm)	**Horizon**	**Matrix Munsell**	**%**	**Mottle Munsell**	**% Mottle**	**Type[1]**	**Loc[2]**	**Texture/Von Post**
0-12	Of 2							Fibric - almost decomposed
12-22	Oh 8	10 YR 2/2	100					Humic - almost completely decomposed
22-58	A	7.5 YR 3/1	100					Clay
58+	refusal							Bedrock?

1Type: C-concretion, D - depletion, RM - reduced matrix, CS - covered or coated sand. 2 Locations: PL - pore lining, M – matrix; No redox features were present, and root material was present throughout the soil matrix. This soil appears hydric and generally meets the hydric soil indicator "Histic Epipedon" (A2) (MCFT 2009).

Table 23: Soil profile for Wetland 5 located on the southwest portion of the Project area.

				Redox Features				
Depth (cm)	**Horizon**	**Matrix Munsell**	**%**	**Mottle Munsell**	**% Mottle**	**Type[1]**	**Loc[2]**	**Texture/Von Post**
0-8	Of4	7.5 YR 2.5/2	100					Fibric – weakly decomposed
8-13	Om6	10YR 2/2	100					Mesic – strongly decomposed
13+	A	2.5Y 4/1	80	7.5YR5/8	20	C	PL	Clay loam

1Type: C-concretion, D - depletion, RM - reduced matrix, CS - covered or coated sand. 2 Locations: PL - pore lining, M – matrix; No redox features were present, and root material was present throughout the soil matrix. This soil appears hydric and generally meets the hydric soil indicator "Histic Epipedon" (A2) (MCFT 2009).

Wetland 1 at the outlet of Mackenzie Lake is currently a littogenous hydrologic regime, influenced by the lake level. However, this may be somewhat artificial as a beaver dam controls the downslope extent of the wetland and is currently flooding some of the area back to the lake. However, despite the current hydrologic regime, it is likely that the footprint of the Wetland 1 is not significantly different that it has been over the long term, as evidenced by minimal die back of trees and stressed vegetation along the perimeter. Some tree species are dying along the former channel area of MacKenzie Brook where it first exits the Lake, as this area is currently flooded to a depth of >1m by the beaver dam.

Photo 11. Wetland 1 at outlet of MacKenzie Lake

It is anticipated that the existence of the wetlands on the height of the north mountain is due primarily to a very shallow soil layer over impermeable basalt bedrock that is visible at the surface in many outcrops around the area.

All of the wetland areas are treed bog or treed swamp with minimal classification diversity. However, some of the wetlands are hardwood dominated while others are softwood dominated. The uniform nature of tree cover is often accompanied by limited sapling and shrub layers. Some of the swamp areas have a more prolific herb stratum, particularly of forbs. The bog areas are dominated primarily by moss groundcover.

The characteristics of the wetland systems encountered within the Project boundaries were similar in the following respects:

- Soils display evidence of either periodic or sustained saturation;
- It is expected that the recharge wetlands within the Project boundaries, the surrounding lands watershed complex, and the surface topography contribute to the aquifer quality throughout the region. None of the encountered wetland areas are expected to contribute to aquifer water quality to a greater extent than surrounding areas;
- No water supplies are withdrawn from the wetlands;
- The quality and quantity of vegetation surrounding the wetlands (generally speaking) provide limitations to erosion potential of surrounding lands into the watershed system. Encountered wetlands do not appear to provide erosion control as a function;
- The quantity of vegetation, the low slopes surrounding the wetlands, and the lack of distinguishable flow channels which directly influence water levels suggests that sediment flow to the wetlands are limited and sediment flow stabilization is not a significant characteristic of the wetlands encountered;
- During periods of low precipitation, the wetlands provide nutrient supplies to dependent wildlife. Wildlife indicators around assessed wetlands (i.e. tracks, browse utilization,

visible sightings) suggest that the habitat is an integral requirement of species in the area. Vegetation is consistent with neighbouring wetland areas and as such the wetlands do not appear to provide regionally or locally unique habitat;

- The wetlands are a contributing factor to the extensive ecosystem complex associated with the Project area. The contributions of the wetlands to the ecosystem appear isolated geographically due to topography and the wetlands do not support the surrounding ecosystem, but form an integral portion of the system;
- Based upon the results of the public consultation and field assessments, there is no evidence to suggest that any social/commercial/or cultural values are influenced by the wetlands encountered.

i. Effects of the Project

Potential impacts to the wetland systems may result from construction, operation and maintenance of the Project that may result in infilling, encroachment by roads or turbine sites, and removal of vegetation within wetland areas. However, based upon the characteristics of wetlands within the Project area, a reasonable expectation of effects that may be anticipated would be limited to vegetation removal/alteration, wildlife displacement and effects to drainage.

There is a low likelihood of contamination as the Project requires minimal use of gasoline, diesel, motor oil, and hydraulic oil, all of which is contained according to appropriate regulations. No vehicles transporting large volumes of TDS regulated goods will be present.

As previously indicated above, soils were assessed at two Project locations for which wetland alterations were considered in order to access proposed turbine locations. In these cases, the *Activities Designation Regulations* (July 20, 2007) require than an approval be obtained from NSDOE for any activity that would result in alteration of a wetland.

ii. Mitigation

Once all wetlands were identified, subsequent access road routing and final turbine site selection was made in order to avoid wetlands and maintain a minimum 30m setback wherever feasible within the other constraints posed by the project.

The 30m minimum setback could not be achieved at Turbine 7 due to project constraints. The footprint for this turbine extends to less than 30m from the edge of wetlands 1 and 14. The distance between these two wetlands is slightly more than 60m and the turbine location is centered between the wetlands. However, in order to build the foundation and clear vegetation for installation activities, an area within 30m of the wetlands will be cleared. Turbine 7 had originally been sited and a building permit issued for a location within wetland 1. Mitigation measures moved this turbine to the current proposed location, which is constrained by the existing wetlands and other development constraints, as the best alternative location.

The second project location for which a 30m minimum setback could not be achieved due to property constraints exists at wetland 2. At this location a small wetland area will be unavoidably altered by road construction. The Provincial "No Net Loss" policy will be maintained through the Wetland Alteration Approval process for the small wetland alteration proposed to Wetland 2. Expansion of the existing wetland at a 3:1 ratio has been proposed as compensation for this unavoidable alteration. Neighbouring landowners were approached for alternate road routing to avoid Wetland 2. Agreement with one landowner was reached that reduced the alteration but a second was not interested in being involved in the project so the alteration could not be fully mitigated.

The application for approval for alteration of the two encountered wetlands will undergo a review and evaluation by the Department of Environment.

As a function of the wetland alteration application, a mitigative sequence approach will be used. This is a step-wise approach that achieves wetland conservation through the application of a hierarchical process of alternatives as follows:

a. avoidance of impacts;
b. minimization of unavoidable impacts; and
c. compensation for residual impacts that cannot be minimized.

p. Groundwater

The Project area is underlain by bedrock of the North Mountain Formation. This bedrock formation consists of tholeiitic plateau basalt rock (NSDNR 2000). Details associated with the groundwater resource in the Project area were identified through a review of the NS well logs database (NSDNR- http://www.gov.ns.ca/nse/groundwater/welldatabase.asp). This database provides information on more than 100,000 water wells in the province, including information on well locations, geology and well construction, well depth and yield. A search of this database was completed for the Hampton area in Annapolis County. A total of 68 well logs were available for review. General conclusions relating to the groundwater resource in the Project area were derived from this information.

The geology of the Project area was described from the drilling processes as consisting of red clay with minor rock and gravel overlying black basalt rock. The average depth to bedrock based on drilling data was between 10-15 feet. Wells appeared to be drilled to an average depth of 255 feet below grade, and were constructed as 6 inch wells with standard 20 feet depths of casing. Information provided on depth of water bearing fractures during drilling activities indicated that the average depth to the shallowest water bearing fractures was approximately 145 feet below grade. Static water levels were not always recorded in the well logs, but information that was provided indicated an average static depth to water of 85 feet. A general review of water yields for these wells indicated an average yield of approximately 13 imperial gallons per minute (igpm).

i. Effects of the Project

The proposed Project is not expected to impact the groundwater resources in the area. No drilling or blasting will be completed into the bedrock at depths where the water bearing fractures have been identified, or at depths where static levels of groundwater have been recorded.

ii. Mitigation

As no effects to groundwater are expected, no mitigation will be integrated.