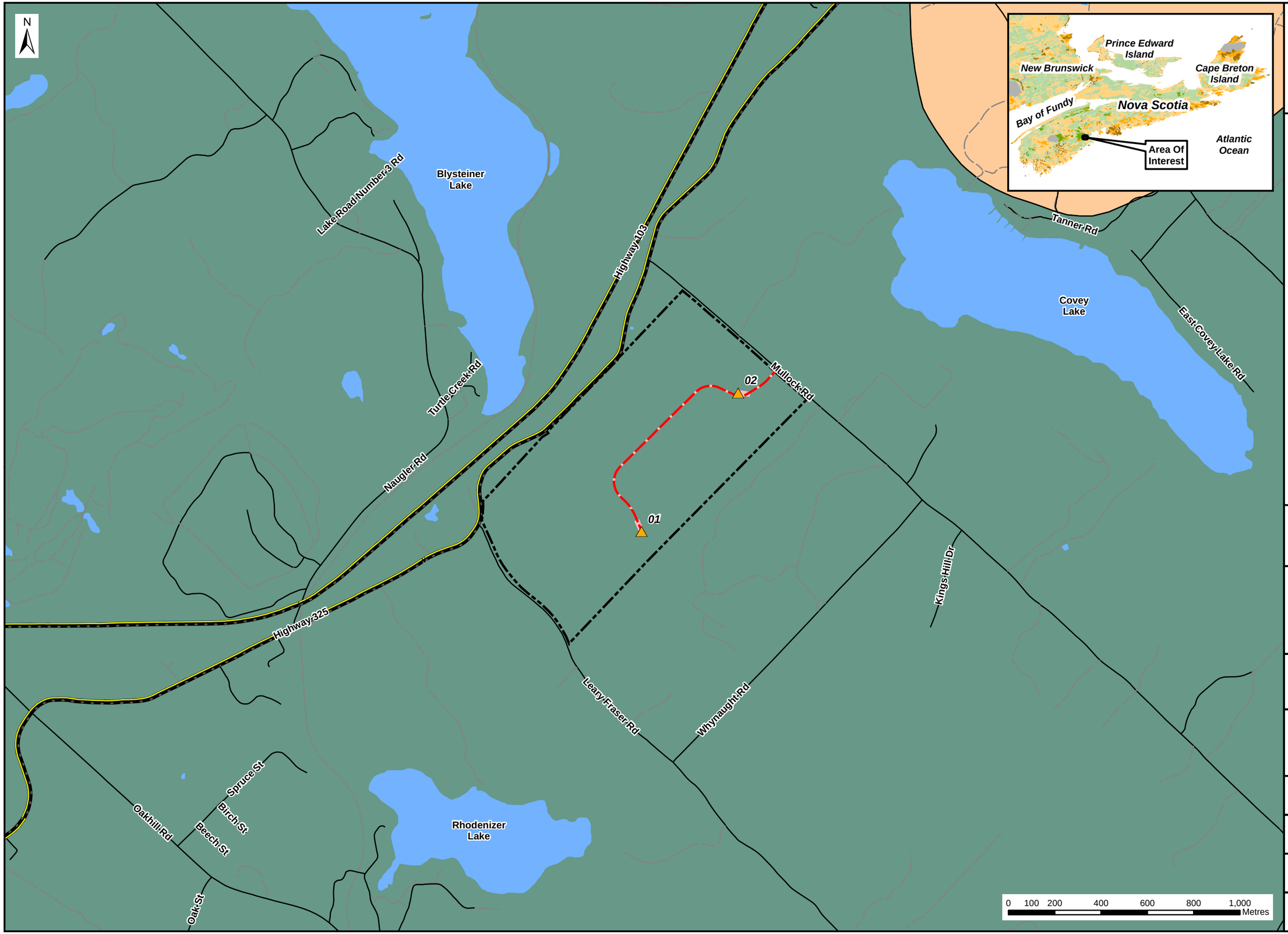

Notes:

1. Reference: Nova Scotia Department of Natural Resources (NS DNR), Minerals and Energy Branch. Map ME 2000-1, Geological Map of the Province of Nova Scotia, Compiled by J. D. Keppie.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Proposed Turbine
- Proposed Access Road
- Permanent Disturbance Area
- Project Site Boundary
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Water Bodies

Bedrock Geology By Formation

- Halifax Formation
- Green Bay Formation

Bedrock Geology

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Scale: 1:15,000	Drawing #: **8.2**
Drawn By: H. Serhan	
Checked By: M. Smith	

8.2.4 Hydrogeology and Groundwater

Groundwater Quantity

Water supplies near the Project site are generally derived from individually drilled or dug wells with a municipal water supply servicing the Town of Bridgewater. A summary of the pertinent (within 2 km of the Project site) well properties included in NSE Well Log Database (NSE 2011a) is presented in Table 8.1.

Table 8.1: Summary of Drilled Well Records

	Drilled Date (yr)	Well Depth (m)	Casing Length (m)	Estimated Yield (Lpm)	Water Level (m)	Overburden Thickness (m)	Water Bearing Fractures (m)
Minimum	1965	15.22	3.04	2.3	0.91	0.61	9.1
Maximum	2009	114.2	42.6	454	30.5	37.2	89.9
Average	1987	48.0	16.7	41.0	9.4	14.8	36.7
Geomean	1987	44.0	12.5	24.6	5.4	9.1	30.5
Number of well records	43	43	43	43	29	35	17

Source: NSE 2011a

Based on short term driller's estimates for the wells in Table 8.1, the average yield is approximately 41.0 Lpm (10.8 gpm) and average well depth is approximately 48.0 m (157.4 ft). These measurements represent very short term yields estimated by the driller at the completion of well construction. Fracture depths ranged from 9.1 m (29.8 ft) to 89.9 m (294.9 ft). The closest drilled well to the Project site is located on Leary Fraser Road, approximately 750 m from the nearest turbine location.

The NSDNR Pump Test Database (NSDNR 2011) provides longer term yields for select wells throughout the province. Three regional wells were drilled through slate bedrock of the Halifax Formation and are located within a 10 km radius of the Project site. Long term safe yields (Q_{20}) ranged from 12.3 liters per minute (Lpm) (3.2 gallons per minute) to 120.9 Lpm (31.9 gpm), and apparent transmissivity (T) values of 0.4 and 12.4 m^2/d. Storativity values were not available from the two pump tests.

Well 077 of the NSE Groundwater Observation Network (NSE 2011b) is located in West Northfield, Lunenburg County, approximately 10.3 km northwest of the Project site. This observation well was drilled to a depth of 48.8 m through slate bedrock of the Halifax Formation. A 5-hour pumping test revealed a transmissivity of 0.44 m^2/day, hydraulic conductivity of $1.44x10^{-2}$ m/day and an estimated safe yield of 10.53 m^3/day (1.6 gpm). This well has been monitored since May 2008. Average water level elevations since monitoring began is 49.6 m above sea level, with annual water level fluctuations of 1.92 m.

Groundwater Quality

Water quality within the Halifax Formation bedrock can be expected to contain significant amounts of manganese and tend to contain sulphide bearing minerals (Fracflow 2004). Significant concerns for groundwater quality are associated with areas of mineralization. Gold deposits are associated with

arsenopyrite mineralization, a natural risk of arsenic in groundwater. All other parameters typically meet the Guidelines for Canadian Drinking Water Quality (GCDWQ) (Health Canada 2012).

Mitigation measures for potential effects to the geophysical environment are provided in Section 4.0.

8.3 Freshwater Environment

The Project site lies within the Lahave Drumlins Ecodistrict, which is part of the Western Ecoregion (Neily *et al*. 2003). A defining feature of this ecodistrict is the drumlinized till plain that slopes in a southwesterly direction towards the Atlantic Ocean. Lakes are common in this ecodistrict with wetlands often found between drumlins and adjacent to meandering streams (Webb & Marshall 1999). The total freshwater area in the ecodistrict is 27,624 ha, representing 10.1% of its area (Neily *et al*. 2003).

The Project site lies within the Lahave River primary watershed, which encompasses an area of approximately 1,700 km^2 and provides diverse habitats for both freshwater and anadromous fish species. Originating in Annapolis County, the Lahave River flows south through the communities of New Germany, Cookville, and Bridgewater before emptying into the Atlantic Ocean. Prominent water bodies in the Lahave River Watershed include Blysteiner Lake, Wentzells Lake, Hirtle Lake, Sherbrooke Lake, Big Lahave Lake and Lake Torment.

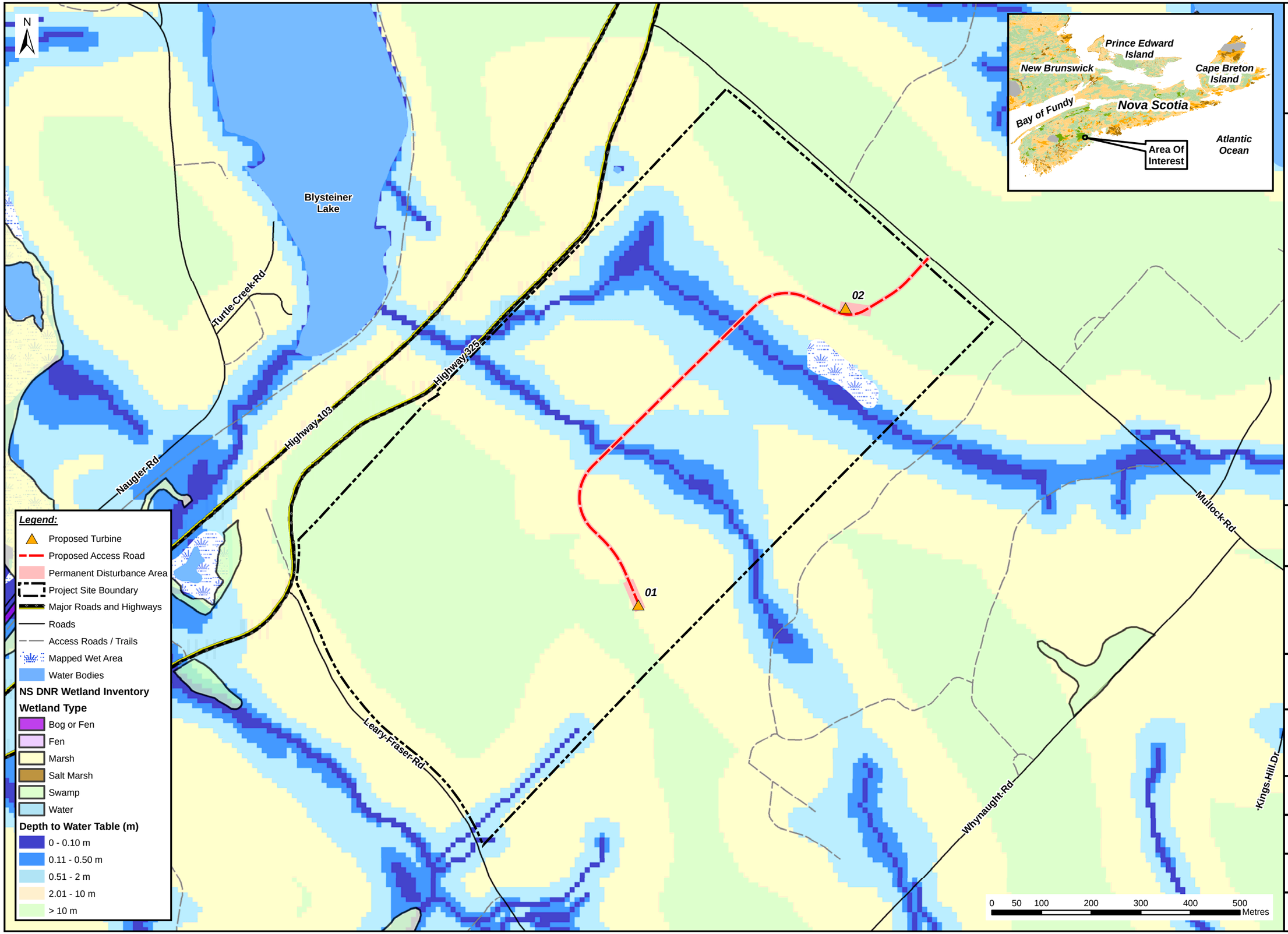
The closest water bodies to the Project site are Covey Lake (600 m northeast), Blystiener Lake (200 m northwest), and Rhodenizer Lake (670 m southwest). A total of twenty two lakes within Lunenburg County are included in the Nova Scotia Lake Inventory Program (NSLIP), which determines the baseline biophysical attributes of lakes throughout the province. Data from the three surrounding lakes mentioned above were reviewed from sampling events completed between 1984 and 2003 (NSE 2012b).

Water chemistry data results were relatively consistent among the lakes with few apparent observations. Surface dissolved oxygen (DO) levels (guideline >6.0 mg/L), pH levels (guideline 5.0 – 9.0),and secchi disk measurements (guideline >1.2 m) were observed to meet water quality guidelines for the protection of aquatic life (CCME 2009) and recreational use (Health Canada 2009).

No lakes or water bodies are present within the Project site boundaries (Drawing 8.3). However, six small watercourses were identified during field assessments completed in June 2012 (Drawing 8.4). General characteristics for these watercourses are provided in Table 8.2.

Table 8.2 Watercourse Characteristics

Feature ID	Wetted Width (m)	Depth (cm)		Substrate	Drainage Direction
		Observed	Bankfull		
Watercourse 1	2	10	25	100% organic muck and fines	Northwest to southeast
Watercourse 2	2 to 4	15	30	Cobble: 30%; Gravel: 50%; Fines: 20%	Northwest to southeast
Watercourse 3	0.5 to 2	10	20	100% organic muck and fines	South to north
Watercourse 4	1.5 to 4	15	35	Boulders: 10%; Cobble: 40%; Gravel: 20%; Oranic fines: 30%	East to west
Watercourse 5	2	10	25	100% organic muck and fines	East to west
Watercourse 6	1 to 1.5	10	35	Cobble: 40%; Gravel: 20%; Fines: 40%	Southeast to northwest



Notes:

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

Wetland and Watercourse Desktop Review Results

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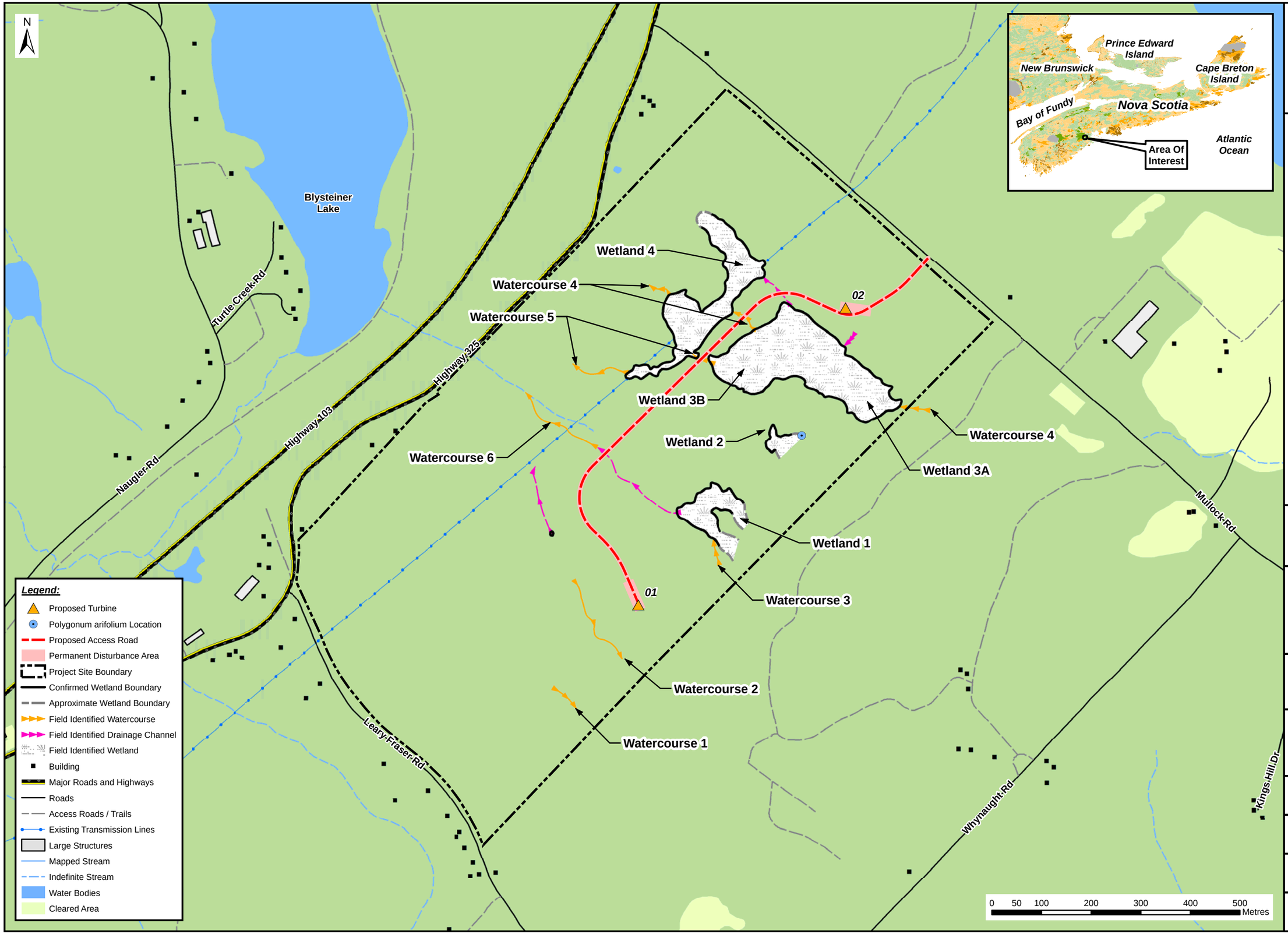
Checked By: M. Smith	



Notes:

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

Wetland and Watercourse Survey Results

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Scale: 1:7000	Drawing #: **8.4**
Drawn By: H. Serhan	
Checked By: M. Smith	

8.3.1 Watercourse Crossings

Based on the current Project layout, three watercourse crossings (watercourses 4, 5 and 6) are expected along the proposed access road. Turbine footprints are not expected to impact watercourses based on the proposed layout.

8.3.2 Fish and Fish Habitat

For the purposes of the EA, all watercourses on the Project site have been assumed to be 'fish bearing' and shall be treated as such throughout site development plans.

A report completed by the Bluenose Coastal Action Foundation (BCAF), identified suitable locations within Lunenburg County, including lakes within the LaHave River, for introduction of Atlantic whitefish (*Coregonus huntsmani*). The assessment included an inventory of fish species present in the lakes assessed. Two lakes located within the vicinity of the Project site were assessed in this study: Blysteiner Lake and Rhodenizer Lake (BCAF 2006). Table 8.3 lists the fish species observed during the sampling events at each of the two lakes.

Table 8.3 Fish Species Identified in Blysteiner and Rhodenizer Lakes

Lake	Sampling Date	Sampled Fish Species	Stocking History
Blysteiner	10/10/1984	• American eel (*Anguilla rostrata*) • banded killfish (*Fundulus diaphanous*) • smallmouth bass (*Micropterus dolomieu*) • white perch (*Morone Americana)*	Brook Trout - 1991
Rhodenizer	05/06/1991	• American eel, • banded killfish, • smallmouth bass, • white perch, • brook trout (*Salvelinus fontinalis*), • brown bullhead (*Ameiurus nebulosus*), • common shiner (*Luxilus cornutus*), • lake chub (Couesius plumbeus), • white sucker (*Catostomus commersonii*), • yellow perch (*Perca flavescens)*	n/a

Source: Bluenose Coastal Action Foundation 2006

In addition to the above listed fish species, a review of the Atlantic Canada Conservation Data Center (ACCDC) database for fish species recorded within a 100 km radius of the Project site was completed. All species, including status rankings, are provided in Table 8.4.

Table 8.4: Fish Species Recorded within a 100 km radius of the Project site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Atlantic salmon	*Salmo salar*	No Status	Not Listed	Special Concern	Red
Atlantic salmon Inner Bay of Fundy Pops	*Salmo salar*	Endangered	Not Listed	Endangered	Red
Atlantic sturgeon	*Acipenser oxyrinchus*	Not Listed	Not Listed	Threatened	Red
Atlantic whitefish	*Coregonus huntsmani*	Endangered	Endangered	Endangered	Red
Striped bass	*Morone saxatilis*	No Status	Not Listed	Threatened	Red

Source: ACCDC 2011

[1] Government of Canada 2012; [2] NS *ESA* 2007; [3] COSEWIC 2012; [4]NSDNR 2010

Fish species recorded within a 100 km radius of the Project site were screened against the criteria outlined in the document "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE 2009b) to develop a list of priority species (e.g. SOCI), which are assessed further as a VEC.

In the context of this EA, SOCI include those that are:

- Listed under *SARA* as "Endangered", "Threatened", or "Special Concern";
- Listed under the NS *ESA* as "Endangered", "Threatened", or "Vulnerable";
- Assessed by COSEWIC as "Endangered", "Threatened", or "Special Concern"; or
- Assessed by NSDNR as "Red" (at risk or may be at risk) or "Yellow" (sensitive).

Priority fish species include:

- Atlantic salmon – "Special Concern" (COSEWIC), "Red" (NSDNR);
- Atlantic salmon (Inner Bay of Fundy population) – "Endangered" (*SARA*), "Endangered" (COSEWIC) "Red" (NSDNR);
- Atlantic sturgeon – "Threatened" (COSEWIC), "Red" (NSDNR);
- Atlantic whitefish – "Endangered" (*SARA*), "Endangered" (NS *ESA*), "Red" (NSDNR); and
- Striped bass – "Threatened" (COSEWIC), "Red" (NSDNR).

Atlantic Salmon

The Atlantic salmon is an anadromous species native to the North Atlantic Ocean and coastal rivers, which undertakes long feeding migrations in the ocean, and returns to freshwater streams to reproduce. The species requires rivers that are clear, cool and well oxygenated, with shallow riffles with gravel, rubble, rock or boulder bottoms for reproduction and the first few years of rearing (Nova Scotia Fisheries and Aquaculture 2007; COSEWIC 2010a).

The Inner Bay of Fundy (IBoF) Atlantic salmon (spawns in those rivers of Nova Scotia and New Brunswick that drain into the Minas Basin and Chignecto Bay (COSEWIC 2010a). None of the on-site watercourses are hydrologically connected to these water bodies; therefore, any Atlantic salmon present at the Project site would not form part of the IBoF population. Atlantic salmon at the Project site would instead be considered part of the NS Southern Uplands population described below.

The LaHave River, located approximately 4 km southwest of the Project site, is known to support a modest population of Atlantic salmon (Southern Uplands pop.) and is hydrologically connected to the watercourses that flow through the Project site. On-site watercourses are ephemeral, with a maximum observed bankfull depth of 35 cm, and are characterized by intermittent surface flow. Although suitable spawning habitat for Atlantic salmon may not be present in the on-site watercourses, these streams may be used during migration or other life stages. Due to the hydrologic connectivity and close proximity to the LaHave River, it cannot be definitively said that the watercourses do not support Atlantic salmon at some life cycle stage.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 14.2.1.

Atlantic Sturgeon

Occurring in rivers and estuaries near North Atlantic shore environments, Atlantic sturgeon has been reported in the Annapolis, Avon, Shubenacadie, St. Croix and LaHave River systems, as well as the Minas Basin (Colligan *et a*l. 1998; COSEWIC 2011). Little is known about the habitat requirements for Atlantic sturgeon at the northern extent of its range, but important freshwater habitats for the species appear to be rivers with access to the sea, preferably with deep channels. Research suggests that the anadromous species spawns in freshwater over hard-bottom substrates at depths of 1-3 m in areas of strong currents, and under waterfalls and in deep pools just above the marine-freshwater demarcation (COSEWIC 2011). Juveniles remain in freshwater for their first summer before migrating to estuaries in winter. Juveniles remain in the freshwater-estuary system for 3 to 5 years before migrating to the near-shore marine environment as adults (NOAA 2006).

In Canada, the species is known to spawn only in two areas, the St. John River and middle St. Lawrence. Small spawning populations are also postulated to exist in the Annapolis, Avon, St. Croix and LaHave systems. Although the on-site watercourses do not provide suitable spawning conditions for the Atlantic Sturgeon, there exists a hydrological connection to the LaHave River, so the species cannot be ruled out at the site.

Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 14.2.1.

Atlantic Whitefish

Atlantic whitefish are a Canadian endemic fish restricted to three lakes in the Petite Riviere watershed (Hebb, Milipsigate and Minamkeak). Though historical populations were anadromous, the remaining population of Atlantic whitefish is considered landlocked and complete their life cycle in the three lakes and connecting streams. Until recently, the lakes have been largely inaccessible to upstream migrants due to a lack of fish passage facilities at Hebbville Dam. Recovery efforts for the

species have included a recently installed (2012) fish ladder at the Hebbville dam, which has shown promise in facilitating fish passage and increasing the species' range for the first time in over a century (Bluenose Coastal Action Foundation 2011; Withers 2012).

A few records of Atlantic whitefish are known from the Petite Rivière watershed outside of the three lakes including Birch Brook, the lower reaches of the Petite Rivière and estuary (Bradford *et al*. 2010 as cited in COSEWIC 2010b), Fancy Lake and the LaHave River estuary (COSEWIC 2010b). Whether Atlantic Whitefish in these areas are remnants of an anadromous population or strays that have passed downstream over the Hebbville Dam is unknown (COSEWIC 2010b).

Habitat requirements for Atlantic Whitefish are not well defined throughout the species' life history, particularly with regards to habitat requirements in the lower reaches of the Petite Rivière (COSEWIC 2010b).

The on-site watercourses are unlikely to provide valuable habitat and do not form part of the Petite Riviere watershed, however they are in close proximity and form part of the adjacent LaHave River watershed. This is an important consideration, in addition to (limited) records of the species in the LaHave estuary, and the uncertainty surrounding habitat requirements.
Potential effects of the Project on this species, as well as proposed mitigation measures, are discussed in more detail in Section 14.2.1.

Striped Bass
Striped bass is an anadromous species typically associated with estuaries and coastal waters, which spawns and over-winters in freshwater and occasionally brackish water. In Nova Scotia, the Annapolis River and the Shubenacadie–Stewiacke River system in the Bay of Fundy historically supported spawning populations (Rulifson and Dadswell 1995). Today, the species is known to spawn only in two rivers in eastern Canada; the Miramichi and the Shubenacadie. Catches have been recorded throughout the province, including Mahone Bay, Minas Basin and Yarmouth County (Rulifson & Dadswell 1995). On-site watercourses are not connected to systems known to support striped bass, so it is therefore unlikely that the species is present at the Project site.

The Project is not expected to have any impact on striped bass and no further consideration of effects and mitigation for specific to this species has been undertaken.

General mitigation measures for aquatic fauna are provided in Section 4.0. Where required, species-specific mitigation is provided in Section 14.

8.4 Terrestrial Habitat

The Lunenburg Drumlins Ecodistrict, which encompasses the Project site, is dominated by coniferous forest, with patches of mixed and hardwood forest occurring in the northwest. Areas of shade-tolerant hardwoods are also found throughout the region (Webb & Marshall 1999). Beech (*Fagus grandifolia*), sugar maple (*Acer saccharum)*, and red oak (*Quercus rubra*) are found, with white pine (*Pinus strobus)* abundant on the lower slopes and valley floors. Black cherry (*Prunus serotina*) is common, while red spruce (*Picea rubens)*, and hemlock (*Tsuga spp*.) are found on moist sites and lower slopes.

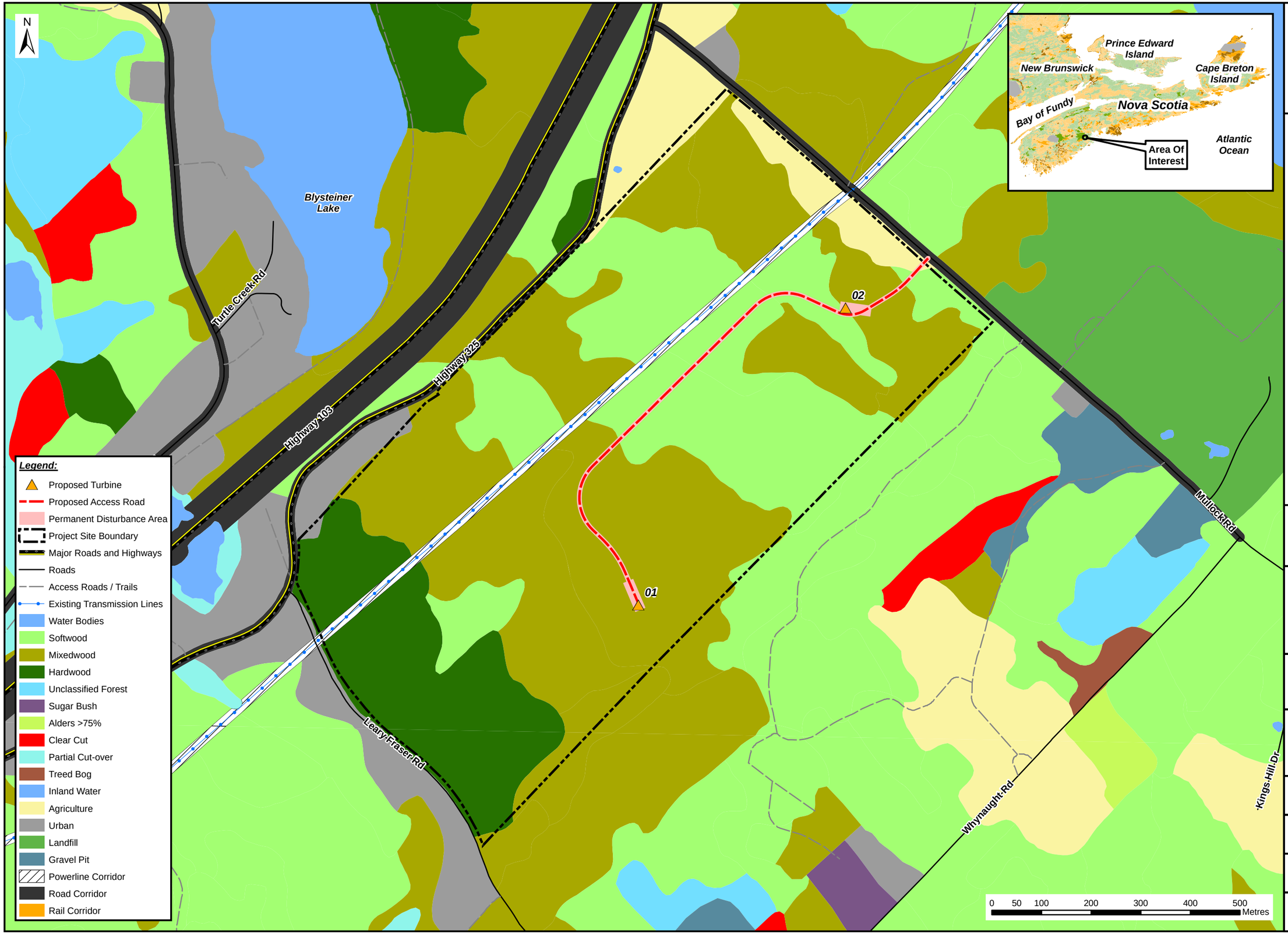
The LaHave River valley is one of the few areas in the Maritimes where white pine can be found in pure stands on abandoned fields on drumlins (Webb & Marshall 1999).

The majority of the Project site is forested, with mixed wood stands as the dominant habitat feature (Table 8.5; Drawing 8.5).

Table 8.5: Habitat Types at the Project Site

Habitat Type	Area (ha)	Percent of Site
Mixed woods	48.7	50%
Softwood	28.25	29%
Hardwood	15.2	15%
Agriculture	3	3%
Power Line Corridor	2.76	3%
Urban	0.16	<1%
Road Corridor	0.1	<1%
Total	**98.17**	**100%**

Source: NSDNR 2012a



Legend:

- Proposed Turbine
- Proposed Access Road
- Permanent Disturbance Area
- Project Site Boundary
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Existing Transmission Lines
- Water Bodies
- Softwood
- Mixedwood
- Hardwood
- Unclassified Forest
- Sugar Bush
- Alders >75%
- Clear Cut
- Partial Cut-over
- Treed Bog
- Inland Water
- Agriculture
- Urban
- Landfill
- Gravel Pit
- Powerline Corridor
- Road Corridor
- Rail Corridor

Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre. Forestry Inventory by Nova Scotia Department Of Natural Resrouces (NS DNR 2011).
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Habitat Cover Type

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Drawn By: H. Serhan	
Checked By: M. Smith	

The Project site is predominantly a conifer forest, including black spruce (*Picea mariana*), red spruce, balsam fir and eastern hemlock (*Tsuga canadensis*). Locally, areas of mixed wood forest intermixing with the above mentioned coniferous species exist and include red maple, paper birch, and American beech hardwood species.

Multiple areas of wetland habitat exist where typical dominant species consist of cinnamon fern herbs and a carpet of sphagnum moss. A small sedge fen was observed where a local lack of trees permitted some sun.

A small powerline right-of-way exists along the northwestern edge of the Project site. Although the area is disturbed, the right-of-way generally exhibits similar habitats as the surrounding forest (conifers and swamps), albeit with a much lower height due to vegetation management associated with maintenance activities.

The Project construction footprint includes a small disturbance area (e.g. road, pad, and laydown area) of approximately 2.95 ha, which represents 2.99% of the total Project site area. Disturbance occurs primarily within mixed wood (67%) and softwood (26%) habitat, with wetland habitat accounting for 3% of the total disturbance area.

The permanent Project footprint, meanwhile, will be reduced due to the reclamation of part of the turbine laydown area used during the construction phase. This measure will reduce the permanent Project footprint to an area of 1.22 ha, representing 1.24% of the Project site.

General mitigation measures for terrestrial habitats are provided in Section 4.0

8.4.1 Wetlands

A desktop identification of the location and extent of potential wetlands across the Project site was completed by reviewing the following information sources:

- Satellite and aerial photography;
- Nova Scotia Wet Areas Mapping database (WAM) (NSDNR 2012b);
- Nova Scotia Geomatics Centre; and
- NS Significant Species and Habitats database (NSDNR 2012c).

Topographic mapping indicates that there is one mapped wetland (swamp) in northeast portions of the Project site (Drawing 8.3). The NS Significant Species and Habitats database identifies two areas of swamp habitat beyond the western Project site boundary, but none located within the site boundaries.

Satellite imagery indicates an open area in the same location as the geomatics identified swamp, further suggesting that that wetland habitat exists in this area. WAM indicates the potential for wetland habitat and/or watercourses to exist in the northeastern half of the Project site, one of which overlaps with the open area observed on the satellite imagery.

Four areas of wetland habitat were observed within the Project site boundaries (Drawing 8.4) during field surveys completed in June and September 2012. The majority of the wetlands are treed swamps that are confined to the northeastern areas of the Project site (Drawing 8.4). These swamps are dominated by black spruce and intermittent red maple tree canopy coverage. The terrain within much of these swamps is comprised of pit and mound undulations, where small (< 5 m^2) areas of upland habitat are present within the wetlands. In some wetlands (Wetlands 1 and 2), the trees and woody shrubs dominated these upland mounds. Ericaceous shrubs, sedges, ferns and bunchberry (*Cornus canadensis*) dominated the composition of shrubs and herbaceous species. Soils are either organic (A1 - Histosol), organic above depleted mineral soils, or depleted sandy soils (A2 – Histic epipedon / A5 – Sandy redox). Surface water run-off and drainage are the primary sources of water to the swamps, and are typically drained by drainage channels or intermittent watercourses.

One herbaceous fen (Wetland 3A) was identified near the northeastern boundary of the Project site (Drawing 8.4). This fen is dominated by cinnamon fern (*Osmunda cinnamomea*) herbs, and sparse ericaceous shrub coverage. Hydric soils (shallow organic over bedrock [A1 – Histosol]), and saturated surfaces with a high water table was observed. Water is supplied via Watercourse 4 from the east, in addition to surface water run-off from the steep slopes to the northeast. This wetland is drained by two watercourses (Watercourses 4 and 5), as well as a drainage channel.

Detailed wetland characterizations are provided in Table C1 (Appendix C).

Turbine siting and access road layout for the Project has been designed to avoid wetland habitat. Therefore, no impacts to wetlands are expected based on the current layout.

8.5 Terrestrial Vegetation

ACCDC records indicate that 275 vascular flora species and 4 nonvascular flora species have been identified within 100 km of the Project site. Of the 275 vascular species identified by ACCDC, 183 SOCI were identified within 100 km of the Project site. This preliminary list was used to develop a short list of plant SOCI that might be present at the Project site. The short list of plant SOCI is provided in Appendix D.

A plant survey was completed on June 27 and September 13, 2012. A complete list of plant species identified during the survey is provided in Appendix D.

One vascular plant SOCI was observed during the plant survey: Halberd-leaf tearthumb (*Polygonum arifolium)* was identified in southeastern portions of Wetland 1 (Drawing 8.4). This species is listed by NSDNR as "Yellow". Yellow-listed species are considered by NSDNR to not be at risk of immediate extirpation or extinction, but may require special attention or protection to prevent them from becoming at risk. This specimen was found in a black spruce swamp with cinnamon ferns and sphagnum moss dominating. An intermittent stream is also present within the wetland. A review of the ACCDC records indicate only a single record for the species at distance of 77 km from the Project site, noted in August 2006. This species is usually found in rich alluvial soils, typically under alders in marshy areas (Zinck 1998).

Halberd-leaf tearthumb was identified over 100 m from the proposed access road and over 270 m from the proposed turbine locations. Therefore, no impacts to this species are expected.

General mitigation measures for potential effects to terrestrial vegetation are provided in Section 4.0.

8.6 Terrestrial Fauna

A review of the NS Significant Species and Habitat Database (NSDNR 2012c) and ACCDC data (ACCDC 2011) for species recorded within a 100 km radius of the Project site was completed. A comparison of habitat mapping data (Section 8.3) to known habitat requirements for species expected to occur within the area, and for all SOCI, was also completed.

Species identified during field studies or that have been recorded within a 100 km radius of the Project site were screened against the criteria outlined in the document "Guide to Addressing Wildlife Species and Habitat in an EA Registration Document" (NSE 2009b) to develop a list of priority species, as presented in the sections that follow.

8.6.1 Mammals

The Nova Scotia Significant Species and Habitat Database (NSDNR 2012c) contains 21 unique species and/or habitat records pertaining to mammals within a 100 km radius of the Project site. These records include:

- Ten that are classified in the database as "Species at Risk" [eight relate to American marten (*Martes americana*) and two relate to Southern flying squirrel (*Glaucomys volans*)].
- Five records that are classified as "Other Habitat" [four relate to American black bear (*Ursus americanus*) and one relates to American beaver (*Castor canadensis*)].
- Four records that are classified as 'Species of Concern", all of which pertain to Fisher (*Martes pennanti*).
- Two records that are classified as "Deer Wintering", which relate to known over-wintering habitat for White-tailed deer (*Odocoileus virginianus*).

There are no records pertaining to terrestrial mammals within a 10 km radius of the Project site.

The ACCDC database (2011) indicates that six species of terrestrial mammals (excluding bats) have been recorded within a 100 km radius of the Project site (Table 8.6).

Table 8.6: Mammal Species Recorded within a 100 km radius of the Project Site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
American marten	*Martes americana*	Not Listed	Endangered	Not Listed	Red
Canada lynx	*Lynx canadensis*	Not Listed	Endangered	Not at Risk	Red
Fisher	*Martes pennanti*	Not Listed	Not Listed	Not Listed	Yellow
Maritime shrew	*Sorex maritimensis*	Not Listed	Not Listed	Not Listed	Green
Mainland moose	*Alces americanus*	Not Listed	Endangered	Not Listed	Red
Southern flying squirrel	*Glaucomys volans*	Not Listed	Not Listed	Not at Risk	Yellow

Source: ACCDC 2011

[1]Government of Canada 2012; [2]NS *ESA* 2007; [3]COSEWIC 2012; [4]NSDNR 2010

Of note is that sightings of many of the most common species are unreported to ACCDC, and are therefore under-represented or absent from the database. Consequently, a review of the ACCDC data reveals predominantly rare or noteworthy species despite the fact that these species certainly represent a small fraction of the existing mammal community in an area.

Field surveys (between February 2012 and March 2013) of mammalian fauna at the Project site consisted of direct observation of individuals, as well as the indirect identification of species by sound and/or sign (e.g. scat, tracks, scent, dens, lodges, etc). Snow-tracking surveys were conducted to search for Mainland moose and other animal sign in January and March 2013. A detailed methodology for snow-tracking surveys is provided in Appendix E.

Table 8.7 lists the mammal species observed/identified at or near the Project site during all field surveys.

Table 8.7: Mammal Species Observed during Field Surveys

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
American black bear	*Ursus americanus*	Not Listed	Not Listed	Not at Risk	Green
American porcupine	*Erethizon dorsatum*	Not Listed	Not Listed	Not at Risk	Green
Common Shrew	*Sorex cinereus*	Not Listed	Not Listed	Not Listed	Green
Eastern coyote	*Canis latrans*	Not Listed	Not Listed	Not Listed	Green
Fisher	*Martes pennant*	Not Listed	Not Listed	Not Listed	Yellow
Racoon	*Procyon lotor*	Not Listed	Not Listed	Not Listed	Green
Red squirrel	*Tamiasciursus hudsonicus*	Not Listed	Not Listed	Not Listed	Green
Snowshoe hare	*Lepus americanus*	Not Listed	Not Listed	Not Listed	Green
White-tailed deer	*Odocoileus virginianus*	Not Listed	Not Listed	Not Listed	Green
Woodland jumping mouse	*Napaeozapus insignis*	Not Listed	Not Listed	Not Listed	Green

[1]Government of Canada 2012; [2]NS *ESA* 2007; [3]COSEWIC 2012; [4]NSDNR 2010

Priority mammal species include:

- American marten – "Endangered" (NS *ESA*), "Red" (NSDNR);
- Canada lynx - "Endangered" (NS *ESA*), "Red" (NSDNR);
- Fisher – "Yellow" (NSDNR);
- Mainland moose – "Endangered" (NS *ESA*), "Red" (NSDNR); and
- Southern flying squirrel – "Yellow" (NSDNR).

American marten

In general, American marten prefers mature, coniferous forests, although mixed-wood forests are also used when specific structural components such as large denning trees and downed-woody debris are present (Scott 2001; Nova Scotia American Marten Recovery Team 2006). Habitat fragmentation, such as that resulting from forestry operations, results in sub-optimal breeding habitat (Scott 2001).

The current known distribution for American marten in Nova Scotia is limited to Cape Breton and the southwestern part of the province, the latter resulting from a reintroduction into Kejimkujik National Park. Although this latter population appears to be centred in Digby, Weymouth, and Yarmouth areas, there have been reports of American marten in Lunenburg County as well (Nova Scotia American Marten Recovery Team 2006). ACCDC records indicate that the closest American marten observation to the Project site was 29 ± 10 km away.

No indication of American marten was observed during field studies at the Project site. Mature mixed-wood and softwood habitat is present throughout the Project site (Drawing 8.5); however, these stands are relatively small in size and are not part of a contiguous forest landscape. Sub-optimal American marten habitat is therefore present at the Project site. Considering the species' habitat requirements and known range in Nova Scotia, it is possible that American marten may occur at the Project site. It is highly unlikely, however, that habitat at the Project site is conducive to establishing a breeding territory. American marten, should they occur at the Project site, would likely represent dispersing individuals in search of permanent territory.

Potential effects of the Project on this species, as well as proposed species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

Canada lynx

Canada lynx typically prefer high elevation softwood stands of varying successional stage, most notably second growth forest following natural or human-induced disturbance, that allow Snowshoe hare (*Lepus americanus*) populations to reach peak densities (Parker *et al*. 1983; Parker 2001). Downed woody debris, such as that associated with older forests, are required for maternal den sites (Nova Scotia Lynx Recovery Team 2006).

The breeding population of Canada lynx in Nova Scotia is limited to the Cape Breton Highlands (Parker 2001; Nova Scotia Lynx Recovery Team 2006). During cyclic lows in Snowshoe hare populations, individual Canada lynx may disperse great distances throughout mainland Nova Scotia. ACCDC data indicate that the closest observation of Canada lynx to the Project site was 17 ± 1 km away.

No indication of Canada lynx was observed during field studies. Mature softwood and mixed-wood forest is present throughout the Project site (Drawing 8.5), which may provide suitable denning habitat for breeding females but likely does not support an adequate Snowshoe hare population. Considering the species' habitat requirements and known range in Nova Scotia, it is highly unlikely that Canada lynx occur at the Project site. Any occurrence of this species would represent a transient individual ranging in search of food during periodic lows in the Snowshoe hare cycle.

The Project is therefore not expected to have any impact on Canada lynx, and no further consideration of effects and mitigation for this species has been undertaken.

Fisher
Fisher prefer dense, mature to old-growth forests with continuous overhead cover (Allen 1983). Generally considered a forest-interior species (OMNR 2000), Fisher require in large tracts of well-connected habitat (Meyer 2007).

Fisher are distributed throughout mainland Nova Scotia, and trapping data suggests population concentrations in Cumberland, Colchester, and Pictou counties (NSDNR 2012d). Approximately 5% of 1,754 Fisher trapped in Nova Scotia between 2000 and 2011 were harvested from Lunenburg County (NSDNR 2012d). ACCDC data indicate that the closest observation of this species to the Project site was 27 ± 10 km away.

Suitable Fisher habitat, including mature softwood and mixed-wood stands with a high degree of canopy closure, is present throughout the Project site (Drawing 8.5). In addition, Fisher tracks were observed on the Project site during snow-tracking surveys in March 2013, verifying that the species does indeed occur at the Project site.

Potential effects of the Project on this species, as well as proposed species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

Mainland moose
Habitat requirements for Mainland moose change throughout the year. Early successional growth, such as that provided by recent cutovers, offers quality foraging habitat for moose, and interspersed wetlands provide suitable summer habitat for cows and calves (Parker 2003; Snaith & Beazley 2004). Mature softwood forest is used as escape cover throughout the year, and also provides thermal relief during the summer months (Broders *et al*. 2012) and relief from deep snows in winter (Telfer 1970).

Five significant concentration areas for Mainland moose have been identified in Nova Scotia (NSDNR 2012e). The Project site is located approximately 23.1 km to the southwest of the closest such area, which encompasses the Halifax peninsula. ACCDC records indicate that the closest observation of this species was 42 ± 10 km away.

No evidence of Mainland moose was observed at the Project site, including during the snow-tracking surveys conducted in January and March 2013. Suitable foraging habitat for Mainland moose at the Project site is limited to the narrow strip of young shrub growth associated with a transmission corridor which bisects the site. Additional escape cover, in the form of mature softwoods, is present in the interior of the Project site (Drawing 8.5). Considering the known concentration areas of Mainland moose in Nova Scotia, as well as the species' ecology (home range, seasonal habitat requirements, etc), there is the potential for this species to occur at the Project site. However, given the site's small size and limited availability of forage habitat, it is unlikely that the Project site would form part of core territory for individual moose. Rather, any Mainland moose occurring at the site would likely be dispersing individuals (i.e., juveniles) in search of a new home range.

Potential effects of the Project on this species, as well as proposed species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

Southern flying squirrel
Southern flying squirrel requires mast bearing trees for forage and tree cavities for nesting and in the Atlantic Region, southern flying squirrels select older forest stands (COSEWIC 2006). In Nova Scotia, the species demonstrates a particular affinity to red oak, which is most commonly found in mixed wood stands as opposed to pure hardwood stands (Lavers 2004).

In Nova Scotia, Southern flying squirrel occur primarily in a region bounded by the South Mountain in the north, Kentville in the east, New Ross in Lunenburg County to the south, and extends to Kejiimkujik National Park in the west (COSEWIC 2006). ACCDC data indicate that the closest observation of this species to the Project site was 49 ± 10 km away.

No indication of Southern flying squirrel was observed during field studies, although the species' nocturnal habits make observations difficult in the absence of targeted surveys. Given that suitable habitat is present and that the known geographic range of the species in Nova Scotia includes Lunenburg County, it is possible that Southern flying squirrel occurs at the Project site. Furthermore, since individual home ranges for Southern flying squirrel are typically less than 10 ha, there is the potential that the Project site includes part or all of a breeding territory for this species.

Potential effects of the Project on this species, as well as proposed species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

8.6.2 Herpetofauna
The Nova Scotia Significant Species and Habitat Database (NSDNR 2012a) contains 62 unique species and/or habitat records pertaining to reptiles and amphibians within a 100 km radius of the Project site. These records include:

- 61 that are classified in the database as "Species at Risk", of which 40 relate to Blanding's turtle (*Emydoidea blandingii*), 12 relate to Wood turtle (*Glyptemys insculpta*), 8 relate to Eastern ribbonsnake (*Thamnophis sauritus*), and 1 relates to Common snapping turtle (*Chelydra serpentina*).
- One record classified as "Species of Concern", which pertains to Wood turtle.

There are no records pertaining to herpetofauna within a 10 km radius of the Project site.

Data from the ACCDC (2011) indicate that four species of terrestrial herpetofauna have been recorded within a 100 km radius of the Project site (Table 8.8).

Table 8.8: Herpetofauna Species Recorded by ACCDC within a 100 km radius of the Project Site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Blanding's turtle	*Emydoidea blandingii*	Endangered	Endangered	Endangered	Red
Eastern ribbonsnake	*Thamnophis sauritus*	Threatened	Threatened	Threatened	Red
Four-toed salamander	*Hemidactylium scutatum*	Not Listed	Not Listed	Not at Risk	Green
Wood turtle	*Glyptemys insculpta*	Threatened	Vulnerable	Threatened	Yellow

Source: ACCDC 2011
[1]Government of Canada 2012; [2]NS *ESA* 2007; [3]COSEWIC 2012; [4]NSDNR 2010

The same data limitations and interpretations as noted for the mammalian fauna (Section 8.6.1) are also applicable to the reptile and amphibian data.

Field surveys of amphibian and reptile species were conducted in conjunction with other surveys between March 2012 and January 2013. Species were either identified directly through visual observation, or indirectly using other evidence (e.g. calls, egg masses, tadpoles). Table 8.9 lists the amphibian and reptile species identified at or near the Project site during field surveys.

Table 8.9: Herpetofauna Species Recorded During Field Surveys

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Northern leopard frog	*Lithobates pipiens*	Not Listed	Not Listed	Not at Risk	Green
Wood frog	*Lithobates sylvaticus*	Not Listed	Not Listed	Not Listed	Green

[1]Government of Canada 2012; [2]NS *ESA* 2007; [3]COSEWIC 2012; [4]NSDNR 2010

Priority herpetofauna species include:

- Blanding's turtle – "Endangered" (*SARA*), "Endangered" (NS *ESA*), "Red" (NSDNR);
- Common snapping turtle – "Special Concern" (*SARA*);
- Eastern ribbonsnake – "Threatened" (*SARA*), "Threatened" (NS *ESA*); "Red" (NSDNR); and
- Wood turtle – "Threatened" (*SARA*), "Vulnerable" (NS *ESA*), "Yellow" (NSDNR).

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

Blanding's turtle
Blanding's turtle make use of a variety of wetland habitats including lakes, ponds, brooks, creeks, and marshes (COSEWIC 2005), and are closely associated with areas of extensive beaver activity (TBTRT 2012). Research conducted in Kejimkujik Park suggests that nesting occurs predominantly on lakeshore cobble beaches (Standing *et al*. 1999).

The known range of this species in Nova Scotia is restricted to the southwestern interior of the province where there are five disjunct populations within the Medway, Mersey, and Sissiboo River watersheds (TBTRT 2012). The Project site is located less than 25 km from the nearest known concentration area (TBTRT 2012), while ACCDC data indicate that the closest observation of this species to the Project site was 38 km away.

No indication of Blanding's turtle was observed during field studies. Watercourses and wetlands at the Project site do not appear to represent optimum habitat, as they lack key features typically required for summering, over-wintering, and nesting. Notwithstanding these habitat deficiencies, individual Blanding's turtles are known travel extensively over-land to access suitable habitat (TBTRT 2012), so it is possible that the Project site may encompass a travel route for Blanding's turtles attempting to access suitable habitat. It is unlikely, however, that a home range for Blanding's turtle would be established at the Project site.

Potential effects of the Project on this species, as well as proposed species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

Common snapping turtle
Common snapping turtle, despite its conservation status, is considered relatively common in mainland Nova Scotia (Davis & Browne 1996). Snapping turtle habitat is usually associated with slow moving water of moderate depth, with a muddy bottom and dense vegetation. Established populations are typically found in ponds, lakes and river edges (COSEWIC 2008).

The species has a widespread distribution across mainland Nova Scotia, including in the Bridgewater area (COSEWIC 2008), although ACCDC records do not include any observations of Common snapping turtle within 100 km of the Project site.

No indication of Common snapping turtle was observed during field studies. Furthermore, the Project site lacks key habitat features for this species, including open water bodies and slow moving rivers. It is therefore unlikely that Common snapping turtle occur at the Project site.

The Project is not expected to have any impact on Common snapping turtle, and no further consideration of effects and mitigation for this species has been undertaken.

Eastern ribbonsnake
Eastern ribbonsnake is a semi-aquatic species associated with a variety of freshwater habitats (COSEWIC 2002). Common habitats in which populations have been identified include slow flowing wetlands with abundant vegetation, which can include fens, meadow streams, lake coves, and shorelines. Eastern ribbonsnake often occurs in association with beaver activity (Parks Canada Agency 2012).

In Nova Scotia, concentrations of Eastern ribbonsnake are thought to be limited to interior portions of the Mersey, Medway, and LaHave River watersheds in the southwestern region of the province (Parks Canada Agency 2012), although recent discoveries have expanded the known range of this species to include the Petite Rivière watershed (Gilhen *et al*. 2012). These most recent records are located less than 15 km from the Project site, while ACCDC data indicate that the closest observation of this species to the Project site was 24 km away.

No indication of Eastern ribbonsnake was observed during field studies. The Project site generally lacks open water wetlands, but a fen located in the northern portion of the Project site may represent suitable Eastern ribbonsnake habitat (Drawing 8.5). Considering the proximity of the Project site to the known range of the species, and the presence of suitable fen habitat, it is somewhat likely that the Project site forms part of a home range for individual/groups of Eastern ribbonsnake.

Potential effects of the Project on this species, as well as proposed species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

Wood turtle
Wood turtle requires three key habitat components: a watercourse, sandy substrate for nesting, and a forested area for thermal relief during the summer months (MacGregor and Elderkin 2003).

The species is found throughout the province but seems to be most abundant in central Nova Scotia, although a small population is present in the LaHave River watershed (MacGregor and Elderkin 2003). ACCDC data indicate that the closest observation of this species to the Project site was 21 ± 10 km away.

No indication of Wood turtle was observed during field studies. However, suitable watercourse and associated riparian habitat is present at the Project site (Drawing 8.5). Watercourse characteristics, meanwhile, do not appear to be conducive to nesting as they lack exposed sandy/gravelly areas (MacGregor and Elderkin 2003). However, the presence of watercourse and riparian habitat means that it is possible that Wood turtle occur at the Project site, particularly during the spring and summer months.

Potential effects of the Project on this species, as well as proposed species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

8.6.3 Butterflies and *Odonates*
The Nova Scotia Significant Species and Habitats (NSDNR 2012c) database identifies three significant habitat features relating to butterflies and Odonates within a 100 km radius of the Project site:

- Two of these records are classified in the database as “Other Habitat” and pertain to Hoary elfin (*Callophrys polios*) and Sphagnum sprite (*Nehalennia gracilis*).
- One record is classified as “Species of Concern”, relating to Jutta arctic (*Oeneis jutta*).

The database contains no records of butterflies or *Odonates* within a 10 km radius of the Project site.

The ACCDC database contains records of 49 unique taxa of butterfly and *Odonates* within a 100 km radius of the Project site (Table 8.10).

Table 8.10: Unique Butterfly and Odonate Species Recorded within a 100 km radius of the Project Site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Aphrodite fritillary	*Speyeria Aphrodite*	Not Listed	Not Listed	Not Listed	Green
Baltimore checkerspot	*Euphydryas phaeton*	Not Listed	Not Listed	Not Listed	Green
Banded hairstreak	*Satyrium calanus*	Not Listed	Not Listed	Not Listed	Undetermined
Bog elfin	*Callophrys lanoraieensis*	Not Listed	Not Listed	Not Listed	Red
Bronze copper	*Lycaena hyllus*	Not Listed	Not Listed	Not Listed	Green
Brook snaketail	*Ophiogomphus aspersus*	Not Listed	Not Listed	Not Listed	Red
Clamp-tipped emerald	*Somatochlora tenebrosa*	Not Listed	Not Listed	Not Listed	Green
Common roadside-	*Amblyscirtes vialis*	Not Listed	Not Listed	Not Listed	Green

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
skipper					
Compton tortoiseshell	*Nymphalis l-album*	Not Listed	Not Listed	Not Listed	Green
Delicate emerald	*Somatochlora franklini*	Not Listed	Not Listed	Not Listed	Yellow
Eastern comma	*Polygonia comma*	Not Listed	Not Listed	Not Listed	Not Listed
Eastern pine elfin	*Callophrys niphon*	Not Listed	Not Listed	Not Listed	Green
Ebony boghaunter	*Williamsonia fletcheri*	Not Listed	Not Listed	Not Listed	Red
Elfin skimmer	*Nannothemis bella*	Not Listed	Not Listed	Not Listed	Green
Forcipate emerald	*Somatochlora forcipata*	Not Listed	Not Listed	Not Listed	Red
Gray comma	*Polygonia progne*	Not Listed	Not Listed	Not Listed	Green
Gray hairstreak	*Strymon melinus*	Not Listed	Not Listed	Not Listed	Green
Green comma	*Polygonia faunus*	Not Listed	Not Listed	Not Listed	Green
Greenish blue	*Plebejus saepiolus*	Not Listed	Not Listed	Not Listed	Not Listed
Harlequin darner	*Gomphaeschna furcillata*	Not Listed	Not Listed	Not Listed	Yellow
Harvester	*Feniseca tarquinius*	Not Listed	Not Listed	Not Listed	Green
Henry's elfin	*Callophrys henrici*	Not Listed	Not Listed	Not Listed	Green
Hoary elfin	*Callophrys polios*	Not Listed	Not Listed	Not Listed	Green
Jutta arctic	*Oeneis jutta*	Not Listed	Not Listed	Not Listed	Red
Juvenal's duskywing	*Erynnis juvenalis*	Not Listed	Not Listed	Not Listed	Green
Kennedy's emerald	*Somatochlora kennedyi*	Not Listed	Not Listed	Not Listed	Red
Lance-Tipped darner	*Aeshna constricta*	Not Listed	Not Listed	Not Listed	Green
Laurentian skipper	*Hesperia comma*	Not Listed	Not Listed	Not Listed	Green
Maine snaketail	*Ophiogomphus mainensis*	Not Listed	Not Listed	Not Listed	Red
Milbert's tortoiseshell	*Aglais milberti*	Not Listed	Not Listed	Not Listed	Green
Monarch	*Danaus plexippus*	Special Concern	Not Listed	Special Concern	Yellow
Mottled darner	*Aeshna clepsydra*	Not Listed	Not Listed	Not Listed	Green
Mustard white	*Pieris oleracea*	Not Listed	Not Listed	Not Listed	Yellow
Northern pearly-eye	*Lethe anthedon*	Not Listed	Not Listed	Not Listed	Green
Ocellated darner	*Boyeria grafiana*	Not Listed	Not Listed	Not Listed	Yellow
Orange bluet	*Enallagma signatum*	Not Listed	Not Listed	Not Listed	Red
Prince baskettail	*Epitheca princeps*	Not Listed	Not Listed	Not Listed	Yellow
Quebec emerald	*Somatochlora brevicincta*	Not Listed	Not Listed	Not Listed	Red
Question mark	*Polygonia interrogationis*	Not Listed	Not Listed	Not Listed	Green
Riffle snaketail	*Ophiogomphus carolus*	Not Listed	Not Listed	Not Listed	Green
Rusty snaketail	*Ophiogomphus rupinsulensis*	Not Listed	Not Listed	Not Listed	Red
Salt and pepper skipper	*Amblyscirtes hegon*	Not Listed	Not Listed	Not Listed	Green
Satyr comma	*Polygonia satyrus*	Not Listed	Not Listed	Not Listed	Yellow
Seaside dragonlet	*Erythrodiplax berenice*	Not Listed	Not Listed	Not Listed	Yellow
Silvery checkerspot	*Chlosyne nycteis*	Not Listed	Not Listed	Not Listed	Undetermined
Skillet clubtail	*Gomphus ventricosus*	Not Listed	Not Listed	Not Listed	Red
Striped hairstreak	*Satyrium liparops*	Not Listed	Not Listed	Not Listed	Undetermined
Taiga bluet	*Coenagrion resolutum*	Not Listed	Not Listed	Not Listed	Red
Vesper bluet	*Enallagma vesperum*	Not Listed	Not Listed	Not Listed	Yellow

Source: ACCDC 2011

[1]Government of Canada 2012; [2]NS *ESA* 2007; [3]COSEWIC 2012; [4]NSDNR 2010

No incidental observations of butterflies were made during other field surveys conducted at the Project site in summer 2012.

Priority butterfly and *Odonate* species include:

- Bog elfin – "Red" (NSDNR);
- Brook snaketail – "Red" (NSDNR);
- Delicate emerald – "Yellow" (NSDNR);
- Ebony boghaunter – "Red" (NSDNR);
- Forcipate emerald – "Red" (NSDNR);
- Harlequin darner – "Yellow" (NSDNR);
- Jutta arctic – "Red" (NSDNR);
- Kennedy's emerald – "Red" (NSDNR);
- Maine snaketail – "Red" (NSDNR);
- Monarch – "Special Concern" (*SARA*), "Special Concern" (COSEWIC), "Yellow" (NSDNR);
- Mustard white – "Yellow" (NSDNR);
- Ocellated darner – "Yellow" (NSDNR);
- Orange bluet – "Red" (NSDNR);
- Prince baskettail – "Yellow" (NSDNR);
- Quebec emerald – "Red" (NSDNR);
- Rusty snaketail – "Red" (NSDNR);
- Satyr comma – "Yellow" (NSDNR);
- Seaside dragonlet – "Yellow" (NSDNR);
- Skillet clubtail – "Red" (NSDNR);
- Taiga bluet – "Red" (NSDNR); and
- Vesper bluet – "Yellow" (NSDNR).

Monarch

Only the Monarch has been granted a designated conservation status at either the provincial or federal level. This species can be found in open-habitats with abundant wildflower growth. Milkweed (*Asclepias* sp.) is a critical element of breeding habitat, whereas asters (*Asteraciae* sp.) and goldenrods (*Solidago* sp.) provide necessary food resources during migration (Mersey Tobeatic Institute 2008).

Nova Scotia falls within the breeding range of this migratory species (COSEWIC 2010c), and individuals can be found throughout the province from May to October (Maritime Butterfly Atlas 2012).

No indication of Monarch was observed during field surveys. Furthermore, open habitat is limited at the Project site, except in the extreme northern portion of the site along Mullock Road (Drawing 8.5). However, considering the widespread distribution of the species in Atlantic Canada, it is possible that Monarch occurs at the Project site, particularly during the migratory period (late summer/early fall). However, it is unlikely that the Project site provides sufficient nectar resources to support a large congregation of migratory Monarchs.

Potential effects of the Project on this species, as well as proposed species-specific mitigation measures, are discussed in more detail in Section 14.2.1.

The requirements as set out in *SARA* and *NSESA* will be adhered to for Project activities. Additional general mitigation measures for terrestrial fauna are provided in Section 4.0. Where required, species-specific mitigation is provided in Section 14.

8.7 Avifauna

The majority of the Project site is forested with mixed wood and softwood forest being most prevalent. Other habitat types including agriculture, power line corridor, urban, and road corridor are also present in varying amounts throughout the Project site. The diversity of habitat types provides foraging, breeding, and roosting habitat for a variety of resident and migratory bird species. Baseline information was utilized to gain insight into protected avifauna habitats, species utilization of the area, and to identify SOCI potentially occurring at or near the Project site

The closest Important Bird Area (IBA) (IBA Canada 2012) is the South Shore – East Queens County Sector IBA located approximately 16.4 km to the south of the Project site. This site encompasses several sandy beaches which are preferred nesting sites for endangered Piping Plovers (*Charadrius melodus*). In addition, thousands of shorebirds including Semipalmated Plovers (*Charadrius semipalmatus*) and Sanderlings (*Calidris alba*) visit this shoreline during their fall migration, as do migratory waterfowl including the occasional endangered Harlequin Duck (*Histrionicus histrionicus*).

The Project site is contained within map square 20LQ81 of the Maritime Breeding Bird Atlas (MMBA 2011). In the most recent edition of the MBBA (covering the years 2006-2010), 80 species were identified as being possible, probable, or confirmed breeders within this area. The following SOCI are considered possible, probable, or confirmed breeders within Project site boundaries:

- Barn Swallow (*Hirundo rustica*) – “Threatened” (COSEWIC), “Yellow” (NSDNR);
- Boreal Chickadee (*Poecile hudsonicus*) – “Yellow” (NSDNR);
- Canada Warbler (*Wilsonia canadensis*) – “Threatened” (*SARA*), “Threatened” (COSEWIC), “Red” (NSDNR);
- Chimney Swift (*Chaetura pelagica*) – “Threatened” (*SARA*), “Endangered” (NS *ESA*), “Threatened” (COSEWIC), “Red” (NSDNR);
- Common Loon (*Gavia immer*) – “Red” (NSDNR);
- Common Nighthawk (*Chordeiles minor*) – “Threatened” (*SARA*), “Threatened” (NS *ESA*), “Threatened” (COSEWIC), “Red” (NSDNR);
- Common Snipe (*Gallinago delicate*) – “Yellow” (NSDNR);
- Eastern Kingbird (*Tyrannus tyrannus*) – “Yellow” (NSDNR);
- Eastern Wood-Pewee (*Contopus virens*) – “Special Concern” (COSEWIC), “Yellow” (NSDNR);
- Golden-crowned Kinglet (*Regulus satrapa*) – “Yellow” (NSDNR);
- Gray Jay (*Perisoreus canadensis*) – “Yellow” (NSDNR);
- Pine Siskin (*Spinus pinus*) – “Yellow” (NSDNR);
- Rose-breasted Grosbeak (*Pheucticus ludovicianus*) – “Yellow” (NSDNR);
- Ruby-crowned Kinglet (*Regulus calendula*) – “Yellow” (NSDNR);

- Spotted Sandpiper (*Actitis macularius*) – "Yellow" (NSDNR); and
- Tree Swallow (*Tachycineta bicolor*) – "Yellow" (NSDNR).

The NS Significant Species and Habitats database contains 400 unique records pertaining to birds and/or bird habitat within a 100 km radius of the Project site. These records include:

- 139 classified in the database as "Other Habitat", of which the majority relate to Bald Eagle (*Haliaeetus leucocephalus*) (67) or Osprey (*Pandion haliaetus*) (62). This also includes records of Great Blue Heron (*Ardea herodias*) (4) and Gray Partridge (*Perdix* perdix) (2), among others.
- 113 records classified as "Species of Concern", of which the majority relate to Common Loon (*Gavia immer*) (71). This also includes records of unclassified Tern species (17) and Common Tern (*Sterna hirundo*) (7), among others.
- 78 records classified as "Migratory Bird", including Great Blue Heron (15), American Black Duck (*Anas rubripes*) (14), and Double-crested Cormorant (*Phalacrocorax auritus*) (12), among others.
- 70 records classified as "Species at Risk", primarily relating to Piping Plover (26) and Common Loon (15) but also including records of Harlequin Duck (7) and Peregrine Falcon (*Falco peregrinus*) (3), among others.

Multiple significant habitat features related to birds are present within a 10 km radius of the Project site (Table 8.11).

Table 8.11. Significant Habitat Features Related to Birds within a 10km Radius of the Project Site

Species	Location	Distance from Project Site (km)	Direction
Common Loon	Mushamush Lake	9.31	N
Common Loon	Langille Little Lake	3.15	N
Bald Eagle	Wetland on Cook's Brook	4.66	W
Osprey	Oak Hill	0.78	WSW
Osprey	Dayspring	1.97	S
Common Loon	Wiles Lake	6.77	SW
Osprey	Blysteiner Lake	0.22	N
Common Loon	Hebb Lake	7.7	SW
Great Blue Heron	Island in Hebb Lake	9.63	SW
Common Loon	Fancy Lake	7.68	SW
Osprey	Area between Hebb Lake and Fancy Lake	8.57	SW
Bald Eagle	Huckleberry Point	3.51	SSW
Bald Eagle	Pleasantville	7.21	S

Source: NSDNR 2012c

The ACCDC database contains records of 96 bird species within a 100 km radius of the Project site. Table 8.12 lists these species as well as their respective provincial and national conservation status ranks.

Table 8.12 Bird Species Recorded within a 100 km Radius of the Project Site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
American Coot	*Fulica americana*	Not Listed	Not Listed	Not at Risk	Undetermined
American Golden-Plover	*Pluvialis dominica*	Not Listed	Not Listed	Not Listed	Yellow
Arctic Tern	*Sterna paradisaea*	Not Listed	Not Listed	Not Listed	Red
Atlantic Puffin	*Fratercula arctica*	Not Listed	Not Listed	Not Listed	Yellow
Baltimore Oriole	*Icterus galbula*	Not Listed	Not Listed	Not Listed	Red
Barrow's Goldeneye	*Bucephala islandica*	Special Concern	Not Listed	Special Concern	Red
Black Guillemot	*Cepphus grylle*	Not Listed	Not Listed	Not Listed	Green
Black-billed Cuckoo	*Coccyzus erythropthalmus*	Not Listed	Not Listed	Not Listed	Red
Black-legged Kittiwake	*Rissa tridactyla*	Not Listed	Not Listed	Not Listed	Yellow
Bobolink	*Dolichonyx oryzivorus*	No Status	Not Listed	Threatened	Yellow
Brown Thrasher	*Toxostoma rufum*	Not Listed	Not Listed	Not Listed	Undetermined
Common Goldeneye	*Bucephala clangula*	Not Listed	Not Listed	Not Listed	Green
Common Moorhen	*Gallinula chloropus*	Not Listed	Not Listed	Not Listed	Undetermined
Common Tern	*Sterna hirundo*	Not Listed	Not Listed	Not at Risk	Yellow
Eastern Bluebird	*Sialia sialis*	Not Listed	Not Listed	Not at Risk	Yellow
Eastern Meadowlark	*Sturnella magna*	No Status	Not Listed	Threatened	Yellow
Eastern Phoebe	*Sayornis phoebe*	Not Listed	Not Listed	Not Listed	Yellow
Eskimo Curlew	*Numenius borealis*	Endangered	Not Listed	Endangered	Undetermined
Gadwall	*Anas strepera*	Not Listed	Not Listed	Not Listed	Red
Great Crested Flycatcher	*Myiarchus crinitus*	Not Listed	Not Listed	Not Listed	Red
Greater Yellowlegs	*Tringa melanoleuca*	Not Listed	Not Listed	Not Listed	Yellow
Harlequin Duck	*Histrionicus histrionicus*	Special Concern	Endangered	Special Concern	Red
Horned Lark	*Eremophila alpestris*	Not Listed	Not Listed	Not Listed	Green
Hudsonian Godwit	*Limosa haemastica*	Not Listed	Not Listed	Not Listed	Yellow
Indigo Bunting	*Passerina cyanea*	Not Listed	Not Listed	Not Listed	Undetermined
Least Sandpiper	*Calidris minutilla*	Not Listed	Not Listed	Not Listed	Green
Long-eared Owl	*Asio otus*	Not Listed	Not Listed	Not Listed	Red
Northern Cardinal	*Cardinalis cardinalis*	Not Listed	Not Listed	Not Listed	Green
Northern Goshawk	*Accipiter gentilis*	Not Listed	Not Listed	Not at Risk	Green
Northern Mockingbird	*Mimus polyglottos*	Not Listed	Not Listed	Not Listed	Green
Northern Pintail	*Anas acuta*	Not Listed	Not Listed	Not Listed	Red
Northern Shoveler	*Anas clypeata*	Not Listed	Not Listed	Not Listed	Red
Peregrine Falcon	*Falco peregrinus*	Threatened	Vulnerable	Special Concern	Yellow
Philadelphia Vireo	*Vireo philadelphicus*	Not Listed	Not Listed	Not Listed	Undetermined
Purple Martin	*Progne subis*	Not Listed	Not Listed	Not Listed	Red
Purple Sandpiper	*Calidris maritima*	Not Listed	Not Listed	Not Listed	Yellow
Razorbill	*Alca torda*	Not Listed	Not Listed	Not Listed	Yellow
Red Knot	*Calidris canutus*	No Status	Endangered	Endangered	Red
Red Phalarope	*Phalaropus fulicarius*	Not Listed	Not Listed	Not Listed	Yellow
Red-breasted Merganser	*Mergus serrator*	Not Listed	Not Listed	Not Listed	Green

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]
Red-necked Phalarope	*Phalaropus lobatus*	Not Listed	Not Listed	Not Listed	Yellow
Roseate Tern	*Sterna dougallii*	Endangered	Endangered	Endangered	Red
Rusty Blackbird	*Euphagus carolinus*	Special Concern	Not Listed	Special Concern	Red
Scarlet Tanager	*Piranga olivacea*	Not Listed	Not Listed	Not Listed	Undetermined
Semipalmated Plover	*Charadrius semipalmatus*	Not Listed	Not Listed	Not Listed	Green
Short-eared Owl	*Asio flammeus*	Special Concern	Not Listed	Special Concern	Red
Solitary Sandpiper	*Tringa solitaria*	Not Listed	Not Listed	Not Listed	Green
Vesper Sparrow	*Pooecetes gramineus*	Not Listed	Not Listed	Not Listed	Red
Virginia Rail	*Rallus limicola*	Not Listed	Not Listed	Not Listed	Undetermined
Warbling Vireo	*Vireo gilvus*	Not Listed	Not Listed	Not Listed	Undetermined
Whimbrel	*Numenius phaeopus*	Not Listed	Not Listed	Not Listed	Yellow
Whip-Poor-Will	*Caprimulgus vociferus*	Threatened	Not Listed	Threatened	Red
Willow Flycatcher	*Empidonax traillii*	Not Listed	Not Listed	Not Listed	Yellow
Wood Thrush	*Hylocichla mustelina*	Not Listed	Not Listed	Not Listed	Undetermined

Source: ACCDC 2011

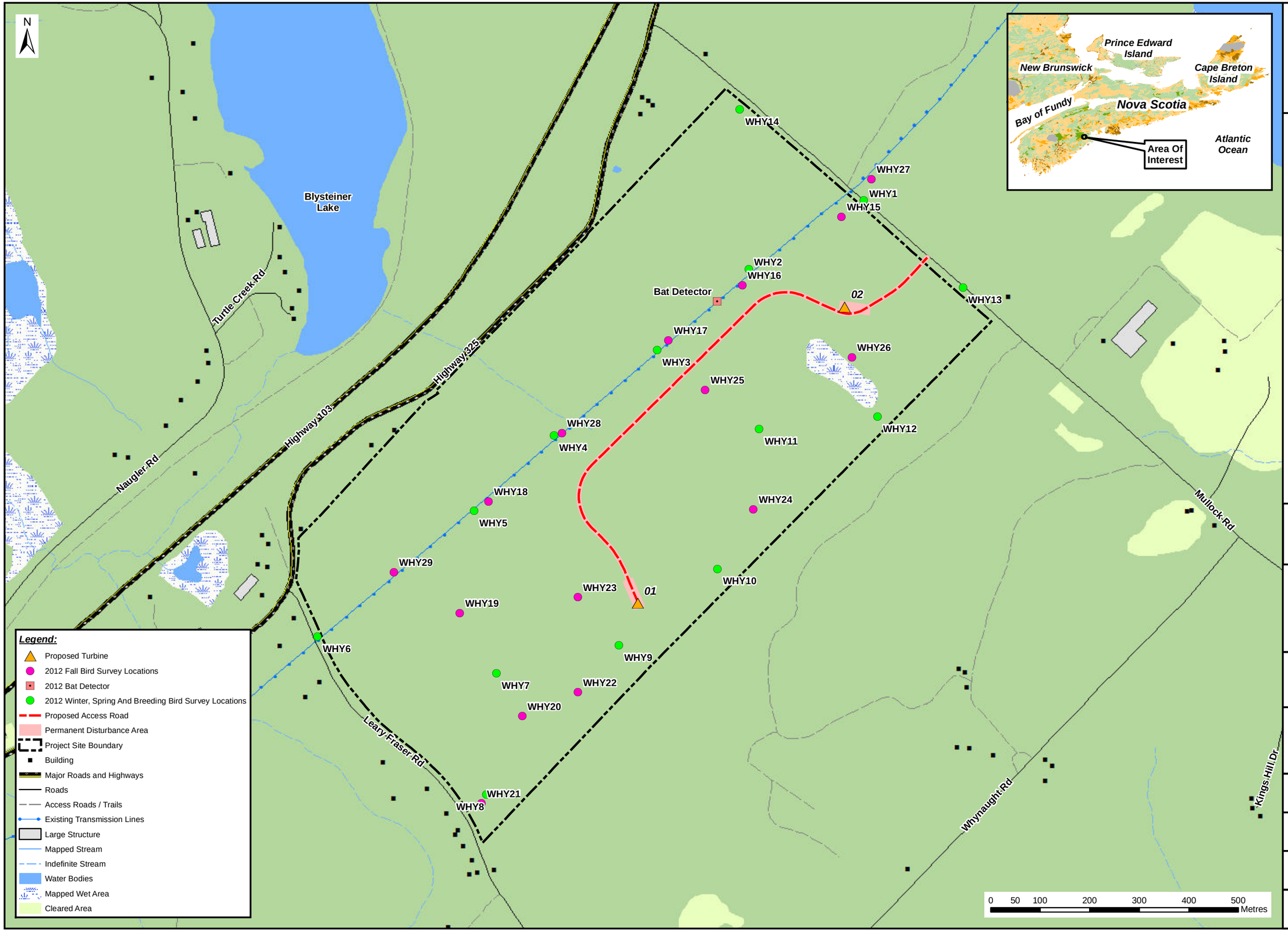
[1]Government of Canada 2012; [2]NS *ESA* 2007; [3]COSEWIC 2012; [4]NSDNR 2010

Field surveys were completed to gather data to characterize the year round, pre-construction (baseline) bird community at the Project site and were designed to capture changes in the diversity and abundance of bird species at the Project site coinciding with such important events as breeding and migration. All field surveys were designed in consultation with officials from NSDNR and CWS, and conformed to protocols outlined in the document "Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds" (CWS 2007).

A summary of each survey is provided in the following sections. Detailed methodology and results are provided in Appendix F.

Winter Bird Survey

Thirteen area searches were conducted at or near the Project site on February 29, 2012 (Drawing 8.6). A total of 19 species were identified, including 529 individual birds (Tables F1/2, Appendix F). American Crow (*Corvus brachyrhynchos*), Black-capped Chickadee (*Parus atricapillus*) and Common Raven (*Corvus corax*) were the most frequently observed and abundant species, and European Starling (*Sturnus vulgaris*), Dark-eyed Junco (*Junco hyemalis*) and Blue Jay (*Cyanocitta cristata*) were also commonly observed.



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Points Taken Are Typically to +/-5m Accuracy.

Bird Survey And Bat Detector Locations

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Drawn By: H. Serhan	
Checked By: M. Smith	

Spring Migration Surveys
Spring migration surveys were conducted on April 11, May 2, and May 25, 2012. A total of 41 stopover count surveys were conducted at 14 locations within or in close proximity to the Project site boundaries (Drawing 8.6).

A total of 65 species, comprising 1,393 individual birds, were observed during the spring migration surveys (Tables F3/4, Appendix F). American Robin (*Turdus migratorius*) was the most frequently observed and most abundant species, while Yellow-rumped Warbler (Dendroica coronate) and Dark-eyed Junco (*Junco hyemalis*) were the second and third most frequently observed species, respectively. American Goldfinch (*Spinus tristis*) and Black-throated Green Warbler (*Dendroica virens*) were also abundant during the spring migration surveys.

Breeding Bird Surveys
Twelve point count locations were surveyed on June 11 and again on July 7, 2012 (Drawing 8.6). A total of 593 individual birds, representing 48 species, were observed during these point counts (Tables F5/6, Appendix F). Of these, 16 species are considered probable breeders based upon the observance of breeding pairs and/or the establishment of permanent territories and one species is a confirmed breeder (MBBA 2006). The most frequently observed and abundant species were American Robin, Red-eyed Vireo (*Vireo olivaceus*), and Black-throated Green Warbler.

The vast majority of the species identified during the breeding bird surveys were passerines. However, a variety of non-passerine birds were also observed during these surveys, including Hairy Woodpecker (*Picoides villosus*), Northern Flicker (*Colaptes auratus*), and Pileated Woodpecker (*Dryocopus pileatus*) (woodpeckers); and Barred Owl (*Strix varia*), Broad-winged Hawk (Buteo platypterus), Great-horned Owl (*Bubo virginanus*), and Osprey (*Pandion haliaetus*) (birds of prey).

Fall Migration Surveys
A total of 41 stopover count surveys were conducted at 14 locations within the Project site boundaries between September and November 2012 (Drawing 8.6). A total of 37 species, consisting of 387 individual birds, were recorded during the fall migration surveys (Tables F7/8, Appendix F). Black-capped Chickadee and Golden-crowned Kinglet (*Regulus satrapa*) were the most abundant species and the most frequently observed species.

Summary of Bird Surveys
The mature, mixed woods dominated habitat at the Project site provides habitat for a number of migrant, breeding, and resident species throughout the year. The bird community at the Project site strongly reflects the forested nature as forest-dwelling species dominated the bird community in all seasons.

The Project site appears to be situated within an important local flyway for resident Corvids during the winter months, as large numbers of both American Crow (*Corvus brachyrhynchos*) and Common Raven (*Corvus corax*) were observed flying over the Project site presumably from night roost(s) to foraging habitat in the northeast. Sixty-one percent of the birds recorded during winter surveys were observed flying overhead. Other resident species, most notably Black-capped Chickadee, were observed in reasonable numbers during the winter, while other common winter species such as

Golden-crowned Kinglet were observed with less regularity than the forested nature of the Project site would suggest.

During spring migration, the bird community was characterized by relatively small flocks either flying over the Project site, or using the Project site directly as a stopover. Spring migrants were distributed throughout the Project site, such that no obvious migration corridors were suggested. Most birds (56%) were observed in mixed woods habitat, likely due to the prevalence of this habitat at the site. The bird community, in terms of abundance and diversity, peaked in late-May, when 55.69 ± 9.97 (mean ± 95% confidence interval) total birds and 16.53 ± 2.29 species were observed.

The absence of water bodies within the Project site boundaries suggests that it is unlikely that waterfowl use the Project site directly, although Mallard (*Anas platyrhynchos*) and Common Loon (*Gavia immer*) were observed flying over the Project site during spring migration, likely en route to nearby lakes. Reasonable numbers of seed-eating Red-breasted Nuthatch (*Sitta canadensis)*, American Goldfinch (*Spinus tristis*) and Purple Finch (*Carpodacus purpureus*) reflect the availability of mature conifers in pure and mixed stands.

Just 68% of the species observed during spring migration were also noted during breeding bird surveys, with absent species including Bay-breasted Warbler (*Dendroica castanea*), Canada Warbler (*Wilsonia canadensis*), Chipping Sparrow (*Spizella passerina*), Evening Grosbeak (*Coccothraustes vespertinus*), Northern Parula (*Parula americana*), and Tree Swallow (*Tachycineta bicolor*). This result suggests that the Project site, while providing breeding habitat for a variety of forest-dwelling species, lacks suitable breeding habitat for many species which instead continue moving to establish breeding territories off-site. Mixed wood habitats were particularly important for breeding birds, with 63% of the birds observed during these surveys being found in this habitat type.

The breeding bird community at the Project site was dominated by common thrushes and warblers, while also featuring Barred Owl (*Strix varia*), Pileated Woodpecker (*Dryocopus pileatus*), and Great Horned Owl (*Bubo virginianus*), species indicative of mature/old-growth forest. Limited wetlands at the Project site likely accounted for the absence and/or low numbers of swamp associated species including Gray Jay (*Perisoreus canadensis*), Swamp Sparrow (*Melospiza georgiana*), and Common Yellowthroat (*Geothlypis trichas*), as well as aerial insectivores like Tree Swallow (*Tachycineta bicolor*).

The species composition at the Project site during fall migration was very similar to that observed during the breeding season. The most abundant species during this time were actually resident species and/or nomads as opposed to true migrants, and migrant passerines were present in small flocks. Relatively few birds (8%) were observed flying overhead during fall migration. These results suggest that the Project site does not lie along an important migratory route during the fall, or at least does not constitute an important stopover site during this time.

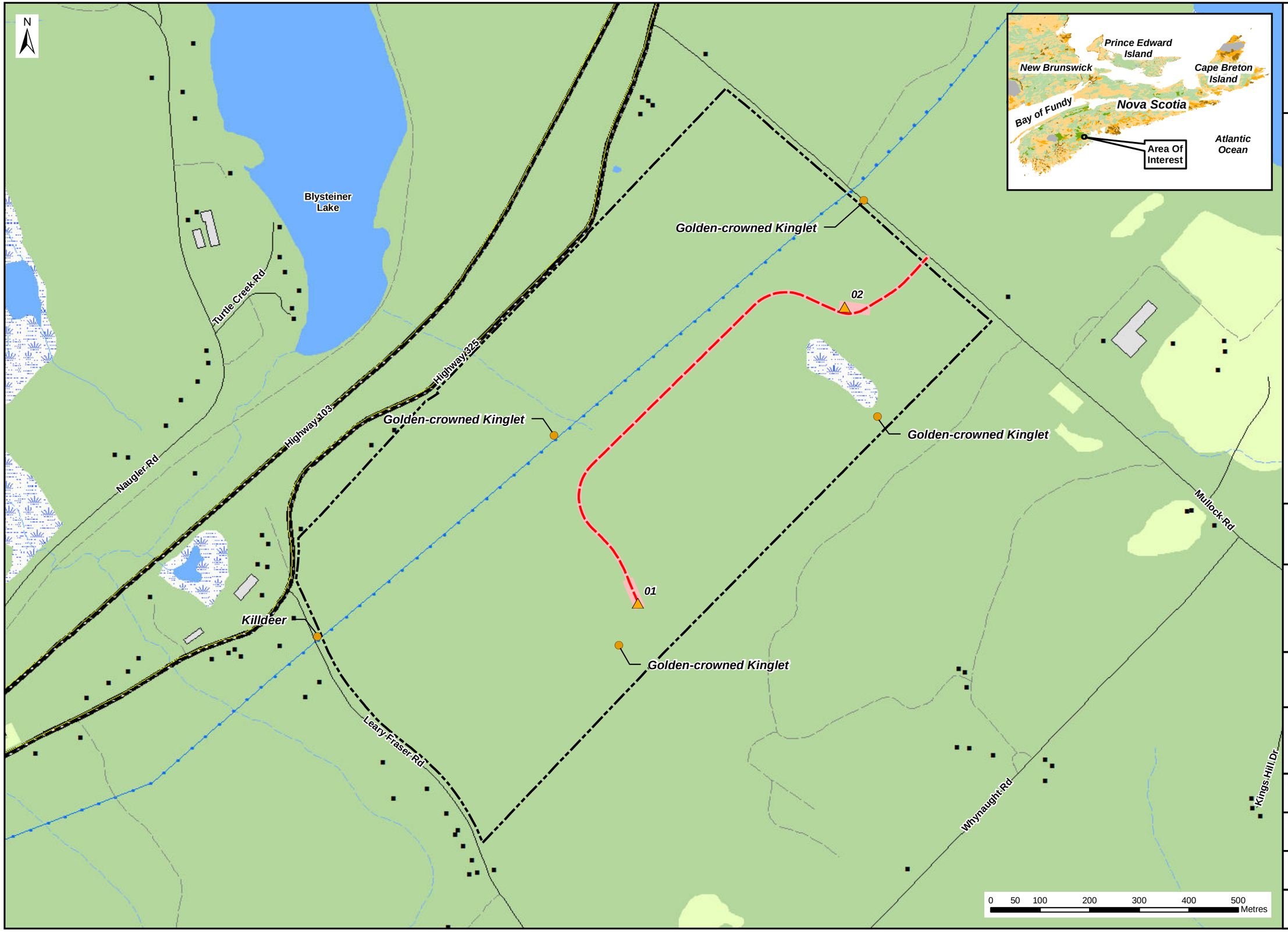
Overall, there were 74 different species identified at or near the Project site during surveys conducted throughout the year, including 12 SOCI (Table 8.13, Drawings 8.7A-D).

Table 8.13: Bird SOCI identified at the Project Site

Common Name	Scientific Name	*SARA* Status[1]	NS *ESA* Status[2]	COSEWIC Status[3]	NSDNR Status[4]	Survey(s) Observed
Bay-breasted Warbler	*Dendroica castanea*	Not Listed	Not Listed	Not Listed	Yellow	Spring (1)
Blackpoll Warbler	*Dendroica striata*	Not Listed	Not Listed	Not Listed	Yellow	Fall (5)
Canada Warbler	*Wilsonia canadensis*	Threatened	Not Listed	Threatened	Red	Spring (1)
Common Loon	*Gavia immer*	Not Listed	Not Listed	Not at Risk	Red	Spring (3)
Eastern Wood-pewee	*Contopus virens*	Not Listed	Not Listed	Special Concern	Yellow	Spring (2), Breeding (10), Fall (4)
Golden-crowned Kinglet	*Regulus satrapa*	Not Listed	Not Listed	Not Listed	Yellow	Winter (10), Spring (21), Breeding (8), Fall (71)
Killdeer	*Charadrius vociferus*	Not Listed	Not Listed	Not Listed	Yellow	Winter (1), Spring (2)
Long-eared Owl	*Asio otus*	Not Listed	Not Listed	Not Listed	Red	Spring (1)
Pine Siskin	*Spinus pinus*	Not Listed	Not Listed	Not Listed	Yellow	Spring (18), Breeding (2), Fall (1)
Rose-breasted Grosbeak	*Pheucticus ludovicianus*	Not Listed	Not Listed	Not Listed	Yellow	Spring (1), Breeding (1)
Ruby-crowned Kinglet	*Regulus calendula*	Not Listed	Not Listed	Not Listed	Yellow	Spring (1), Breeding (4)
Tree Swallow	*Tachycineta bicolor*	Not Listed	Not Listed	Not Listed	Yellow	Spring (3)

[1]Government of Canada 2012; [2]NS *ESA* 2007; [3]COSEWIC 2012; [4]NSDNR 2010

The requirements as set out in the *MBCA* will be adhered to for Project activities. Additional mitigation measures for avifauna are provided in Section 4 and 14.



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Points Taken Are Typically to +/-5m Accuracy.

Legend:

- Proposed Turbine
- Species Locations
- Proposed Access Road
- Permanent Disturbance Area
- Project Site Boundary
- Building
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Existing Transmission Lines
- Large Structure
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Winter Bird Species of Conservation Interest Locations

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Date:	Project #:
April 2013	12-4329
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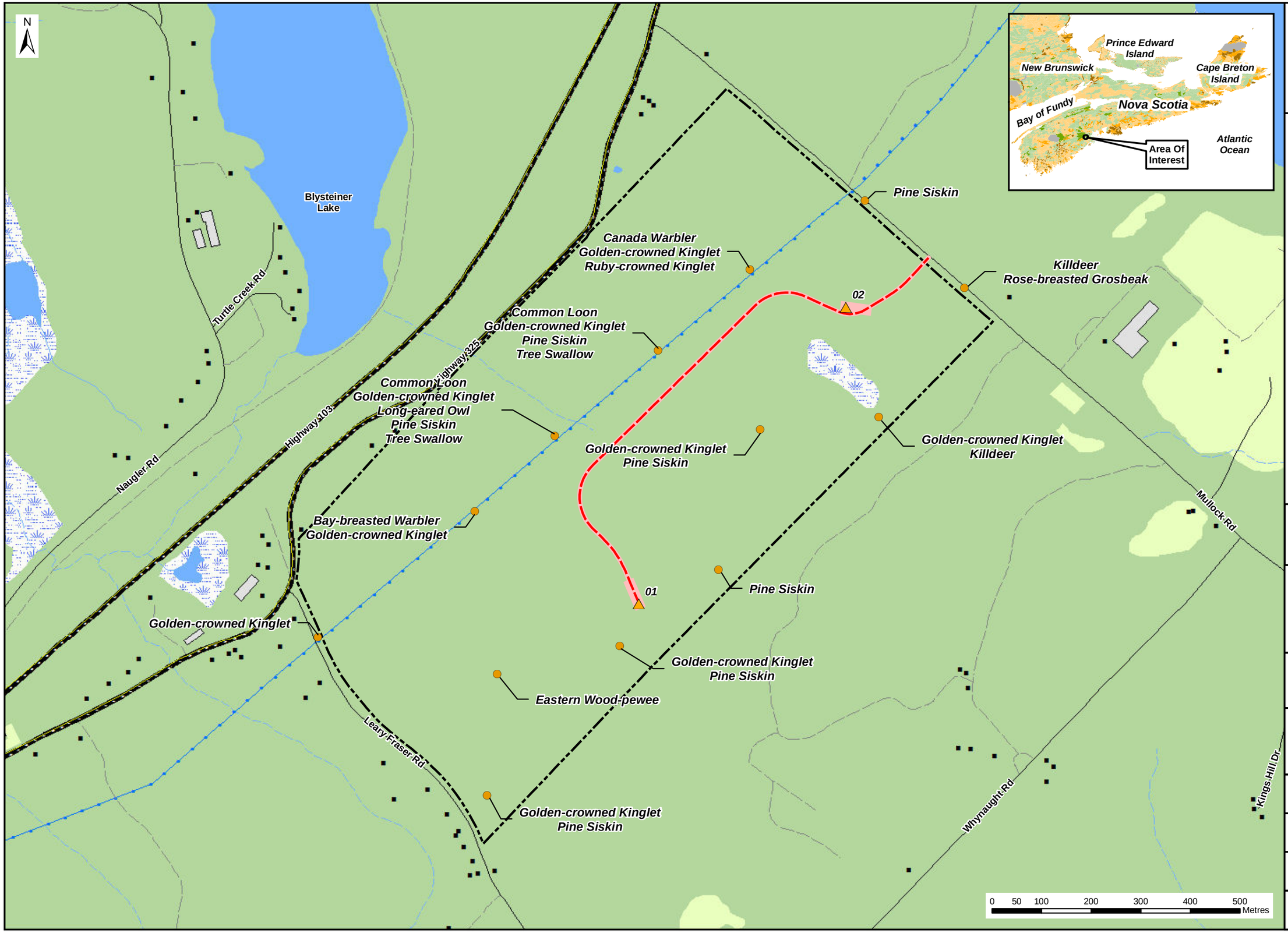
Drawn By: G. Gregory	
Checked By: M. Smith	



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Points Taken Are Typically to +/-5m Accuracy.

Legend:

- Proposed Turbine
- Species Location
- Proposed Access Road
- Permanent Disturbance Area
- Project Site Boundary
- Building
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Existing Transmission Lines
- Large Structure
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Spring Bird Species of Conservation Interest Locations

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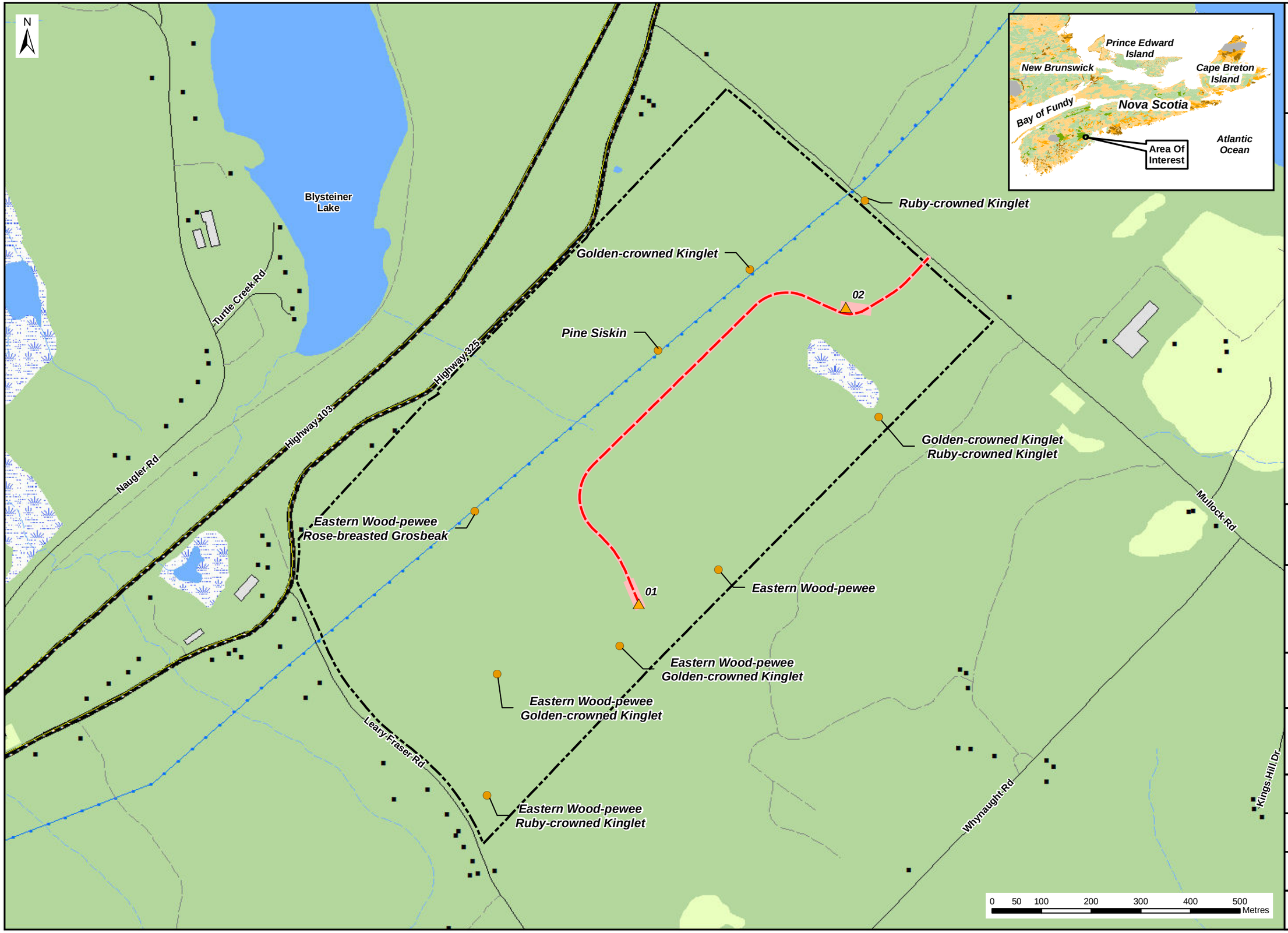
Date:	Project #:
April 2013	12-4329
Scale: 1:7000	Drawing #: **8.7B**
Drawn By: G. Gregory	
Checked By: M. Smith	



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.
3. GPS Points Taken Are Typically to +/-5m Accuracy.

Legend:

- Species Locations
- Proposed Turbine
- Proposed Access Road
- Permanent Disturbance Area
- Project Site Boundary
- Building
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Existing Transmission Lines
- Large Structure
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Breeding Bird Species of Conservation Interest Locations

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