species (F= 0.214, p= 0.647) observed per survey location during the breeding season at the Project site compared to the Control site.

Fall Migration Surveys- Project Site
A total of 40 stopover count surveys were carried out at 16 transects across the Project site during site visits on September 17, October 25, and November 13, 2013 (Drawing 8.8). A total of 43 species, consisting of 424 individual birds, were recorded (Tables G9/10, Appendix G). Black-capped Chickadee (*Poecile atricapillus*), Golden-crowned Kinglet (*Regulus satrapa*), and Blue Jay (*Cyanocitta cristata*), all resident species, were the most abundant and frequently observed species.

Overall, migrant passerines accounted for 55.8% of the species and 32.3% of the individual birds observed during fall migration surveys at the Project site. There were 11.33 ± 3.64 (mean ± 95% confidence interval) individual birds and 5.69 ± 1.50 species observed per survey transect during fall migration at the Project site.

A passage migration survey was also carried out at the Project site on September 17, 2013, during the traditional peak of raptor migration through Nova Scotia. The survey encompassed a two hour time period from 11:00 AM to 1:00 PM, and was carried out from a vantage point allowing an unobstructed view of a ridge to the south/southeast of the Project site (Drawing 8.8). A single Broad-winged Hawk (*Buteo platypterus)* was the only diurnal migrant observed during the survey (Table G11, Appendix G).

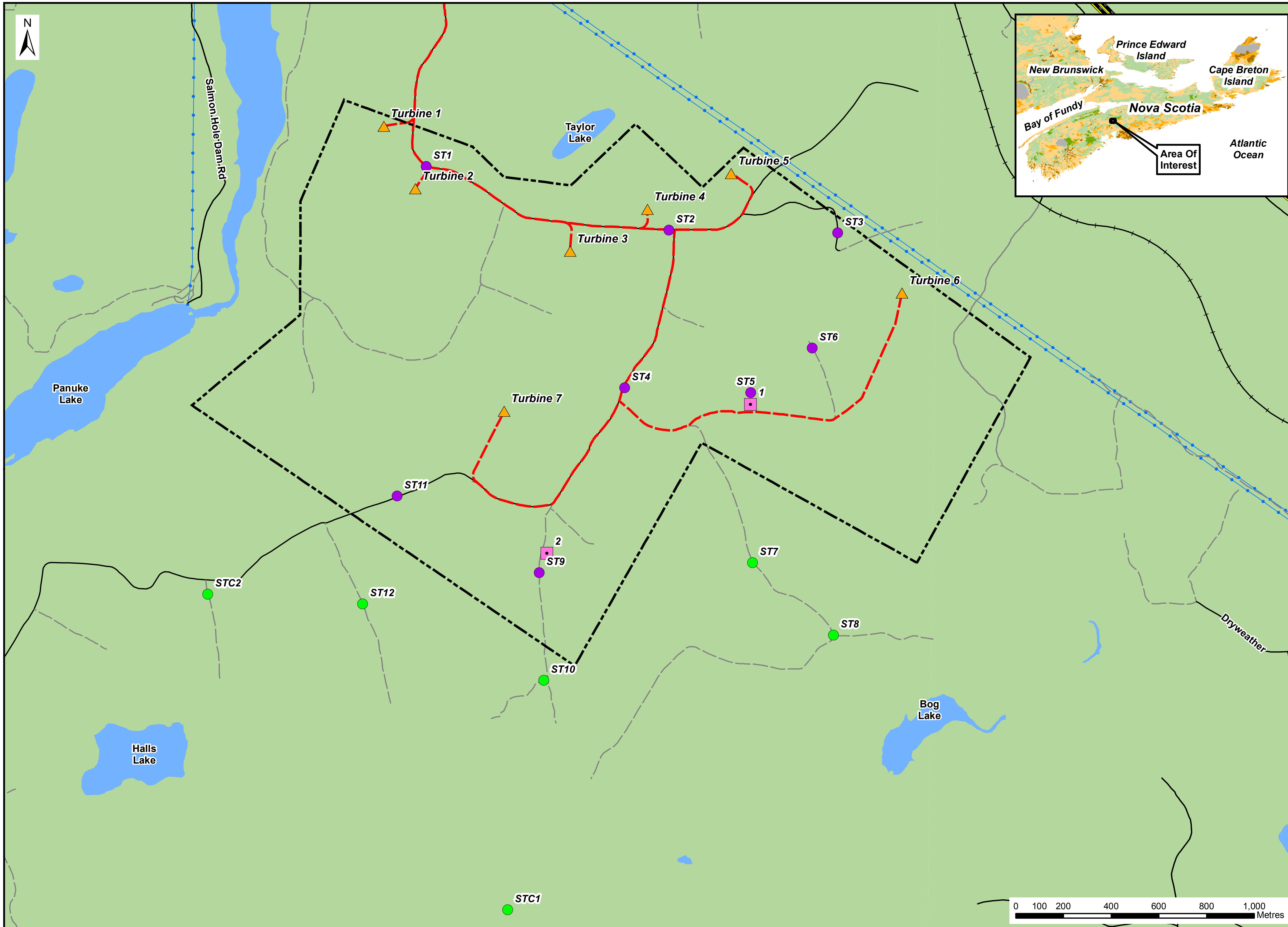
Fall Migration Surveys- Control Site
Fall migration surveys at the Control site were limited to a single stopover count along the Ellershouse Road, to the north of the Project site, on October 25, 2013 (Drawing 8.8).

American Crow (*Corvus brachyrhynchos*) and Black-capped Chickadee, both species commonly associated with human habitation, were observed during this Control site survey (Table G12, Appendix G).

Winter Bird Survey – Project Site
A total of 14 area search surveys were carried out across the Project site during a site visit on December 7, 2013 (Drawing 8.8). A total of 8 species, consisting of 55 individual birds, were recorded (Tables G13/14, Appendix G). Black-capped Chickadee (*Poecile atricapillus*), Golden-crowned Kinglet (*Regulus satrapa*), and Blue Jay (*Cyanocitta cristata*), all resident species, were the most abundant and frequently observed species.

Overall, there were 3.92 ± 1.57 (mean ± 95% confidence interval) individual birds and 1.78 ± 0.55 species observed per survey location during winter surveys at the Project site.

Winter Bird Survey – Control Site
Winter surveys at the Control site were limited to a single stopover count along the Ellershouse Road, to the north of the Project site, on December 7, 2013 (Drawing 8.8).



Notes:

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Project Site Boundary
- Proposed Turbine
- Proposed Access Road
- Bat Detector Locations

Spring/Breeding Survey Locations

- Control Site
- On-Site
- Active Railroad
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Existing Transmission Lines
- Water Bodies

Spring Migration /Breeding Bird Survey Locations and Bat Detector Locations

Strum
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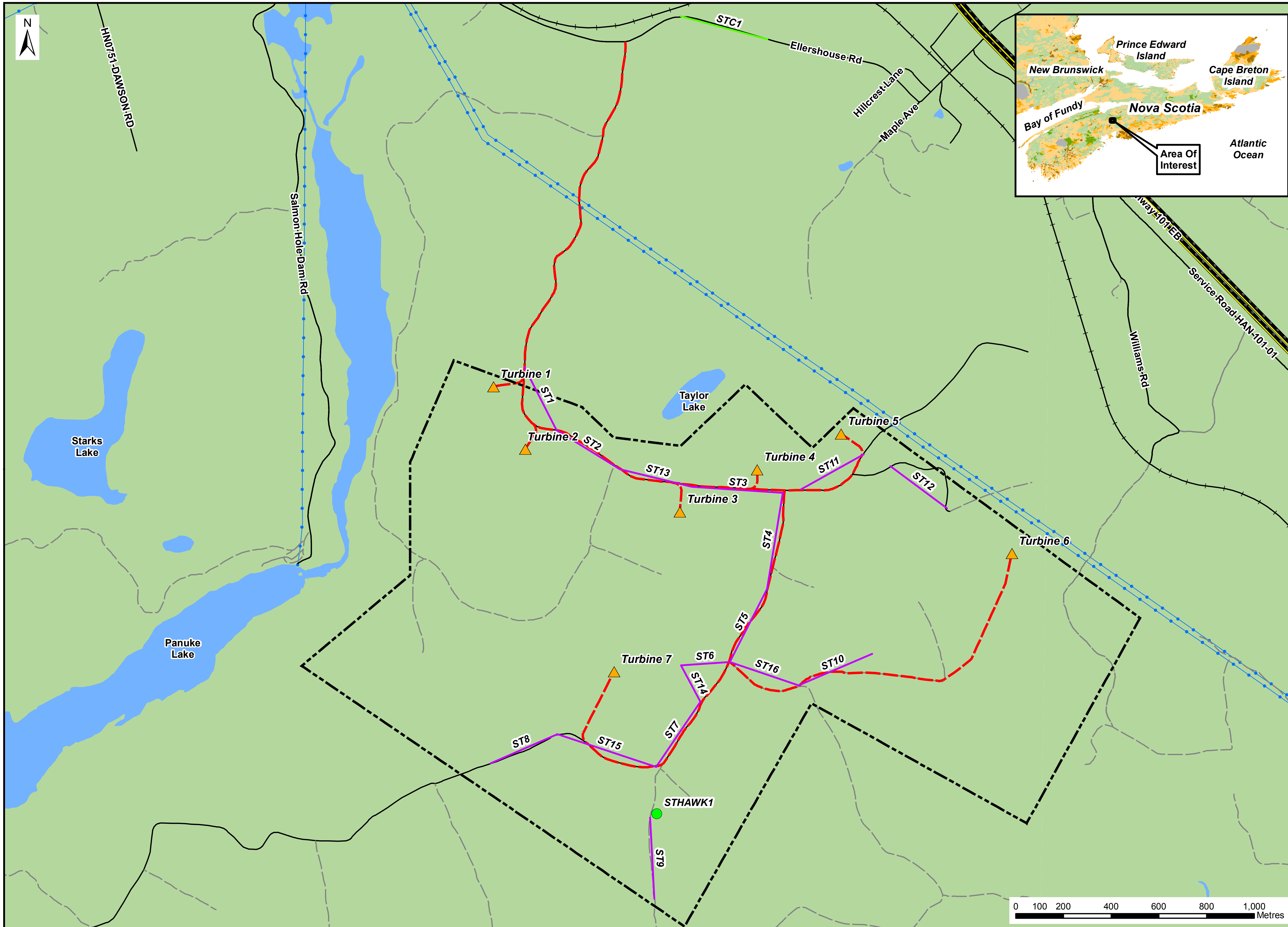
Date: Nov. 2013	Project #: 12-4583
Scale: 1:15,000	Drawing #: 8.7
Drawn By: G. Gregory	
Checked By: M. Smith	



Notes:

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Project Site Boundary
- Proposed Turbine
- Proposed Access Road
- Passage Migration Survey Location

Fall Migration/Winter Survey Transects

- Control Site
- On-Site
- Active Railroad
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Existing Transmission Lines
- Water Bodies

Fall Migration and Winter Survey Locations

Strum CONSULTING

Date: Nov. 2013	Project #: 12-4583
Scale: 1:15,000	Drawing #: 8.8
Drawn By: G. Gregory	
Checked By: M. Smith	

Four species were observed at the Control site location, including American Goldfinch (*Spinus tristis*), Blue Jay, Golden-crowned Kinglet, and Purple Finch (*Carpodacus purpureus*) (Table G15, Appendix G).

Bird Survey Summary

The Project site is situated along a prominent ridge the guards the mouth of the Avon River estuary, and resides in a landscape dominated by softwood and mixed wood stands, interspersed with cutovers and freshwater lakes. The bird community in the general Project area reflects both the habitat character and geographic location.

The arrival of spring migrants at the Project area occurs in pulses consistent with patterns observed throughout the region. Both overall abundance and diversity increase as the spring migration period progresses. Early migrants such as American Robin, Hermit Thrush, and White-throated Sparrow are present in reasonable numbers in late April, while the initial pulse of migrant warblers such as Black-throated Green Warbler, Palm Warbler, and Yellow-rumped Warbler reaches the site by early May. At the culmination of the main passerine migration period, at which time it may be inferred that the process of breeding territory establishment is well under way, the dominant feature of the spring migrant community is warblers associated with mid-aged to mature forest habitats, such as Black-and-White Warbler, Black-throated Blue Warbler (*Dendroica caerulescens*), Ovenbird (*Seiurus aurocapilla*), and Black-throated Green Warbler, or those adaptable to varying successional forest stage and/or disturbance including Magnolia Warbler (*Dendroica magnolia*) and Common Yellowthroat (*Geothlypis trichas*). The absence of Palm Warbler and the low numbers of Yellow-rumped Warbler and Chestnut-sided Warbler (*Dendroica pensylvanica*) in late May are notable due to the prevalence of apparently suitable edge/regenerating cutover habitat at the Project site.

No waterfowl/waterbirds were observed during spring migration surveys, although it is likely that individuals move between a series of freshwater lakes on the landscape. Nonetheless, observations do not suggest that the Project site is situated within an important migratory corridor for these species.

A comparison of Project site and Control site data suggests strongly that the spring migrant bird community at the Project site is similar in numbers, overall diversity, and composition to that of the surrounding area.

The Project site supports a relatively diverse breeding bird community. As in the spring migration surveys, the dominant species during the breeding season were birds associated with forest or edge habitats. While overall these species were present in reasonable numbers, the relatively large area surveyed does not suggest that breeding densities at the site are particularly high. Ovenbird, for instance, was the most abundant species during the final breeding season survey with 14 individuals observed. Given that species' 200 m detection radius (BAMP 2013a) was survey at eight locations, a 100 ha effective survey area for Ovenbird was employed within the Project site. This results in a calculated density of 0.139 birds/ha, below the 0.391 birds/ha density estimate for the species in Nova Scotia (BAM 2013). While similar calculations were not undertaken for other breeding species, this result is representative of the overall pattern.

Over 83% of those species observed during late spring migration surveys were also observed at some point during the breeding season, which suggests that the majority of species using the Project site as stop-over habitat during migration remain to establish breeding territories. Noticeably absent from the Project site's breeding community were most boreal species, including as Gray Jay, Boreal Chickadee, Spruce Grouse (*Falcipennis canadensis*), and Black-backed Woodpecker-, although the latter species is more common along Nova Scotia's Eastern Shore. These absences are likely due to the general lack of black spruce/balsam fir dominated wetlands at the Project site. This pattern is also evidenced by the rather low numbers of breeding Golden-crowned Kinglets at the site. Waterfowl and waterbirds were also absent from the breeding community, due mainly to the lack of open water features at the Project site.

The presence of Pileated Woodpecker suggests that trees of adequate size are present in intact forest stands to support a diverse cavity, if not abundant, nesting community. Indeed, six species of cavity nesting birds were observed at the Project site. Given that Barred Owl was also recorded during the passerine spring migration season, it is likely that this species also breeds at the site in late winter.

A comparison of Project site and Control site data suggests strongly that the breeding bird community at the Project site is similar in numbers, overall diversity, and composition to that of the surrounding area.

Given their transient nature and less rigid habitat affinities, it can be difficult to draw meaningful conclusions about a site's ability to attract migrant passerines in the fall. As is typical of primarily forested habitats, the fall bird community at the Project site in September was typified by mixed flocks of migrants travelling with Black-capped Chickadees. Common species within these flocks at this time included Black-throated Green Warbler, Black-and-white Warbler, Magnolia Warbler, Rey-eyed Vireo and Northern Parula (*Parula americana*), among others, the largest of such mixed flocks numbering 23 individuals. As the fall migration period progressed, an influx of Golden-crowned Kinglets coincided with the departure of most migrants, such that Black-capped Chickadees and Golden-crowned Kinglets accounted for over half of all birds observed at the site during October and November. Nomadic finches were only represented by small numbers of Purple Finch (*Carpodacus purpureus*) and American Goldfinch (*Spinus tristis*) during the entirety of the fall migration period, although it remains to be seen if broad movements of other cone/seed specialists will encompass the Project site during the winter months. Migrant sparrows accounted for just 3% of all birds observed during the fall migration period, despite surveys during the traditional peak of sparrow migration in October. It is likely that migrant sparrows actually account for a lower proportion of the fall bird community than is indicated by the survey results, since Dark-eyed Juncos will often over-winter in Nova Scotia, particularly if supplemental food sources (*i.e.*, feeders) are available.

While mixed flocks were numerous at the Project site, particularly during the peak of warbler migration, features that may attract large number of migrants (*i.e.*, clusters of fruit bearing trees/shrubs, open water wetlands, etc) were not observed. It is therefore unlikely that the Project site is located within an important flyway for fall migrants.

Results from surveys completed in early winter do not suggest that the Project site supports a particularly robust winter bird community, although reasonable numbers of Black-capped Chickadees and Golden-crowned Kinglets were observed. No winter visitor species were observed, and nomadic finches were limited to small numbers of American Goldfinch and Purple Finch. Although it is impossible to predict the density of the expected winter bird community as the season progresses, particularly for nomadic species whose distribution is influenced by cone crops in other regions, the Project site nonetheless would appear to offer attractive features for over-wintering birds. Steep slopes create valleys which likely afford shelter from harsh winter conditions, so it is possible that over-wintering passerines may congregate at these locations when the weather deteriorates.

Overall, there were 60 different species identified at or near the Project site during surveys conducted during the spring, breeding, and fall seasons, including 10 priority species (Table 8.13, Drawings 8.9A-D).

Table 8.13: Bird SOCI identified at the Project Site

Common Name	Scientific Name	SARA Status	NSESA Status	COSEWIC Status	NSDNR Status	Survey(s) Observed
Bay-breasted Warbler	*Dendroica castanea*	Not Listed	Not Listed	Not Listed	Yellow	Fall
Boreal Chickadee	*Poecile hudsonicus*	Not Listed	Not Listed	Not Listed	Yellow	Fall
Canada Warbler	*Wilsonia canadensis*	Threatened	Endangered	Threatened	Red	Spring, Breeding
Eastern Wood-pewee	*Contopus virens*	Not Listed	Vulnerable	Special Concern	Yellow	Fall
Golden-crowned Kinglet	*Regulus satrapa*	Not Listed	Not Listed	Not Listed	Yellow	Spring, Breeding, Fall, Winter
Gray Jay	*Perisoreus canadensis*	Not Listed	Not Listed	Not Listed	Yellow	Spring
Pine Siskin	*Spinus pinus*	Not Listed	Not Listed	Not Listed	Yellow	Spring, Breeding
Ruby-crowned Kinglet	*Regulus calendula*	Not Listed	Not Listed	Not Listed	Yellow	Spring, Breeding, Fall
Wilson's Warbler	*Wilsonia pusilla*	Not Listed	Not Listed	Not Listed	Yellow	Fall
Yellow-bellied Flycatcher	*Empidonax flaviventris*	Not Listed	Not Listed	Not Listed	Yellow	Spring, Breeding

[1]Government of Canada 2012; [2]NS *ESA* 2013; [3]COSEWIC 2012a; [4]NSDNR 2010

Of the priority species listed in Table 8.13, the following two species are listed under either *SARA* or NS *ESA*:

- Canada Warbler; and
- Eastern Wood-Pewee

The likelihood of these species to be impacted by the Project is evaluated below.

Canada Warbler

The Canada Warbler uses a wide range of forest types that have a well-developed shrub layer and a structurally-complex forest floor (COSEWIC 2008). In Nova Scotia, highest breeding densities are achieved in poorly drained areas such as treed and shrub swamps (BAMP 2013b). Wetland habitats are infrequent on the Project site and are scarce in proximity to proposed infrastructure (Section 8.4.1; Drawing 8.4A-D, Appendix D).

Canada Warbler was observed twice at the same location, within early successional mixed wood near a watercourse, during late spring migration and during breeding season surveys (Drawing 8.9B). The breeding season for Canada Warbler is rather restricted, and extends from the second week of June to the second week of July. It's possible that the late-May observation represented an individual arriving on territory, and that the subsequent observation at this location was the same individual. That singing persisted into late June may indicate that this individual was an un-mated male. Indeed, the species is considered just a "Possible" breeder at the Project site due to the absence of stronger breeding evidence.

Canada Warbler was also observed at a Control site location to the south of the Project site during late spring migration surveys, which may suggest the establishment of a breeding territory in this area. Based on the distance (>750 m) between Canada Warbler observations and the proposed turbine locations, the maintenance of a buffer around all field-identified wetlands, and the apparent availability of suitable habitat in the surrounding landscape, it is unlikely that Project activities will adversely affect the Canada Warbler.

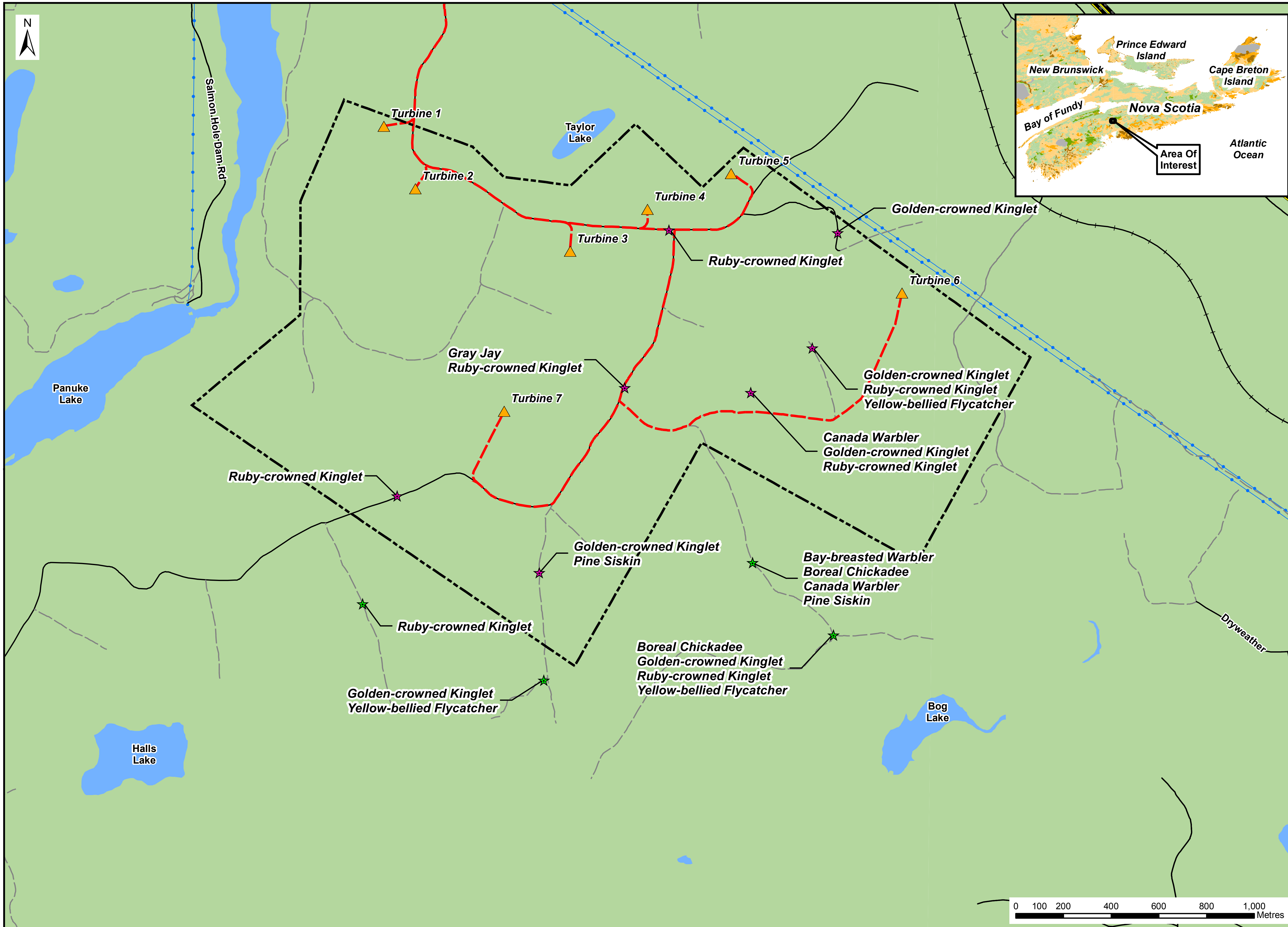
Eastern Wood-Pewee

The Eastern Wood-Pewee is a forest insectivore exhibiting a wide range of habitat use, but generally found in deciduous forests in areas of lower canopy cover (*e.g.*, near forest clearings and edges) (McCarty 1996). On the Project site, mature deciduous and mixed wood stands are prevalent and commercial forestry operations have resulted in an abundance of edges and adjacent patches of regenerating vegetation at varying successional stages.

One male Eastern Wood-Pewee was detected at the Project site during the fall migration period, perched atop a young balsam fir adjacent to a recent cutover (Drawing 8.9C). The individual was likely using edge habitat at the Project site as a stopover.

This individual was observed over 380 m from nearest proposed turbine location. Other Project activities, including access road construction, will not encroach on forested habitats on this part of the Project site. This species was also observed at a Control site location to the south of the Project site, indicating that viable habitat is available in nearby areas. Given the current prevalence of forest/cutover edge habitat at the Project site and in the surrounding landscape, it is unlikely that the Project will negatively impact the Eastern Wood-Pewee.

The requirements as set out in the *MBCA* will be adhered to for Project activities. Additional general mitigation measures for Project-related effects to avifauna are provided in Section 4.0. Additional mitigation for avifauna is provided in Section 13.



Notes:

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

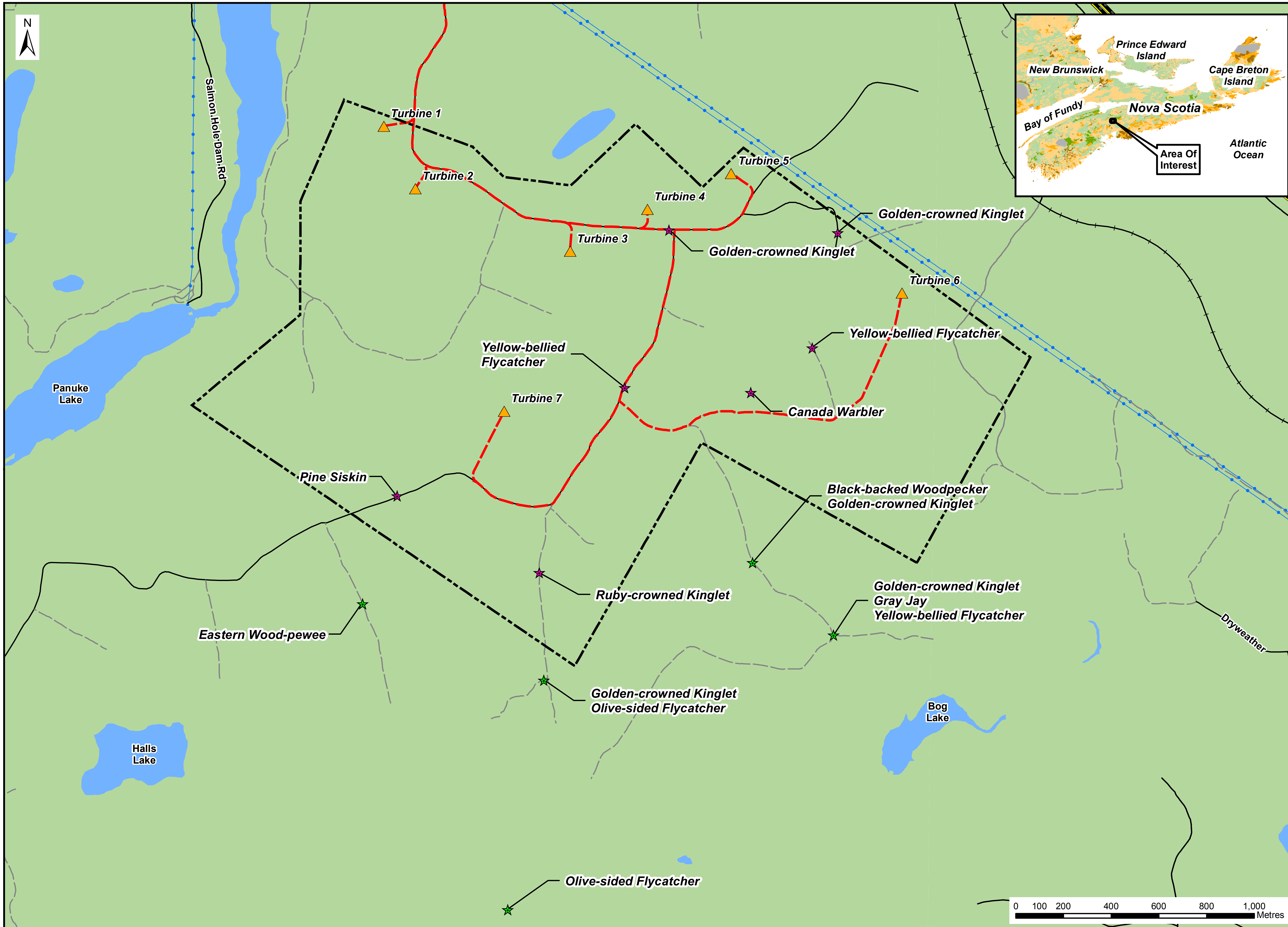
Legend:

- Project Site Boundary
- Proposed Turbine
- Proposed Access Road
- Spring Migration Priority Species Locations (Control Site)
- Spring Migration Priority Species Locations Project Site)
- Active Railroad
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Existing Transmission Lines
- Water Bodies

Spring Migration Priority Species Locations

Strum CONSULTING

Date: Nov. 2013	Project #: 12-4583
Scale: 1:15,000	Drawing #: 8.9A
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.

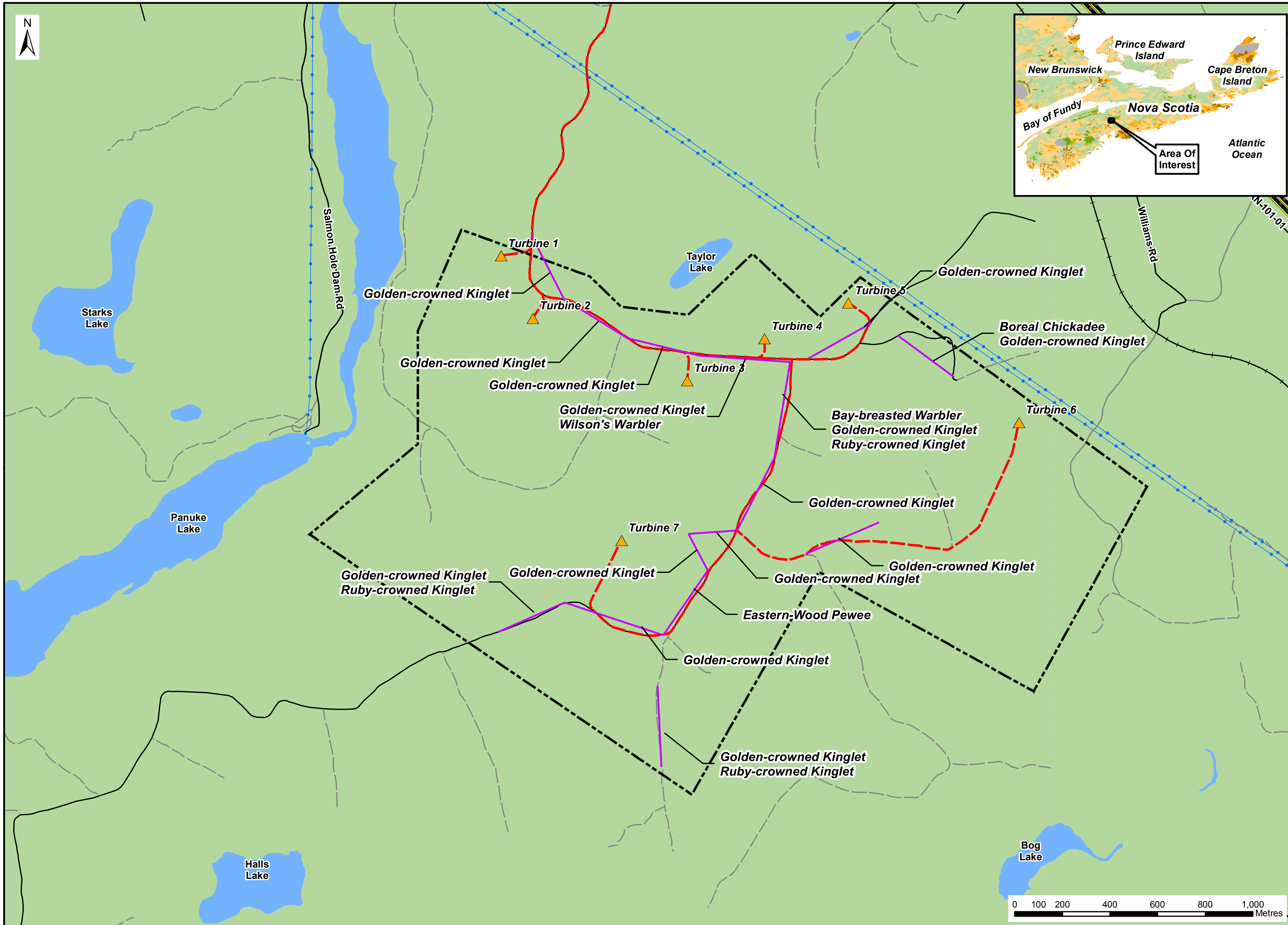
Legend:

- Project Site Boundary
- Proposed Turbine
- Proposed Access Road
- Breeding Priority Species Locations (Control Site)
- Breeding Priority Species Locations (Project Site)
- Active Railroad
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Existing Transmission Lines
- Water Bodies

Breeding Priority Species Locations

Strum CONSULTING

Date: Nov. 2013	Project #: 12-4583
Scale: 1:15,000	Drawing #: 8.9B
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.

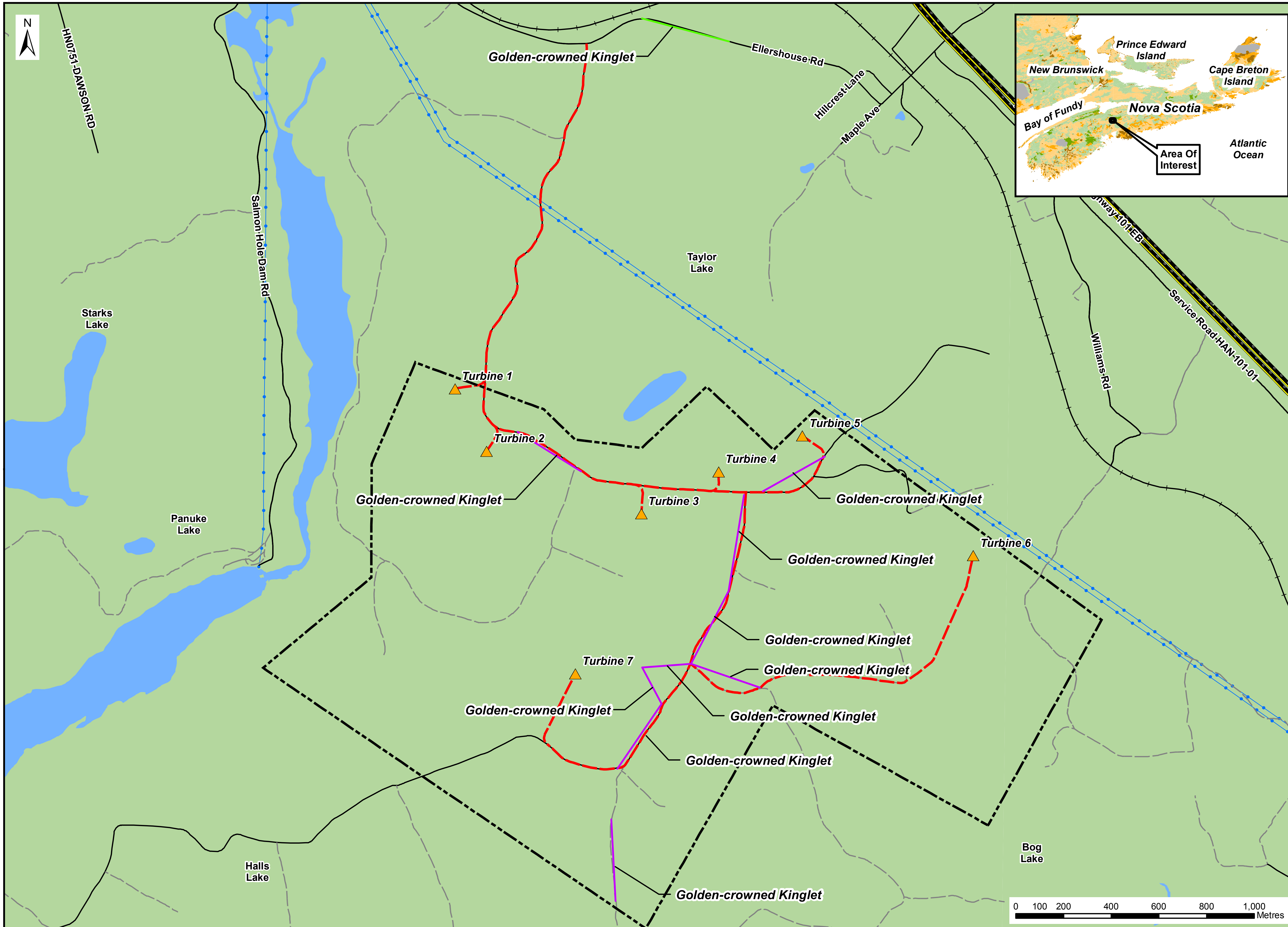
Legend:

- Project Site Boundary
- Proposed Turbine
- Proposed Access Road
- Fall Migration Priority Species Locations
- Active Railroad
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Existing Transmission Lines
- Water Bodies

Fall Migration Priority Species Locations

Strum CONSULTING

Date: Nov. 2013	Project #: 12-4583
Scale: 1:15,000	Drawing #: 8.9C
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.

Legend:

- Project Site Boundary
- Proposed Turbine
- Proposed Access Road
- Winter Priority Species Locations (Project Site)
- Winter Priority Species Locations (Control Site)
- Active Railroad
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Existing Transmission Lines
- Water Bodies

Winter Priority Species Locations

Strum CONSULTING

Date: Nov. 2013	Project #: 12-4583
Scale: 1:15,000	Drawing #: 8.9D
Drawn By: G. Gregory	
Checked By: M. Smith	

8.8 Bats

The Nova Scotia Significant Species and Habitats database (NSDNR 2012c) indicates sixteen features related to bats and/or bat habitats within a 100 km radius of the Project site. All are classified in the database as "Species at Risk", and relate to Little brown myotis (*Myotis lucifugus*) (11) or bat hibernacula (5). The database identifies one records relating to bats within a 10 km radius of the Project site. This is Frenchman's Cave, located approximately 3.65 km to the north.

Moseley (2007) provided an overview of the known bat hibernacula in the caves and mines of Nova Scotia. This research indicates 16 known hibernacula within a 100 km radius of the Project site (Table 8.14).

Table 8.14: Known Bat Hibernacula within 100 km of the Project site

Hibernaculum	Distance to Project Site (km)	Direction
Frenchman's Cave	3.65	N
Miller's Creek Cave	7.18	N
Woodville Ice Cave	12.83	NNE
Cheverie Cave	24.95	NNW
Centre Rawdon Gold Mine	25.58	NE
Walton Barite Mine	30.62	N
Peddlar's Tunnel	34.32	NNW
Minasville Ice Cave	39.38	NNE
Cave of the Bats	45.95	E
Hayes Cave	45.95	E
Gayes River Gold Mine	54.87	E
Black Brook Cave	57.50	E
Lear Shaft	67.07	NE
The Ovens	73.08	S
Vault Cave	81.64	W
Lake Charlotte Gold Mine	84.81	ESE

Source: Moseley (2007)

Frenchman's Cave, the closest known hibernaculum, is considered a small hibernacula which supports 10 – 50 over-wintering bats, although all three of the hibernating species have been recorded at this site (Moseley 2007).

The closest hibernaculum considered to be of significance is Cheverie Cave, situated almost 25 km to the northwest. This dissolution cave in gypsum is thought to have historically supported up to 1,000 over-wintering bats, mostly Northern long-eared bats (Moseley 2007).

The largest known hibernaculum in Nova Scotia is Hayes Cave, located in South Maitland approximately 46 km to the northeast (Moseley 2007). Up to 6,000 bats enter this cave in September and reside until June (Davis and Browne 1996), although preliminary results from 2012 suggest that White-nose syndrome has reduced the hibernating population to approximately 250 individuals (M. Elderkin, personal communication).

Table 8.15 presents bat species recorded within a 100 km radius of the Project site, according to ACCDC.

Table 8.15 Bat 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]
Eastern pipistrelle	*Pipistrellus subflavus*	Not Listed	Not Listed	Endangered	Yellow
Hoary bat	*Lasiurus cinereus*	Not Listed	Not Listed	Not Listed	Undetermined
Northern long-eared myotis	*Myotis septentrionalis*	Not Listed	Endangered	Endangered	Yellow

Source: ACCDC 2013
[1]Government of Canada 2012; [2]NS *ESA* 2013; [3]COSEWIC 2012a; [4]NSDNR 2010

The Northern long-eared myotis, Little-brown myotis, and Tri-colored bat were added to the NS *ESA* list and declared endangered on July 11, 2013. A 90% population decline over the past two years has been attributed to a disease called white-nose syndrome, cause by the fungus *Geomyces destructans* (NS *ESA* 2013). The disease has killed nearly 7 million bats in eastern North America in the past 8 years. White-nose syndrome is lethal and affects all bat species that congregate in caves and abandoned mines used for hibernation through the winter (NS *ESA* 2013).

Field surveys of bat migration/habitat use were carried out for 38 consecutive days from August 26 to October 3, 2013 using two AnaBat SD2 Detectors (Titley Electronics, Columbia, Missouri). Bat detectors were located in habitats representative of the Project site and that are expected to provide suitable foraging habitat for bats (*i.e.,* edges and wetlands). Detector 1 was deployed in an open shrub swamp, on the Project site, approximately 1.1 km southwest from the closest turbine (Turbine 6). Detector 2 was deployed on the boundary of a clear-cut and a mid-aged softwood stand approximately 860 m south of Turbine 7 (Drawing 8.7). Detector 2 was damaged after 29 sampling days, and was subsequently taken down on September 24th, 2013 and not redeployed.

In total, 105,855 files were recorded, of which only 20 were determined to be bat generated ultrasound. The remaining files were determined to be caused by extraneous noise.

Most echolocation calls recorded at both detectors were associated mostly associated with Myotis species bats (*i.e.*, Little brown myotis (*Myotis lucifugus*) and Northern long-eared myotis (*Myotis septentrionalis).* Due to their similarity, calls of Nova Scotia's two resident Myotis species (Little brown myotis and Northern long-eared myotis) can be difficult to reliably distinguish from one another (O'Farrell et al. 1999), so these calls were not identified to species. A single Tri-colored bat (*Perimyotis subflavus*) call was detected on the night of August 27th at Detector 1 (Table 8.16). No calls were detected beyond September 12th at Detector 1 and beyond September 19th at Detector 2.

Table 8.16: Number of Echolocation Calls Recorded at the Project Site (Aug 26th – Oct 2nd)*

Date	Detector 1		Detector 2
	Myotis spp.	*Perimyotis*	*Myotis spp.*
26-Aug-13	1	0	0
27-Aug-13	1	1	0

Date	Detector 1		Detector 2
	Myotis spp.	*Perimyotis*	*Myotis spp.*
28-Aug-13	2	0	0
29-Aug-13	0	0	0
30-Aug-13	0	0	0
31-Aug-13	0	0	0
01-Sep-13	1	0	0
02-Sep-13	1	0	0
03-Sep-13	0	0	0
04-Sep-13	0	0	0
05-Sep-13	0	0	0
06-Sep-13	1	0	0
07-Sep-13	0	0	0
08-Sep-13	0	0	0
09-Sep-13	0	0	4
10-Sep-13	2	0	0
11-Sep-13	0	0	0
12-Sep-13	1	0	0
13-Sep-13	0	0	0
14-Sep-13	0	0	1
15-Sep-13	0	0	1
16-Sep-13	0	0	0
17-Sep-13	0	0	0
18-Sep-13	0	0	2
19-Sep-13	0	0	1
20-Sep-13	0	0	0
21-Sep-13	0	0	0
22-Sep-13	0	0	0
23-Sep-13	0	0	0
24-Sep-13	0	0	N/A
25-Sep-13	0	0	N/A
26-Sep-13	0	0	N/A
27-Sep-13	0	0	N/A
28-Sep-13	0	0	N/A
29-Sep-13	0	0	N/A
30-Sep-13	0	0	N/A
01-Oct-13	0	0	N/A
02-Oct-13	0	0	N/A
Total per site	**10**	**1**	**9**

* detector 2 sustained damage and was removed from the field on Sept 24th, 2013.

It's possible that the absence of calls after early to mid-September can be explained by the fact that most bats had completed their migration through the area to their respective hibernacula. Alternatively, insect prey availability may have diminished in the area, causing bats to forage in more productive habitats (*i.e.*, over open water). The low number of bat calls detected throughout the sampling period indicates that bat activity on the site appears to be low.

Bat species that were identified during field surveys 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. These priority species include:

- Little brown myotis – "Endangered" (NS *ESA*), "Endangered" (COSEWIC), "Yellow" (NSDNR);
- Northern long-eared myotis – "Endangered" (NS *ESA*), "Endangered" (COSEWIC), "Yellow" (NSDNR); and
- Tri-colored bat (or Eastern pipistrelle) – "Endangered" (NS *ESA*), "Endangered" (COSEWIC), "Yellow" (NSDNR).

The Little brown myotis is the most common species in Nova Scotia, and is probably ubiquitous in the province (Broders *et al*. 2003). During the day, the Little brown myotis will roost in buildings, trees, under rocks, in wood piles, and in caves, congregating in tight spaces to roost at night (Fenton and Barclay 1980). As a non-migratory species, Little brown myotis hibernates from September to early or mid-May in abandoned mines or caves (Fenton and Barclay 1980; Mosely 2007).

ACCDC data does not provide for any records of Little brown myotis within 100 km of the Project site. However, until recently, this species was considered quite common throughout the province, so observations of were likely not reported. It is highly likely that some of the echolocation calls recorded during field studies were emitted by Little brown myotis.

The Northern long-eared myotis, although once considered uncommon throughout Nova Scotia (Moseley 2007), is likely ubiquitous in the forested regions of the province (Broders *et al*. 2003). This species is widely distributed in the eastern United States and Canada, and is commonly encountered during swarming and hibernation (Caceres and Barclay 2000). During the day, Northern long-eared myotis show a preference for roosting in trees, the characteristics of which have been shown to vary according to the reproductive status of bred females (Garroway and Broders 2008). Females appear to prefer shade tolerant deciduous trees over coniferous trees, whereas males roost alone in coniferous or mixed-stands in mid-decay stages (Broders and Forbes 2004). Northern long-eared myotis are also non-migratory and are typically associated with the Little brown myotis during hibernation, in caves or abandoned mines (Moseley 2007). Hibernation in this species is thought to begin as early as September and can last until May (as cited in Caceres and Barclay 2000).

ACCDC data indicates that the closest Northern long-eared myotis sighting to the Project site was 3.65 km away at Frenchman's Cave. It is highly likely that some of the echolocation calls recorded during field studies were emitted by Northern long-eared myotis.

Tri-colored bat, formerly known as the Eastern pipistrelle, is frequently observed in Nova Scotia, but has a restricted distribution focused in the interior of the southwest region of the province (Farrow and Broders 2011). Research conducted at Kejimkujik National Park found Tri-colored bats to be locally abundant, and results indicate that this population may represent the only breeding population of the species in Canada (Broders *et al.* 2003). In the summer months, the Tri-colored bat is concentrated in a geographic area bounded by Wolfville to the west, Halifax to the northeast, and Shelburne to the southeast (Quinn and Broders 2007). The species occurs throughout most of eastern North America, with Nova Scotia representing the northeastern extent of its range (Fujita and Kunz 1984).

Tri-colored bats require clumps of *Usnea* lichen for roosting; a habitat feature typically associated with mature spruce and balsam fir trees (Farrow 2007). This association suggests that the species may be negatively impacted by intensive forestry practices that remove roosting habitat (Farrow 2007). A few, isolated stands of mature softwood forest dominated by red spruce and hemlock are still present throughout northern and eastern areas of the Project site (Drawing 8.5), yet mature balsam fir trees were conspicuously absent.

The species typically forages over water bodies, but also feeds over tree canopies (reviewed by Quinn and Broders 2007) and it appears that, unlike the Little brown myotis, Tri-colored bats stay active throughout the night, possibly as a means to reduce intraspecific competition (Broders *et al.* 2003). This species is non-migratory, and generally hibernates alone, or in small numbers, in caves or abandoned mines where it appears to show a preference for small side passages, rather than main passages (Fujita and Kunz 1984; Moseley 2007). Individuals show strong fidelity to specific hibernacula, although in Nova Scotia only 10 hibernating individuals have ever been recorded (Quinn and Broders 2007).

ACCDC data indicates that the closest Tri-colored bat sighting to the Project site was 3.65 km away at Frenchman's Cave. A Tri-colored bat echolocation call was recorded on the Project site, so it is confirmed that this species occurs on the Project site during late-summer movements to hibernacula. It is also possible that this species occurs on the Project site during the breeding season.

9.0 SOCIO-ECONOMIC ENVIRONMENT

9.1 Local Demographics and Industry

The Project site is located in the community of Ellershouse, within the Municipality of the District of West Hants. The largest communities in the Municipality include Windsor (pop. 3,785), Falmouth (pop. 1,213), Hantsport (pop. 1,159), and Brooklyn (pop. 970) (Statistics Canada 2012). The nearest communities to the Project site are Hartville (3.1 km), St. Croix (4.6 km), Newport Station (5.5 km) and Five Mile Plains (6.8 km).

9.1.1 Demography

Population statistics for the district of West Hants derived from the 2011 census are summarized in Table 9.1.

Table 9.1 Population in West Hants

Population Statistics	West Hants
Population in 2011	14,165
Population in 2006	13,871
Population change from 2006-2011 (%)	2.1
Total private dwellings in 2011	6,205
Land area (square km)	1,242
Population density per square kilometer	11.4

Source: Statistics Canada 2012

The age distribution in West Hants reveals a median age of 44.5 years, which is slightly higher than the provincial median age (43.7), and the HRM (39.9) (Statistics Canada 2012). An overview of age distribution for 2011 in West Hants is outlined in Table 9.2 below.

Table 9.2: Age Distribution in West Hants

Age Statistics	West Hants
0 - 14 years	2,365 (16.7%)
15 - 64 years	9,545 (67.4%)
65+ years	2,255 (15.9%)
Total Population	**14,165 (100%)**

Source: Statistics Canada 2012

In 2006, the average income for individuals in West Hants was $29,880 a year, compared with the average of $31,795 for Nova Scotia (Province of Nova Scotia, 2013). These averages are lower than the Canadian average individual income of $37,302. The average value of dwellings in the West Hants increased 79.2% between 1996 and 2006 to $145,819. In comparison, the average value of dwellings in the province increased 82.5% during the same period to $158,000 (Table 9.3).

Table 9.3: Household Costs and Average Individual Income

Jurisdictions	Average Housing Value	Average Individual Income
West Hants	$145,819	$29,880
Province of Nova Scotia	**$158,000**	**$31,795**

Source: Province of Nova Scotia 2013

9.1.2 Health Care and Emergency Services

The Brooklyn Volunteer Fire Department is located approximately 9 km north east of the Project site on Highway 215. The Windsor Fire Department is also located nearby, approximately 12 km northwest of the Project site, on King Street in the Town of Windsor.

Health services in the region are provided by the West Hants/Uniacke Community Health Authority, which offers a wide range of services throughout the Municipality of West Hants, including Hants Community Hospital, located in Windsor. Health and emergency services exist in the area and are accessible to Project workers if the need should arise.

9.1.3 Industry and Employment

Statistics for West Hants indicate that the unemployment rate in 2011 was 10.6%, which is slightly higher than the provincial average of 10% (Province of NS 2013). With regard to employment rates, the West Hants employment rate was 55%, which is slightly lower than the provincial rate of 56.8% (Province of NS 2013).

A breakdown of the labour force within West Hants is provided in Table 9.4. The highest proportion of workers in West Hants fall into the “retail trade” category (13.5%). Other significant industries include construction, health care and social services (Statistics Canada 2012).

Table 9.4: Top industries for the employed labour force, West Hants

Industry	Total West Hants
Total employed labour force 15 years +	6,660
Retail Trade	900 (13.5%)
Construction	800 (12.0%)
Health Care and Social Services	775 (11.6%)

Source: Statistics Canada 2012

The Town of Windsor is located approximately 11 km northwest of the Project site, and offers a range of business services. A review of businesses located within 10 km of the Project site is provided in Table 9.5.

Table 9.5: Local Businesses and Proximity to Project Site

Business	Distance and direction to Project site*
Weiner Brown Alignment Centre	1.5 km northeast of the Project site, on Williams Road
Ellershouse General Store	3.2 km northeast of the Project Site, on Ellershouse Road, Ellershouse
Coyote Hill Golf Course and Driving Range	6.9 km North of the Project Site, on Hwy 215, Newport Corner
Doucettes Office Solutions	7.4 km northwest of the Project Site, on Wentworth Rd, Windsor
Nova International Ltd.	7.9 km northwest of the Project Site, on Highway 1, Windsor
Boulderwood Stables	8.1 km northeast of the Project Site, on Trunk 1, Ardoise
Oulton Fuels	8.8 km northwest of the Project Site, on Highway 14, Windsor
Downeast Motel	8.8 km northwest of the Project Site, on Trunk 1, Windsor
Borealis Art	9.0 km northwest of the Project Site, on Trunk 1, Windsor
The Bread Gallery	9.0 km northeast of the Project Site, on Hwy 14, Brooklyn
Goldhouse Chinese Restaurant	9.2 km northwest of the Project Site, on Trunk 1, Windsor

*All distances measured from center of the Project site, using the most direct route.

A number of local artists and photographers are based out of the community of Ellershouse, including Woodland Wool, Signature Glass, David Howell's Paintings, Steve Sharpe Scenic & Landscape Photography and Transformed Life Photography.

9.1.4 Community Benefits

The Project is committed to sharing economic opportunities with the local community, throughout the development and life-span of the Project via the use of local skills and labour where possible, municipal tax revenue, and on-going energy literacy/education. The Project team has created a CLC, which will help to identify Project-related opportunities and benefits for the local community. A number of socio-economic benefits have been identified which may be expected from the Project. Economic effects as a result of the Project will include job creation and increased revenue for the Municipality of the District of West Hants.

Investment in the Local Community

It is estimated that the Project will result in approximately $10 million in investments into the province of Nova Scotia. This investment has already begun and is expected to continue in the form of contracts with Nova Scotia companies for professional services (*i.e.,* engineering, project management, legal), equipment and construction materials, road and foundation construction, tower erection, interconnection and transportation services. The Project Team is committed to providing Project-related benefits to the local community and first must better understand the community's needs. The CLC (see Section 12.1) will play a vital role in helping the development team better understand the community, its desires and expectations, as well as identifying opportunities for community involvement and related benefits.

Job Creation

Minas is a local company who understands the importance of supporting local rural communities. The Project Team is committed to using as many local skills as possible. Potential work includes environmental studies, geotechnical investigation, engineering, land and snow clearing, surveying, Project site security, road construction and maintenance, turbine component transportation, turbine foundation construction, turbine installation, collector system construction, and substation construction. Specifically, elements of job creation throughout the lifespan of the Project may include:

- Project Development- During the development phase of the Project, Nova Scotian professionals will deliver a variety of services, including: civil and electrical engineering services, legal services, environmental and biological survey services, archaeological services, land and community relations services, and many others. Dozens of professionals within Nova Scotia will render their services as part of the development of the Project.
- Construction - Though the construction phase of the Project is relatively short, it will require significant manpower for realization. Much of the construction employment will come through contracting and subcontracting of Nova Scotia construction firms. This will likely include significant elements of civil and electrical construction. It is estimated that the Project will require approximately 20–50 jobs of varying duration throughout the development and construction periods.

- Operations and Maintenance - Operational wind projects require long-term operations and maintenance professionals to be located either on-site or within short driving distance of the Project. It is generally anticipated that a team of two operations and maintenance technicians can maintain regular operations and maintenance service on approximately a dozen turbines. The jobs associated with operations and maintenance are long-term, steady, stable, and high-paying jobs

In addition to the direct investments that the Project would bring to Nova Scotia's economy, a suit of auxiliary economic benefits can also be expected. It has previously been demonstrated that investments in wind power developments can result in significant indirect ancillary benefits to local communities. Workers that are directly involved with the development would contribute to local economies by redistributing wealth to a variety of goods and services such as hotels, restaurants, and grocery stores (USDE 2008).

The Project Team is currently in the process of compiling a list of local businesses which provide skills, equipment and ancillary services, which may contribute to, and benefit from the Project throughout the various phases of its lifespan.

Tax Revenue

As outlined in the *Wind Turbine Facilities Municipal Taxation Act* (2006), the Municipality of the District of West Hants will receive tax revenues per MW on an annual basis and as such, the royalty will annually increase as the Consumer Price Index rises. The Project is expected to enhance the community's economic development by providing tax revenue of $60,000 to $100,000 annually to the Municipality.

Education

A renewable energy project in a community allows residents to gain a better understanding of wind technology and how wind power can help reduce reliance on fossil fuels. Energy literacy is an increasingly important skill in today's economy, and the Project team is committed to providing energy literacy to the communities surrounding the Project, and is available to answer questions and provide a better understanding of local and provincial energy issues. The CLC has noted that there are schools in nearby communities of Brooklyn, Newport Station and Windsor that could benefit from energy literacy programs.

9.2 Land Use and Value

The property on which the proposed wind farm is to be built is "Commercial Forest" land owned by Atlantic Star Foresty Ltd. Land use around the Project site is varied, and includes Provincial Crowns lands to the south-southwest, "Resource Forest" lands to the north-northwest, and a mix of "Resource Forest", residential and farm lands to the northeast along Highway 101. The St. Croix First Nation Reserve (IR 34), which forms part of the Annapolis Valley First Nation, is located along the western boundary of the property, approximately 4.5 km from the centre of the Project site (Service NS 2013). The St. Croix Reserve was established in 1851, though it does not appear to be presently inhabited (Davis MacIntyre and Associates Ltd. 2013).

Potential effects on property values is often a concern of neighboring residents due largely to anecdotal reports from appraisers of drastic declines in property values following the nearby installation of a wind energy facility (as reviewed in Gulden 2011). Despite these concerns, a number of rigorous and statistically defensible studies have concluded that wind energy developments have had no significant effect on surrounding property values.

Prior to 2013, the most comprehensive study on the impact of wind farms on property values had been completed by Hoen *et al.* (2009). This research analyzed data on nearly 7,500 sales of single family homes situated within 10 miles (16 km) of 24 existing wind farms in the United States. Eight different hedonic pricing models failed to generate statistically significant evidence that property values for houses located within 10 miles of wind farms are influenced by the developments. Subsequent research by the same laboratory but employing further analyses confirmed these results (Hoen *et al*. 2010).

Carter (2011) analyzed home transactions in a rural landscape surrounding small (1-4 turbines) wind energy developments, while employing a hedonic model to statistically control for variables affecting all real estate transactions such as square footage, age of home, and school zone. This study concluded that proximity to the wind farms did not impact average selling price of homes; in fact, in one case, homes closer to a wind farm sold for significantly higher than those elsewhere (Carter 2011).

A study by Hinman (2010) tracked property transactions in communities located close to a 240-turbine wind farm for an eight year period that spanned pre-development and operation stages. Hinman (2010) found that before project approval, property values in the area decreased. This was attributed to a fear of the unknown effects that the development would have; an effect known as anticipation stigma. However, once the development became operational, property values recovered. This recovery was attributed to a greater understanding of the operational effects of the development. Anticipation stigma, however, was not detected in a similar study in Colorado (Laposa and Mueller 2010), in which it was concluded that the announcement of a large wind energy development did not significantly reduce the selling prices of homes surrounding the proposed development.

Until very recently, the primary limitation of previous research on the effects of wind energy facilities on surrounding home values has been that research has been based on relatively small sample sizes (data sets) of relevant home-sale data. The inability to account for the complexity of the various factors which affect property values has also been cited as a limitation to previous studies. In particular, data had been limited for homes located within about a half mile (800 m) of turbines, where impacts would be expected to be the largest: Hinman (2010) (n~11); Carter (2011) (n~41). This is in part due to the fact that setback requirements generally result in wind facilities being sited in areas with relatively few houses, limiting the number of sales transactions available to be analyzed (Hoen *et al.* 2013). Although these smaller datasets are adequate to examine large impacts (*e.g.*, over 10%), they are less likely to reveal small effects with any reasonable degree of statistical significance.

A recent study published in August 2013 by Berkeley National Laboratory (principal authors) was conducted to address these gaps in data, and included the largest home-sale data set to date. Researchers collected data from 51,276 home sales spanning 27 counties in nine states, related to 67 different wind facilities (Hoen *et al*. 2013). These homes were within 10 miles of 67 different wind facilities, and 1,198 of the sales analyzed were within 1 mile (1.6 km) of a turbine, giving a much larger data set than previous studies have collected. The data span the periods well before announcement of the wind facilities to well after their construction (Hoen *et al.* 2013).

Two types of models were employed during the study to estimate property-value impacts: (1) an ordinary least squares model, which is standard for this type of study, and (2) a spatial-process model, which accounts for spatial variability. These models allow the researchers to control for home values before the announcement of a wind facility (as well as the post-announcement, pre-construction period), the spatial dependence of unobserved factors effecting home values, and value changes over time. A series of robustness models was also employed to add an additional level of confidence to the study results (Hoen *et al.* 2013).

Regardless of model specification, the results of the study revealed no statistical evidence that home values near turbines were affected in the post-construction or post-announcement/pre-construction periods. Therefore, the authors conclude that if effects do exist, either the average impacts are relatively small (within the margin of error in the models) and/or sporadic (impacting only a small subset of homes) (Hoen *et al*. 2013).

Research has consistently demonstrated that, in a variety of spatial settings and across a wide temporal scale, sale prices for homes surrounding wind energy facilities are not significantly different from those attained for homes sited away from wind energy facilities.

9.3 Recreation and Tourism

The Town of Windsor and surrounding area offers a range of entertainment and recreational services, including amusement parks, exhibition grounds, museums, theatre, and dining. The Windsor region is well-known throughout the province for many activities coinciding with the fall harvest including apple picking, farmers markets and pumpkin festivals.

Existing outdoor recreation in the vicinity of the Project site includes snowmobiling, ATVing, hunting, fishing, golfing, camping and hiking. Coyote Hill Golf Course and Driving Range, a par 35, 9 hole course, is located 6.9 km north of the site. Smiley’s Provincial Park is located approximately 11 km northeast of the site, which includes a campground, picnic area, playground and walking trails. Boulderwood Stables is located approximately 8 km northeast of the Project Site, which offers year-round trail riding, day camps, and swimming. Panuke Lake Nature Reserve brings a variety of recreational opportunities including hunting, fishing, wildlife viewing, and boating. Fishing is a popular activity in the area, with nearby Panuke Lake hosting an annual Smallmouth Bass Tournament. The existing roads and trails within the Project site are frequently used by local hunters, ATV and snowmobile associations including the Hants Sno-Dusters Snowmobile Association.

The 2011 Nova Scotia Visitor Exit Survey Community Report outlines the total trips (stopped or stayed) to communities in Nova Scotia, to particular tourist regions, as well as capture rates of communities within tourist regions (Nova Scotia Department of Economic and Rural Development and Tourism 2011). The nearest communities to the Project site examined were Windsor, Hantsport, and Brooklyn in the Fundy Shore and Annapolis Valley region and Mount Uniacke in the Halifax Regional Municipality. Table 9.6 shows the total trips (people who stopped for at least 30 minutes or stayed overnight) that were made to these communities as well as their capture rate (the percentage of parties that stopped in a specific community compared to other communities within the region) out of the total number of parties who visited the tourism region.

Table 9.6: Communities Visited in Nova Scotia

Region/Community	Total Trips (% who stopped or stayed)	Capture Rate (%)
Fundy Shore and Annapolis Valley	**37%**	
Windsor	5%	14%
Hantsport	2%	4%
Brooklyn	2%	4%
Halifax Regional Municipality	**79%**	
Mount Uniacke	2%	2%

Source: NSDERDT 2011

The low percentage of total trips and capture rate suggests that tourism is not a major economic driver in the immediate vicinity of the Project site.

It is difficult to determine with certainty how tourists will react to a wind development. Wind farms are objects of fascination for many and thus can generate tourism for the local community. Some wind farms attract thousands of visitors per year and the benefits of even drawing a fraction of that amount of visitors to a community can be felt by many businesses including shops, restaurants and hotels (CanWEA 2006a). Pincher Creek, Alberta developed a 19 MW wind farm in 1993, since that time tourism revenue from visitors from as far away as Russia has generated $5,000 in annual sales of clothing and souvenirs branded with the “Naturally Powerful Pincher Creek” logo (CanWEA 2006a). The North Cape Wind Farm, a 10.56 MW wind facility located near Tignish Prince Edward Island, has become a regional attraction, bringing in over 60,000 visitors per year. The provincial government constructed a restaurant and gift shop at the site, resulting in a capital expenditure of $1.4 million. At the time of publication, the restaurant and gift shop were generating approximately $260,000 in annual revenue and employing 20 seasonal workers from mid-May to the end of October (CanWEA 2006b).

A 2002 study by Market and Opinion Research International interviewed tourists visiting Argyll and Bute, Scotland and asked them about their attitudes towards the presence of wind farms in the area. Of those who knew about the surrounding wind farms (40% of those interviewed), 43% felt that wind farms had a positive effect on the area, 43% felt it made no difference, and 8% felt it had a negative effect (Market and Opinion Research International 2002).

The turbines will consist of a small footprint on privately owned land. The Project team is committed to working with local recreational groups to ensure continued access to the site within the bounds of all safety considerations. Therefore, no negative impacts are expected to the broader recreational community.

10.0 CULTURAL AND HERITAGE RESOURCES

10.1 Archeological Resource Impact Assessment

Davis MacIntyre and Associates Limited conducted an ARIA for the Project. The assessment included a historic background study and reconnaissance of the Project site to determine the potential for archaeological resources within the site.

Archaeological reconnaissance was conducted in November 2013. The assessment indicated that the immediate Project site was not likely settled by First Nations peoples or by Euro-Canadians. Historic maps and documents indicate that there was a settlement to the north of the site in the late 19th century, and that logging camps existed, particularly to the west of the site. Logging roads, some of which are still in existence, pass through the site; however the reconnaissance did not reveal any past cultural activity aside from 20th and very early 21st century logging. The site has been determined to be of low archaeological potential and, therefore, no further mitigation has been recommended at this time (Davis MacIntyre and Associates Ltd. 2013).

The ARIA has been forwarded to the NS Department of Communities, Culture and Heritage. When a response letter is received, a copy will be provided to NSE

11.0 OTHER CONSIDERATIONS

11.1 Shadow Flicker

Shadow flicker can occur when rotating blades cast flickering shadows during times of direct sunlight. The magnitude of shadow flicker is determined by the position and height of the sun, wind speed and direction, geographical location, time of year, cloud cover, turbine hub height and rotor diameter, and proximity to the turbine (CanWEA 2011).

For shadow flicker to occur, the following criteria must be met:

1. The sun must be shining and not be obscured by clouds/fog.
2. The source turbine must be operating.
3. The wind turbine must be situated between the sun and the shadow receptor.
4. The wind turbine must be facing directly towards, or away from, the sun such that the rotational plane of the blades (*i.e.*, rotor plane) is perpendicular to the azimuth of incident sun rays. For this to occur, the wind direction would have to be parallel to the azimuth of the incident sun rays throughout the day.
5. The line of sight between the turbine and the shadow receptor must be clear. Light-impermeable obstacles, such as vegetation, tall structures, etc., will prevent shadow flicker from occurring at the receptor.
6. The shadow receptor has to be close enough to the turbine to be in the shadow.

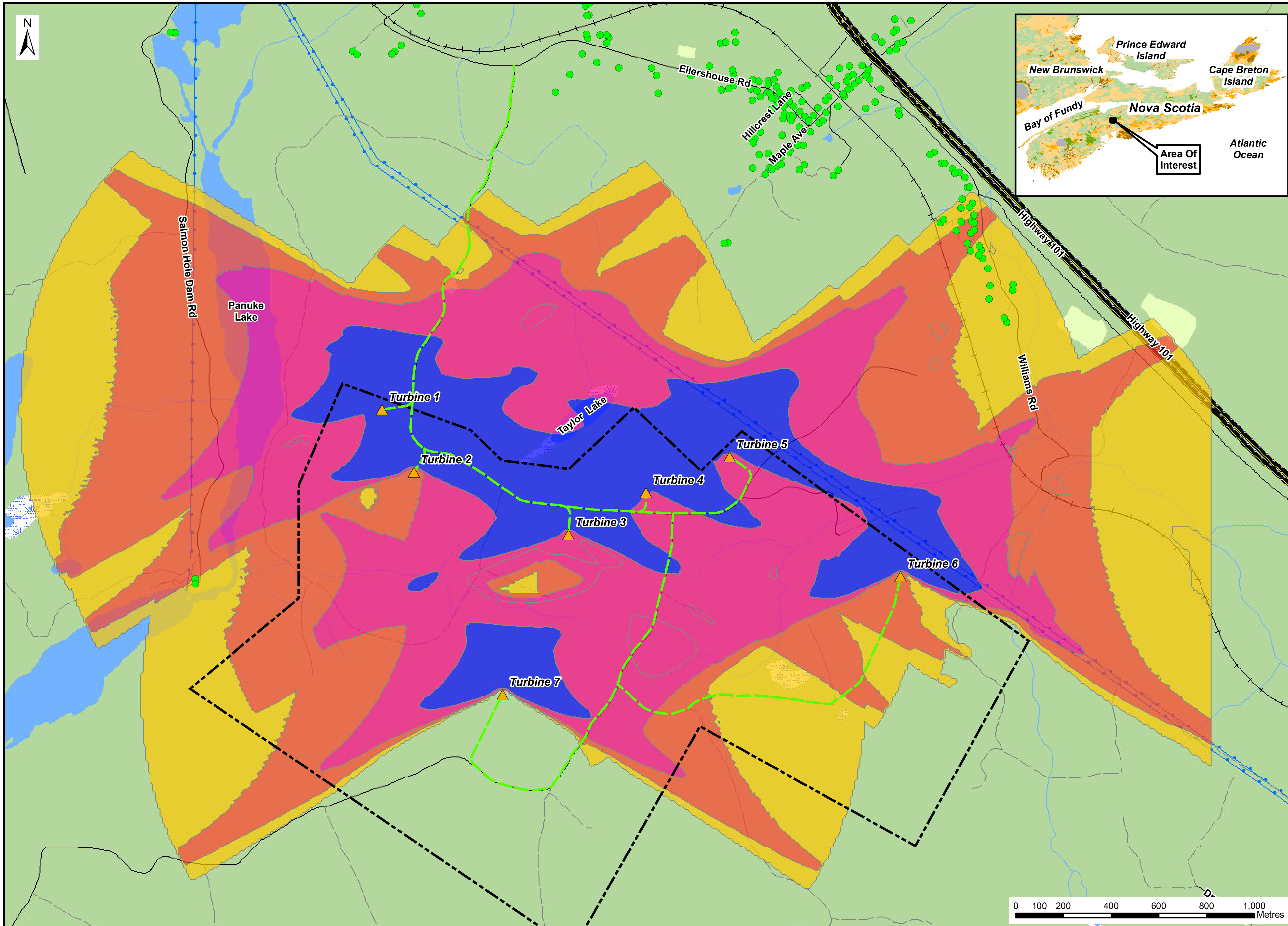
A shadow flicker assessment was completed for the proposed Project to assess the potential impact on surrounding shadow receptors. The analysis was conducted using the WindPRO version 2.9 software package, assuming worst case scenario conditions, including constant sunshine and receptor windows oriented perpendicular to the rotational axis of the turbines. There are no municipal, provincial, or federal guidelines related to shadow flicker, but many jurisdictions (including NSE) have adopted the industry standard of no more than 30 hours of shadow flicker per year, or no more than 30 minutes of shadow flicker on the worst day of the year at residential receptors. These guidelines were used in the shadow flicker assessment for the Project and do not apply to commercial receptors.

A list of 189 potential receptors, within 2 km of the Project site (Appendix H), was developed using GIS data from the Nova Scotia Geomatics Centre and aerial imagery. For modeling purposes, the receptor list is considered to be conservative as no distinction has been made between habitable dwellings and barns, sheds, or outbuildings. Modeling results (Appendix H) indicate that all residential receptors are predicted to comply with the industry standard of no more than 30 minutes of shadow flicker on the worst day, and no more than 30 hours of shadow flicker per year (Drawing 11.1).

11.2 Electromagnetic Interference

The rotating blades and support structures of wind turbines can interfere with various types of electromagnetic signals emitted from telecommunication and radar systems (RABC and CanWEA 2012). In response to this phenomenon, the Radio Advisory Board of Canada (RABC) and CanWEA developed guidelines for assessing the EMI potential from a wind turbine development. These guidelines cover both disclosed and non- disclosed systems. For disclosed systems, the guidelines outline a consultation based assessment protocol that establishes areas, called “consultation zones”, around transmission systems, based on the type and function of the system. For non-disclosed systems, the guidelines give a list of required contacts which must be consulted to determine the potential Project impact.

The EMI study for this Project was completed in accordance with the RABC/CanWEA published guidelines, to assess the potential impact of the proposed Project on existing radiocommunication, radar and seismoacoustic monitoring systems (RRS systems). Location information and frequency details were obtained from the Technical and Administrative Frequency Lists database, which is administered by Industry Canada, and from email communications with the Royal Canadian Mounted Police (RCMP), Department of National Defense (DND), Canadian Coast Guard, EC, NAV CANADA and Natural Resources Canada. Results of the disclosed system assessment are provided in Table 11.1.



Notes:

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Existing Receptors
- Proposed Turbine
- Proposed Access Road
- Project Study Area
- Active Railroad
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Existing Transmission Lines
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Shadow Modeling Results

Predicted Shadow Hours/Year

- <0.5 - 10
- 10 - 30
- 30 - 100
- 100 +

Shadow Flicker Modeling Results

Strum CONSULTING

Date: Nov. 2013	Project #: 12-4583
Scale: 1:15,000	Drawing #: 11.1
Drawn By: G. Gregory	
Checked By: M. Smith	

Table 11.1: Disclosed RRS System Consultation Results

Signal Source	Specified Operator	Consultation Zone Radius	Consultation Results
Point-To-Point (PTP)			
Transmitter or Receiver	N/A	1	Not required - no systems identified within consultation zone.
Transmission Path	N/A	Transmission Pathway intersects Project	Consultation with NSPI Customer Operations required regarding Newtonville – South Uniacke PTP Transmission.
Over- The- Air Reception			
FM Transmitter	N/A	1	Consultation with Minas Basin Pulp and Power Co. Ltd. required regarding Salmon Hole Dam FM transmission tower.
	CBC	5	Not required - no systems identified within consultation zone.
TV Transmitter	N/A	1	Not required - no systems identified within consultation zone.
	CBC	89	Consultation with CBC recommended regarding 20 Digital TV Transmitters and 1 Analog TV Transmitter identified within consultation zone. Further analysis or consultation with the CBC/ Radio- Canada may be required at the request of the CBC.
TV Receiver (equation)	N/A	6.2	It is recommended that the community be invited to notify the Project Team of any signal reception issues post construction. 1,612 dwellings within consultation zone.
Cellular Type Networks			
Transmission Tower	N/A	1	Not required - no systems identified within consultation zone.
Satellite Systems			
Transmitter or Receiver	N/A	1	Not required - no systems identified within consultation zone.
Transmission Pathway	N/A	10	Not required - no systems identified within consultation zone.
Land Mobile Networks			
Land Mobile Radio Tower	N/A	1	Not required - no systems identified within consultation zone.
Airport			
Airport	Military or Civilian	10	Not required - no airports identified within consultation zone.

Results of the non- disclosed system consultation are provided in Table 11.2.

Table 11.2: Non- Disclosed RRS System Consultation results

System Operator	System Type	Consultation Results
DND	Radiocommunication Systems	Received a letter of non-objection on November 7, 2013.
	Air Defence and ATC Radars	Received a letter of non-objection on October 22, 2013.
Royal Canadian Mounted Police	Radiocommunication Systems	Correspondence submitted on September 17, 2013 – still awaiting response.
Canadian Coast Guard/ Department of Fisheries and Oceans	Vessel Traffic System Radars	Received a letter of non-objection on September 19, 2013.
Environment Canada	Weather Radars	Received a letter of non-objection on October 7, 2013.
NAV Canada	Civilian ATC Radars	Correspondence submitted on September 26, 2013 – still awaiting response.

System Operator	System Type	Consultation Results
Natural Resources Canada	Seismoacoustic Monitoring Stations	Correspondence submitted on September 17, 2013 – still awaiting response.

Relevant correspondence from the above operators is provided in Appendix I.

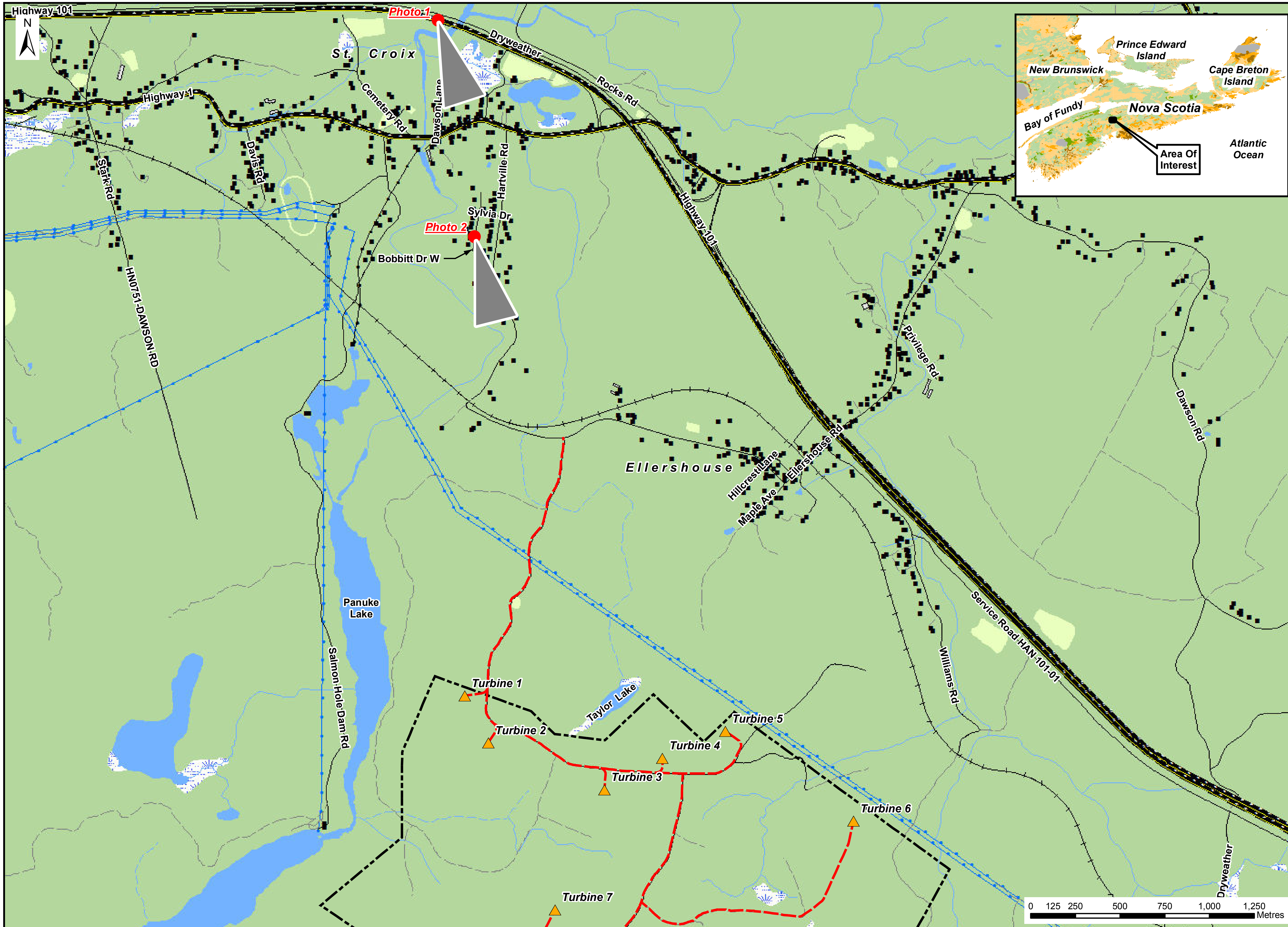
11.3 Visual Impacts

Predicted View Plane

To assess the potential impact on visual aesthetics in the local area, representative photos were taken from vantage points within the community to complete a Visual Impact Assessment.

Photographs were collected with magnetic bearings and a GPS waypoint recorded at each photo location. Geographical Information System (GIS) software was used to plot the photo locations and construct bearing lines to assist in the construction of a 3D view, generated using the GIS. A 3D surface was then constructed using the provincial Digital Elevation Model points from the Nova Scotia Topographic Database, which supports 5 m contour intervals. The proposed turbine location and specifics regarding the height of the turbine were used to develop the view plane. Each selected viewing site was created using the viewer location (photo GPS point, elevation, and bearing line) resulting in an accurate 3D view. The resulting computer generated view was then merged with the digital photographs using a scaled image of the proposed turbine.

Photos were taken from two locations, shown in Drawing 11.2. Simulated results are provided in Figures 11.1-11.2.



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:

- Visual Assessment Location
- Proposed Turbine
- Proposed Access Road
- Project Study Area
- Building
- Active Railroad
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Large Structure
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Visual Assessment Locations

Strum CONSULTING

Date: Nov. 2013	Project #: 12-4583
Scale: 1:20,000	Drawing #: 11.2
Drawn By: H. Serhan	
Checked By: M. Smith	

Figure 11.1: Actual (above) and simulated (below) views looking south from Bobbitt Drive West.

Figure 11.2: Actual (above) and simulated (below) views looking south from Highway 101 near the St. Croix River.

11.4 Sound

Sound from wind turbines comes from two general sources: the mechanical equipment, and the sound from the interaction of the air with the turbine parts, primarily the blades (NSDE 2008). In modern turbine designs, much of the mechanical noise is mitigated through the use of sound insulating materials. Aerodynamic noise, however, is a product of the turning of turbine blades and is thus an unavoidable aspect of wind power operations. Turbines can emit noises of different frequencies, and an individual's perception of the sound can depend on hearing acuity and tolerance for particular sound types (NRC 2007). Furthermore, the propagation of sound from the turbine source to a receptor, such as a residential dwelling, is influenced not only by the sound power level emitted from the turbine, but also by local factors such as distance to the receptor, topography, and weather conditions (Hau 2006). For example, increases in wind speed result in increases in ambient, natural noise (from vegetation movement) that can mask the sounds emitted from the turbine(s) (NRC 2007).

Nova Scotia has no specific sound guidelines for wind farms; however, through the EA process, NSE requires that predicted noise levels at identified residential receptors (as well as camps/cottages, daycares, hospitals and schools) not exceed 40 dBA. As this guideline is intended to be protective of human sleep disturbance, 40 dBA does not apply to commercial or vacant lot receptors. This guideline was used in the current sound assessment for the Project.

Acoustic Assessment

An acoustic assessment was conducted for the Project to predict sound pressure levels at identified receptors within a 2 km radius of the proposed turbine locations. The assessment was completed using the WindPro v. 2.8 software package. For the purposes of this model, receptors included all structures identified in the provincial topographic mapping, as well as any additional identifiable structures based on aerial imagery. No attempt to distinguish sheds and outbuildings from dwellings or cottages was made. The model followed ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method and calculations, and was based on the following input information:

- UTM coordinates for the wind turbines;
- 1/1 Octave band sound power level data, either provided by the manufacturer or calculated by WindPro, for the wind turbines;
- UTM coordinates for receptors (all structures within a 2 km radius of the Project site were evaluated – 189 receptors in total);
- A wind speed of 8 m/s, the speed at which the highest sound power level output is achieved (based on test data from the manufacturer); and
- Topographic data for the surrounding area.

The ISO 9613-2 calculation method assumes meteorological conditions that are ideal for noise propagation, including a ground temperature of 10°C and 70% relative atmospheric humidity. A ground factor of 0.7 was applied to the model, representing predominantly porous ground (*i.e.*, capable of vegetative growth) interspersed with hard surfaces (*e.g.,* water).

A total of 189 structures were identified within a 2 km radius of the proposed turbine locations. Modeling results indicated that no existing structure has predicted sound levels exceeding 40 dBA (ranges were from 29.1 to 36.7 dBA). Mapping illustrating the predicted sound levels relative to structures is provided in Drawing 11.3. Excessive noise resulting from turbine operation is not expected to be an issue at any existing dwellings/residences. Detailed results are provided in Appendix J.

A literature review related to infrasound is provided in Appendix C.

12.0 CONSULTATION AND ENGAGEMENT

12.1 Public Consultation

The Project team will continue to consult with the public regarding Project development. To date, the Project team has delivered presentations to the Municipal District Council of West Hants, local residents, the CLC, and special interest groups. A summary of the consultation for this Project is provided in Table 12.1. Detailed information on the open house event and the website is provided below.

Table 12.1: Consultation Meetings and Events

Date	Participants	Format/Activity
April 22, 2013	NSDNR	Consultation regarding the timing of spring bird surveys.
May 2, 2013	NSDNR	Email discussing Mainland moose survey methodology
May 30, 2013	NSE/NSDNR	Project meeting with NSE and NSDNR
June 11, 2013	NSDNR	Phone conversation with Mark E to discuss bat monitoring and timing.
September 13, 2013	NSE/NSDNR	Project meeting with NSE and NSDNR.
September 24, 2013	West Hants Municipal Council	Presentation: The Municipal Council of the District of West Hants received a presentation from the Project team sharing information on the Project.
October 1, 2013	Local Community	The first open house event was held at the Ellershouse Community hall, and was attended by about 75 members of the public.
October 15, 2013	Eric Christmas, Kwilmu'kw Maw-klusuaqn Negotiation Office (KMKNO) (Mi'kmaq Rights Initiative)	Meeting to provide Mr. Christmas and the First Nations community with Project details.
October 17, 2013	Recreational Groups	A meeting was held on October 17th to discuss current recreational use by snowmobile club members, hunters and cottager owners to discuss concerns and continued access to the site by these groups.
October 22, 2013	West Hants MLA	A meeting was held in Windsor to provide Project details.

Date	Participants	Format/Activity
October 30, 2013	CLC	The CLC met in October and November to discuss CLC guidelines, blasting, health effects, property values, and benefits to the Ellershouse community.
November 13, 2013	CLC	The CLC met in October and November to discuss CLC guidelines, EA studies, health and safety concerns (sound, infrasound and shadow flicker), and benefits to the Ellershouse community.
November 18, 2013	Brooklyn Fire Department	A meeting was held with the chief of the Brooklyn fire department, to provide Project details.
December 7, 2013	Local Community	A field trip to the Nuttby Wind Farm was held on December 7th to engage interested citizens and answer questions about wind farms.
December 17, 2013	Glooscap First Nation	A meeting is scheduled with the Glooscap First Nation Band Council to provide details of the Project.

Community Relations Manager
Mary-Frances Lynch, of Minas is serving as the Community Relations Manager for the Project. This role involves coordinating meetings, addressing community concerns and answering questions, as well as acting as a liaison between the community and the Project team.

Community Liaison Committee
A CLC has been created for the Project, to act as an advisory body to the development team, to provide a forum for the two way exchange of information, and to bring questions and concerns forward to the development team. The CLC is chaired by John Woods of Minas, and is formed by eight additional members, who represent the interests of local residents, landowners, recreational groups and local businesses from Ellershouse and surrounding areas.

CLC meetings are held regularly, and are attended by CLC members and Project team representatives, while members of the public are always welcome to attend. The CLC will continue to meet regularly and to play a role throughout the development of the Project over the coming years. All CLC meeting minutes are posted at the Ellershouse post office, as well as the Project website within 7 days of minutes being approved.

The first CLC meeting was held on October 30th, 2013 at the Ellershouse Community Hall and was attended by five CLC members (in addition to the Chair), three members of the Project team, and six guests which included local residents and a Co-op student. At the October 30th, 2013 meeting, the following topics were discussed:

- Blasting;
- Health effects;
- Effects on property values;
- Community benefits;
- Transportation of turbines; and
- Field trip to a wind farm.

A second CLC meeting was held on November 13, 2013 at the Ellershouse Community Hall, and was well-attended by members of the public. This second meeting featured a presentation about the EA methodology and findings to date. The presentation covered the following topics:

- EA process;
- Sound modeling;
- Infrasound; and
- Shadow flicker.

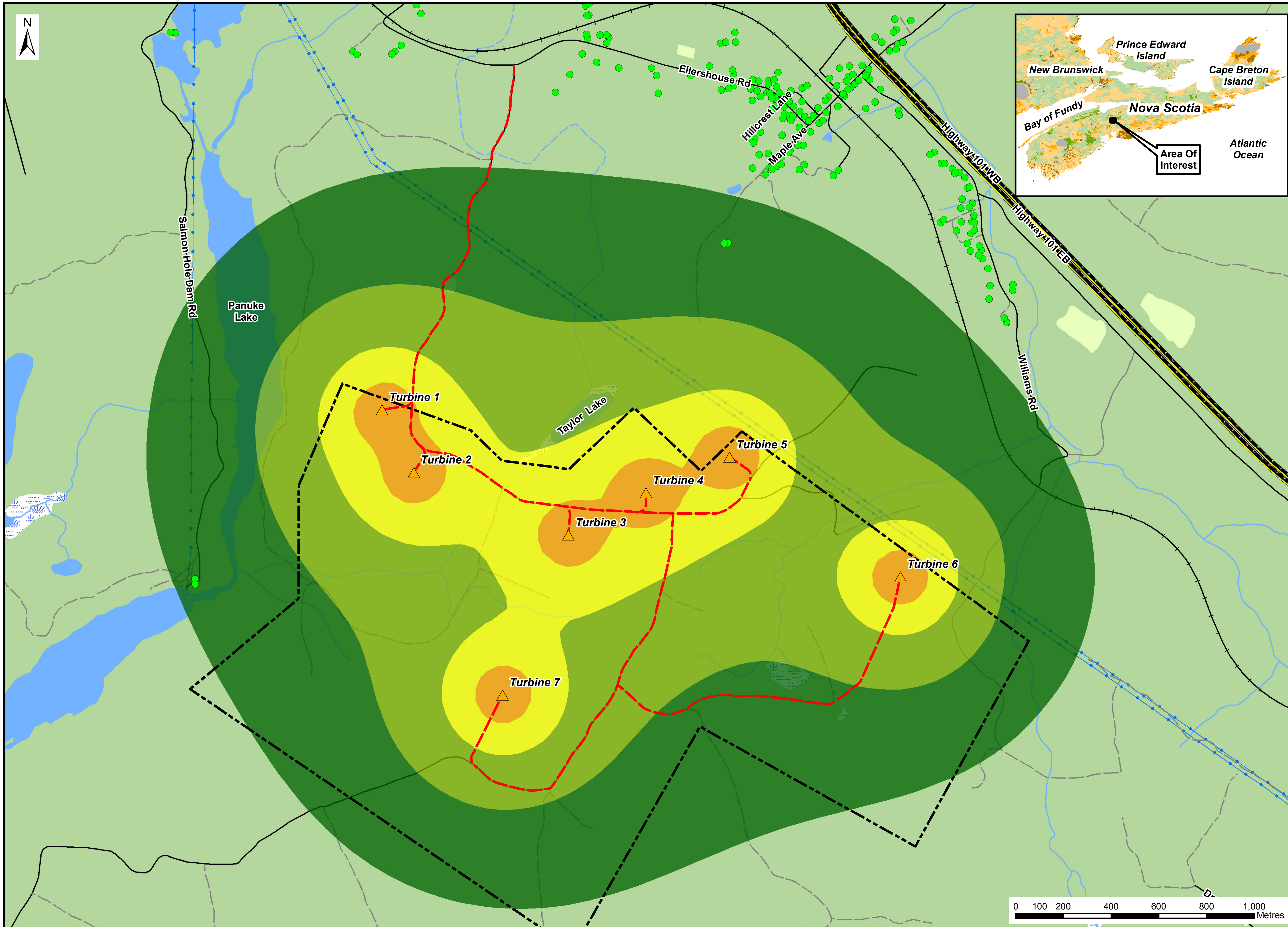
The committee also discussed an upcoming fieldtrip to a wind farm.

Open House Events
The first community open house was held at the Ellershouse Community Hall on October 1, 2013. Representatives from Minas Energy as well as staff and council members from Berwick and Mahone Bay were present to provide information on the proposed wind energy Project as well as to answer any questions or concerns from community members. The open house featured posters sharing information on the Project team, benefits to the area, the EA process, and an overview of Project sound, shadow flicker and visual assessment studies. Copies of the posters and newsletter from the open house are provided in Appendix K.

Attendees had the opportunity to speak one-on-one with Project team members and submit written comments and/or questions. Attendees were able to review Project information and voice comments and concerns in various ways:

- Read Project posters and the newsletter;
- Speak one-on-one with Project team members;
- Fill out a form on skills, resources and equipment they may contribute to the Project, to provide an inventory of resources available for Project construction and operation; and
- Fill out a questionnaire asking about the quality of information received, quality of the open house, and any comments or concerns about the Project.

Of the residents attending the open house who provided written comments, 28 filled out an open house feedback form. Some attendees commented that they would rather a town-hall format, while others wrote questions on local benefits, property values, traffic, sound, setback and light pollution. Some were supportive of the Project and expressed a desire to work closely with the Project team on the CLC.



Notes:

1. Reference: Digital Topographic Mapping by Nova Scotia Geomatics Centre.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Existing Receptors
- Proposed Turbine
- Proposed Access Road
- Project Study Area
- Active Railroad
- Major Roads and Highways
- Public Roads
- Access Roads / Trails
- Existing Transmission Lines
- Mapped Stream
- Mapped Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Sound Modeling Results

Predicted Sound Level (dBA)

- 35 - 40
- 40 - 45
- 45 - 50
- 50 +

Sound Modeling Results

Strum CONSULTING

Date: Nov. 2013	Project #: 12-4583
Scale: 1:15,000	Drawing #: 11.3
Drawn By: G. Gregory	
Checked By: M. Smith	

Figure 12.1: Open house held in Ellershouse, October 1, 2013

The Project Team will continue to help address any concerns raised by local citizens over the duration of the Project's development.

Newsletters

To date, two Project newsletters have been mailed out to local residents within 4 km of the Project site, and are available on the Project website (see below for additional website information). Newsletters provide up to date information on Project status, news, meetings and events as well as answers to questions commonly asked by the community regarding the Project. Copies of the September 2013 and November 2013 newsletters are provided in Appendix K.

Website

A website for the Project has been developed and can be accessed at: *http://www.areans.ca/project.html*. The website provides an overview of the Project, provides access to the featured posters presented at the first open house, shares information on upcoming meetings and Project news, as well as allows interested members of the public to pose questions to the Project team. Common questions from open house sessions and one-on-one meetings have been posted on the website to share information with a wider public audience. An email list is also maintained by the Project Team, to which all interested parties are welcome to subscribe.

Wind Farm Field Trip

The Project Team organized a field trip to the Nuttby Wind Farm on December 7th, 2013 to engage interested citizens and to facilitate an opportunity to answer any questions they may have about wind farms and technology. The Nuttby Wind Farm is a 45 MW, 22 turbine wind farm located between Truro and Tatamagouche. Transportation was provided to and from the Ellershouse Community Hall.

The field trip was attended by eleven interested residents from Ellershouse and area (Figure 12.2). Attendees had the opportunity to enter and stand below an operating turbine to experience sound and visuals. Project team members and Nuttby site staff were on-hand to answer questions. Common questions were related to the topics of sound, transportation issues, health impacts, bird and bat impacts, aviation lighting, and community benefits.

Figure 12.2: Community field trip to Nuttby Wind Farm, December 7, 2013.

The Project Team has also engaged in one-on-one meetings with individual landowners and other stakeholders within the community, and will continue to do so as required to address specific concerns.

12.2 Aboriginal Engagement

Due to the Project's proximity to Mi'kmaq First Nations communities, the Project's Community Relations Manager has contacted the following groups/communities:

- Eric Christmas – Mi'kmaq Energy Advisor, KMKNO;
- Chief Sydney Peters, Glooscap First Nation; and
- Chief Janette Peterson, Annapolis Valley First Nation

On October 9, 2013 an email was sent to the KMKNO requesting a meeting to discuss the Project. A meeting was held on October 15, 2013 and the following topics were discussed:

- Project size and location;
- Minas' involvement in the Project;
- Municipal Utilities ownership of the Project;
- Project timeline;
- EA studies;
- Project benefits;
- Community engagement; and
- First Nations areas of interest and benefits.

Eric Christmas agreed to assist Minas in planning meetings with the Chiefs of Glooscap and Annapolis First Nations and sent an email to Chiefs Peters and Peterson on November 6, 2013, requesting a meeting of all parties to discuss the Project. Phone calls were made to Glooscap and Annapolis First Nations by the Community Relations Manager on November 15, 2013 to follow up on the meeting request. Voicemails were left with both band offices.
Subsequent calls to the band offices were made on November 19, 2013. Glooscap First Nation requested that an email be sent to the Band Administrator Amanda Peters to schedule a meeting. Annapolis First Nation took the Community Relations' Manager contact information and agreed to follow up. The Community Relations Manager received a voice mail from Glooscap Band Administrator on November 26, 2013 and followed up with a call and voicemail to the Band Administrator on November 28, 2013. On December 4, 2013, a meeting date was scheduled for a presentation to the Glooscap Band Council for December 17th, 2013. Minas Energy will continue to work with the Annapolis Band office to schedule a meeting with to discuss the project.

A letter outlining Project information was sent to Beata Dera, Senior Consultation Advisor at the Office of Aboriginal Affairs on November 14, 2013. A copy of the letter can be found in Appendix K.

12.3 Review of Public Concerns

Issues and concerns raised by the public and other stakeholders throughout the consultation process to date can be grouped into seven broader categories which have been assessed throughout the EA.

Concerns include:

- Potential effects from sound generated by wind turbines;
- Potential effects on property values on lands near the Project site;
- Potential effects to the visual landscape around the Project site;
- Potential effects to birds and other wildlife from the construction and operation of wind turbines;
- Concerns regarding public health and safety;
- Benefits to the local community; and
- Recreational access and land-use.

Sound
Residents living near the Project site expressed concerns over the potential for noise during construction and decommissioning phases of the Project, as well as annoyance from noise generated by turbine blades during operation.

Mitigation measures related to construction and decommissioning activities are provided in Section 4.5 and will be further assessed in the Project EPP.

Sound modeling was completed to ensure that sound levels generated by operating turbines at all existing receptors will comply with the NSE standard of 40 dBA (exterior of the residence).

Additional details regarding sound assessment methodology and results are provided in Section 11.4. Infrasound is considered in the Human Health Literature Review provided in Appendix C.

Property Values
Potential effects on property values have been identified as a concern of neighboring residents. A review was completed on available literature related to the effect of wind farms on surrounding property values and a discussion is provided in Section 9.2.

Visual Landscape
Photos taken from locations near the Project site were used to create simulated images of the view plane for public viewing. Additional details and results of the visual assessment for the Project are provided in Section 11.3.

Birds and Wildlife
The public has raised concerns about mortality of birds and bats resulting from collisions with wind turbines. Sensory disturbances, as well as habitat loss for birds, bats and other forms of wildlife are also common concerns.

Extensive desktop and field studies have been completed to assess birds, bats and other wildlife and associated habitats at or near the Project site. Extensive consultation has been ongoing with NSDNR and CWS to ensure due diligence is practiced with regards to wildlife. The Proponent has committed to ongoing monitoring as requested by these agencies.

Details on wildlife methodology and results for fish, terrestrial fauna, birds, and bats are provided in Sections 8.3, 8.6, 8.7 and 8.8, respectively.

Public Health and Safety
The public is often concerned about the potential for effects to health and safety from wind turbines. In addition to sound levels, common concerns include infrasound, shadow flicker and the risk of ice throw. Due to the distance between Project infrastructure and potential receptors, no adverse shadow flicker impacts to residential receptors are expected.

A literature review regarding additional potential for effects to health and from wind turbines was also completed. The main findings of this review are provided in Appendix C.

Benefits to the Local Community

A common question that has been asked during CLC meetings and community events is what benefits the local community can expect from the construction of the Project, given that the power generated from the wind farm will be provided to the Towns of Berwick and Mahone Bay. One of the main objectives of the CLC is to help the Project team identify Project-related opportunities and benefits specific to the local community. Community benefits expected from the Project are outlined in Section 9.1.4.

Recreational Access and Land Use

The Project site is frequently used by various local groups for recreational activities - snowmobiling, hunting, ATVing and cottaging in particular. Concerns have been raised about the impacts the Project could have on safety and access to these lands by current users. A meeting was held on October 17 to discuss current recreational use by snowmobilers, ATVers, hunters and cottagers and facilitating continued access to the site. The development team has engaged with the Project insurer to determine a solution that would ensure continued use of the site by the various groups. Discussion are ongoing about conditions under which main access roads can remain accessible and the Project Team is committed to working with recreational groups on this matter, within the bounds of safety.

13.0 EFFECTS ASSESSMENT

Based on the discussion in Section 7, the following were identified as VECs:

- SOCI (fauna);
- Avifauna; and
- Bats.

To ensure all relevant issues and concerns related to the proposed Project are identified, an interaction matrix was used to evaluate the interactions between the Project phases and the VECs (Table 13.1). The potential for accidents and malfunctions is also considered for each Project phase.

Table 13.1: Interaction Matrix

Project Phases/Activities	SOCI (fauna)	Avifauna	Bats
Site Preparation and Construction			
Land Surveys for Placement of Roads, Turbines and Associated Works		X	
Geotechnical Investigations	X	X	
Placement of Sedimentation and Erosion Control Measures			
Clearing of Trees and Grubbing Areas for Construction	X	X	X
Access Road Upgrading and Construction	X	X	X
Laydown Area and Turbine Pad Construction	X	X	X
Transportation of Turbine Components			

Project Phases/Activities	SOCI (fauna)	Avifauna	Bats
Turbine Assembly	X	X	X
Grid Connection			
Removal of Temporary Works and Site Restoration			
Commissioning			
Operation and Maintenance			
General Operation and Maintenance	X	X	X
Vegetation Management	X	X	
Decommissioning			
Dismantling and Removal of Turbines from Project Site	X	X	X
Removal of Turbine Foundations to Below Grade and Reinstatement of Topsoil	X	X	X
Removal of On-site Roads and Reinstatement of Lands	X	X	X
Removal and Disposal of Collection System, Conductor and Poles	X	X	X
Removal of All Other Equipment and Stabilization of Lands	X	X	X

13.1 Environmental Effects Analysis Methodology

The completion of the environmental effects analysis involves consideration of the following elements:

- Description of potential negative environmental effects;
- Mitigation measures;
- Residual effects;
- Significance of residual environmental effects; and
- Monitoring or follow up programs.

This EA is structured to include proposed mitigation to reduce or eliminate potential adverse environmental effects. The determination of significance of adverse environmental effects is based on post-mitigation (residual) effects, rather than unmitigated potential effects. The significance of residual effects of the Project will be determined using the criteria, based on federal and provincial EA guidance (Table 13.2).

The expectation for, and significance of, residual effects determines the need for a monitoring and/or follow-up program.

Table 13.2: Criteria for Identification and Definition of Environmental Impacts

Attribute	Options	Definition
Scope (Geographic Extent)	Local	Effect restricted to area within 1 km of the Project site
	Regional	Effect extends up to several km from the Project site
	Provincial	Effect extends throughout Nova Scotia
Duration	Short-term	Effects last for less than 1 year

Attribute	Options	Definition
	Medium-term	Effects last for 1 to 10 years
	Long-term	Effects last for greater than 10 years
Frequency	Once	Occurs only once
	Intermittent	Occurs occasionally at irregular intervals
	Continuous	Occurs on a regular basis and regular intervals
Magnitude	Negligible	No measurable change from background in the population or resource; or in the case of air, soil, or water quality, if the parameter remains less than the standard, guideline, or objective
	Low	Effect causes <1% change in the population or resource (where possible the population or resource base is defined in quantitative terms)
	Moderate	Effect causes 1 to 10% change in the population or resource
	High	Effect causes >10% change in population in resource

The potential level of impact after mitigation measures are applied (*i.e.*, residual effects) was identified based on the criteria and definitions provided in the NRCan document, "Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms Under the Canadian Environmental Assessment Act" (NRCan 2003) (Table 13.3).

Table 13.3: Definition of Significant Residual Environmental Impact

Significance Level	Definition
High	Potential effect could threaten sustainability of the resource and should be considered a management concern. Research, monitoring, and/or recovery initiatives should be considered.
Medium	Potential effect could result in a decline in resource to lower-than-baseline but stable levels in the study area after Project closure and into the foreseeable future. Regional management actions such as research, monitoring, and/or recovery initiatives may be required.
Low	Potential effect may result in slight decline in resource in study area during life of the Project. Research, monitoring, and/or recovery initiatives would not normally be required.
Minimal/None	Potential effect may result in slight decline in resource in study area during construction phase, but should return to baseline levels.

13.2 Effects Assessment

Effects and mitigation measures related to each VEC are described below. Potential effects of the Project on the identified VECs are further analyzed in Tables 13.4 to 13.6 to identify and evaluate the significance of residual effects, based on the criteria listed above. Mitigation measures are also summarized.

13.2.1 Species of Conservation Interest

It is widely acknowledged that wind energy development can have a suite of potential direct and indirect impacts on terrestrial fauna (Arnett *et al.* 2007; Kuvlesky, Jr. *et al.* 2007). General construction activities within and adjacent to watercourses and water bodies, can affect aquatic fauna and habitat. The extent and magnitude of these impacts can vary with the stage of the Project but are present for all phases.

During the site preparation and construction phases of wind energy projects, potential impacts to SOCI will be related to:

- sensory disturbance;
- habitat loss/alteration and/or fragmentation;
- effects on fish passage/migration; and
- mortality.

Sensory Disturbance
Sensory disturbance to fauna SOCI may occur from a variety of anthropogenic sources. For wind energy projects, disturbance impacts are typically most significant during the construction phase, which involves increased presence of on-site personnel, vehicles, and heavy equipment (Helldin *et al.* 2012). Avoidance impacts related to the construction phase have been reported for large mammals in two cases [*e.g.*, Rocky Mountain Elk (*Cervus elaphus*) (Walter *et al*. 2006) and wolves (Álvares *et al.* 2011)], but in both cases the effects were temporary and subsided once construction was completed. It is expected that avoidance or displacement effects related to the site preparation and construction phases of the Project will not persist in the long-term.

It is also important to distinguish wind energy facility roads from high-use motorways in regards to sensory disturbance. Many of the documented effects of roads are related to avoidance due to traffic noise (Forman and Alexander 1998). The magnitude of such effects will be greatly reduced in the context of this wind energy development, as road traffic will be minimal (maintenance vehicles during operations) and limited.

Sensory disturbance during the operations and maintenance phase of the Project will be limited to the presence of on-site personnel conducting maintenance on Project infrastructure. Although literature on the topic is sparse, most evidence suggests that in general, terrestrial wildlife are not adversely effected by operating wind turbines. It was determined that a population of elk in Oklahoma, for example, did not change their home range or experience reduced dietary quality within an operating wind power development (Walter *et al.* 2006). It is therefore unlikely that ungulates in the Project site, including White-tailed deer and Mainland moose, will be affected. Likewise, the small mammal community at a wind energy development in Spain was demonstrated to be unaffected by turbine operations (de Lucas *et al.* 2005).

Impacts to fauna SOCI during the decommissioning phase of the Project will be similar to those experienced during the site preparation/construction phase (Helldin *et al.* 2012). Namely, sensory disturbance due to the increased presence of on-site personnel and the operation of heavy equipment may elicit temporary displacement/avoidance behaviours in mobile wildlife species.
No sensory disturbance impacts are expected for fish SOCI.

Habitat Loss/Alteration
Although the permanent footprint of a wind energy facility is generally estimated to be just 5 to 10% of the Project site (Arnett *et al.* 2007), there is the potential that significant habitat elements for certain fauna SOCI may altered/removed during site preparation activities, such as clearing, for turbine pads and access roads. However, the effects may be negligible if the habitat is in adequate

supply in the general area surrounding the Project site (Arnett *et al.* 2007). Since the turbine footprint represents approximately one percent of the Project site and habitat types at the Project site are common in the surrounding landscape, the effects of habitat loss/alteration on terrestrial fauna SOCI will be minimized.

The construction of roads has a variety of well-documented, adverse effects including fragmentation of otherwise continuous segments of suitable habitat and restriction of movement of individuals between habitat patches (Trombulak and Frissell 2000, Eigenbrod *et al.* 2008), avoidance of adjacent habitat, increased access for hunters/poachers (Brody and Pelton 1989; Helldin *et al.* 2012), which can potentially result in increased mortality of certain wildlife species while also facilitating the expansion of interspecific competitors (Beazley *et al.* 2004) and exotic species (Trombulak and Frissell 2000). The road network for this Project will have a small footprint due to the overall size of the Project and the incorporation of the existing road network into the Project design, which will significantly reduce the magnitude of any potential effects.

Potential effects to fish SOCI and associated habitat during the site preparation and construction phases the Project would be primarily related to the construction and upgrading of access roads and the installation of crossing structures where roads intercept watercourses. Vegetation clearing along banks and land adjacent to watercourses could result in significant habitat degradation for fish and other aquatic biota if appropriate mitigation techniques are not employed. The alteration or removal of riparian vegetation may result in bank instability and erosion, leading to sedimentation of the water body and degradation of water quality.

Removal of overhanging vegetation from stream banks decreases shade/cover for fish resulting in increased vulnerability to predators and potentially in increased localized water temperatures. Likewise, the removal of instream cover, such as coarse woody material or edge habitat (*e.g.*, undercut banks) may have a similar effect on fish habitat. Coarse woody material also provides habitat for aquatic invertebrates. Alterations to channel morphology and interference with sediment transport may also lead to fish habitat modification/degradation (MTO 2009). Many effects to fish habitat can be mitigated through thoughtful planning and the incorporation of standard mitigation and BMPs (refer to Section 4).

The potential effects of the Project on fauna SOCI habitat during the operational phase are likely to be minimal. Aside from surface disturbance and the possible removal of regenerated vegetation, decommissioning will not include additional habitat loss/alteration. Therefore, the impacts to fauna SOCI during this phase of the Project are not expected to be significant in magnitude or long-term in duration.

Effects on Fish Passage/Migration
Lack of consideration for fish migration/passage during the design of crossing structures and/or appropriate installation techniques may also lead to a number of effects on Atlantic salmon. These effects typically manifest as modifications or barriers to fish movement through the affected watercourse. Barriers to fish passage include velocity barriers, alteration of the stream gradient and insufficient flow/depth (MTO 2009).

Many effects to fish passage can be mitigated through thoughtful planning and the incorporation of standard mitigation and BMPs (refer to Section 4.0).

Collision Mortality
Increased vehicle and heavy equipment traffic during all phases of the Project may result in collisions with terrestrial wildlife. It is expected that these collision events will be minimized by the implementation of safe work practices (*e.g.*, strict adherence to speed limits, obeying all warning signs, etc.). Collisions, should they occur, will be infrequent and will not have a significant effect on population levels.

General Mitigation Measures
The following specific mitigative measures will be implemented to avoid and mitigate any potential effects on SOCI:

- Minimization of the footprint of physical disturbance by:
    - Alignment of access roads with existing roads and logging trails, wherever possible.
    - Where the aforementioned is not possible, designing and constructing access roads to avoid environmentally sensitive habitats, where possible, and ensuring the most efficient means to access turbines is achieved.
    - Maintenance of a buffer around sensitive habitats such as watercourses and wetlands, where possible.
    - Minimizing routine vegetation clearing:
        - clearing of land only if required for construction area footprint;
        - restoration of areas of disturbance where possible, post construction; and
        - siting construction compounds in/on non-sensitive areas.
- Completion of a comprehensive schedule and determination of timelines to efficiently complete Project activities within the shortest time frames possible.

Species-Specific Mitigation
Desktop and field analyses for fauna SOCI revealed several species that have the potential to occur at the Project site. Addressing the potential impacts of the Project on these species will require species-specific mitigation techniques, as described below:

Fisher:
- Avoid disturbance to mature forest stands;
- Leave coarse woody debris and standing deadwood intact; and
- Avoid disturbance to dispersal corridors, particularly riparian areas.

Long-tailed Shrew:
- Avoid disturbance to talus slope habitat.

Mainland moose:
- Project personnel will report any evidence of Mainland moose to NSDNR.

Monarch:

- Should large congregations of Monarchs be found at the Project site, Project activities in the area should cease until the migrating group has left the Project site. This is most likely to occur in late summer, prior to the fall migration.

Wood turtle:

- Based on recommendations outlined in the document 'Protecting and Conserving Wood Turtles: A Stewardship Plan for Nova Scotia' (MacGregor and Elderkin 2003), and the "NS Transportation and Public Works Generic Environmental Protection Plan for the Construction of 100 Series Highways" (2007), the following general procedures will be implemented to ensure the protection of Wood turtles:
  - Any turtles found will be relocated outside of the construction zone, along the same habitat corridor in the direction of travel the turtle was originally oriented and preferably upstream within the same riparian habitat corridor (< 400 m).
  - Any sightings of wood turtle will be reported to the NS Wood Turtle Recovery Team at 1-866-727-3447.
  - Adequate, permanent buffers of vegetation will be left around important Wood turtle habitat. If necessary (*i.e.*, in the event that Wood turtles are confirmed at the site), an appropriate mixture of shrubs and trees shall be planted to create a buffer.

Fish SOCI (American Eel, Atlantic Salmon, Striped Bass)

- The siting, design, installation and decommissioning of all crossing structures will incorporate ongoing consultation with DFO, and NSE, and will avoid areas of sensitive habitat and ensure that fish passage is maintained; and
- Additional mitigation for the protection of fish habitat will be ensured through the NS watercourse alteration permitting process.

<u>13.2.2 Avifauna</u>

The effects of a wind farm on birds are variable and depend on factors such as the development design, topography of the area, habitats affected, and the bird community in the wind farm area (Drewitt and Langston 2006). Although some effects are related to construction (*e.g.,* habitat alteration), most potential effects on avifauna are mainly related to operation and may include:

- habitat loss/alteration;
- mortality resulting from direct collision; and
- sensory disturbance.

Habitat Loss/Alteration

Habitat alterations resulting from the site preparation and construction phases of wind energy developments have the potential to impact bird populations either directly or indirectly (Arnett *et al.* 2007). However, impacts are considered less severe than those from other energy extraction developments such as oil and gas exploration because the disturbance is limited to the construction footprint (*i.e.,* turbine pads, roads, associated buildings, etc.) (Kuvlesky *et al.* 2007). The magnitude of these impacts, however, may be magnified if the disturbed area contains sensitive plant communities that provide important habitat to local bird populations (Kuvlesky *et al.* 2007). Altered landscapes can potentially lead to displacement of species with sensitive habitat requirements (Arnett *et al.* 2007). Site clearing and preparation may involve the removal of key habitat features, such as standing deadwood, mature trees, or shrub cover required as foraging and/or breeding habitat for certain bird species.

Mid-aged to mature forest, for example, is present at the Project site and its removal may displace bird species into other mature stands in the general area. Surface disturbance is greater in the construction phase than in the operational phase because large right of ways need to be created to accommodate large construction equipment and transport vehicles (Arnett *et al.* 2007). It can therefore be assumed that impacts associated from direct habitat alteration are greatest in the short-term, except when key habitat features are permanently removed. Depending on the availability of nearby alternative habitat, habitat alterations associated with wind energy infrastructure may have detrimental effects on local bird populations. Avifauna surveys indicated that forest birds were the dominant feature of the Project site's bird community. The landscape of the Project site and immediately surrounding area features forest stands that would appear to provide suitable alternative habitat to bird species displaced due to habitat alteration at the Project site. Those species preferring edge/transitional habitat will also find suitable in the surrounding landscape due to the prevalence of cutovers.

Collision Mortality

The most overt potential effect of the Project on birds is direct mortality resulting from collision with Project infrastructure, namely turbine blades, during the operational phase. Most evidence suggests that mortality levels resulting from turbine collisions are low (EC *et al.* 2012) although many studies do not adequately incorporate carcass removal by scavengers into mortality estimates. In a review of night migrant fatalities at wind farm sites in North America, Kerlinger *et al.* (2010) found fatality rates of less than one bird/turbine/year to approximately seven birds/turbine/year, even with corrections made for scavenger removal and searcher efficiency. Furthermore, multi-bird fatality events, in which more than three birds were killed at a turbine site in a single night, were found to be rare and may have been related to lighting and/or inclement weather (Kerlinger *et al.* 2010). A recent review of Canadian wind farms concluded that less than 0.2% of the population of any species is affected by either collisions with, or displacement by, wind turbines (Zimmerling *et al*. 2013).

Collision risk is greater on or near areas used by large numbers of foraging or roosting birds or in important migratory flyways (Drewitt and Langston 2006). In Canada, passerines account for 70% of all fatalities, with most occurring during the fall migration season (EC *et al.* 2012). The probability of raptor collision with wind turbines depends on the species, turbine height, and local topography (de Lucas *et al.* 2008). Collision risk can therefore be greatly reduced by incorporating knowledge of the avifauna into the design and placement of wind power infrastructure.

In summary, available research suggests that the probability of large-scale fatality events occurring at wind farms is extremely low (Kerlinger *et al.* 2010) and the observed mortality caused by wind energy facilities is low compared to other sources of human caused bird mortality (*i.e*., buildings, communications towers, vehicles, etc.) (Kingsley and Whittam 2005). Baseline information gained from avian surveys can be combined with site specific considerations to greatly reduce the risk of bird collisions. Since no major migratory movements of passerines, shorebirds, waterfowl, or birds of prey were observed at the Project site, it is unlikely that significant mortality events will occur as a result of collisions with Project infrastructure.

Sensory Disturbance

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

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

General Mitigation Measures

The following mitigative measures will be implemented to avoid and mitigate any potential effects on avifauna:

- Where possible, clearing of site vegetation will be conducted outside of the breeding and nesting season for birds (April to August). If this is not possible, a mitigation plan will be developed in consultation with NSDNR and CWS prior to clearing activities.
- Use of lighting during construction and on turbine hubs and blades will be limited to minimum levels while still meeting requirements of Transport Canada.
- There will be no general lighting at the Project site. Lighting will only be used when technicians are working on-site.
- Where possible, placement of Project infrastructure in habitats significant to bird species (as identified during avian surveys) will be avoided. These include wetlands, mature forests, and areas with large, hollow trees.
- Post-construction monitoring will be implemented under direction from NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.

<u>13.2.3 Bats</u>

The installation of wind turbines has the potential to impact bats both directly and indirectly (Arnett *et al.* 2007). Although some effects are related to construction (*i.e.*, habitat alteration), most potential effects on bats are mainly related to operation and may include:

- habitat loss/alteration;

- mortality resulting from direct collision and/or barotrauma; and
- sensory disturbance.

The significance of these impacts at the population level depends on a number of biotic and abiotic variables, including the number of individuals affected and the stability of the population, season, physiologic condition of the individuals affected, and weather factors.

Habitat Loss/Alteration

Habitat alterations, including vegetation clearing and soil disruption (NRC 2007) resulting from the site preparation and construction phases, may impact bats (Arnett *et al.* 2007). The removal of trees during the site clearing and preparation phases can be especially detrimental, particularly to those bat species which use trees as roosting habitat (Arnett *et al.* 2007).

Some studies, however, suggest that habitat changes related to wind power developments may in fact create benefits to bats by increasing cleared areas and creating access roads, both of which can be used by bats as foraging habitat (as cited in Arnett *et al.* 2007; Kunz *et al.* 2007a). In relation to this, small-scale disturbances, including creating small cutblocks or small scale access roads through forested habitat, have been shown to stimulate an increase in bat activity relative to previous years (Grindal and Brigham 1998). It is important to note, however, that increased edge habitat due to forest clearing may subsequently increase the risk of mortality by virtue of attracting bats to the area of the operating turbine (Kunz *et al.* 2007b). Despite the fact that the Project site is interspersed with such cutovers, bat activity was determined to be quite low based on pre-construction monitoring.

Mortality

Mortality of bats is a potential effect during the operational phase of wind energy projects. Necropsy of recovered carcasses found that the cause of death for baths killed at wind-energy facilities is an indiscernible combination of direct collision with the turbine blades and barotrauma (Grodsky *et al.* 2011), although more recent pathological research has found that traumatic injury is the major cause of bat mortality at wind farms and that post-mortem artifacts may manifest themselves as pulmonary barotrauma lesions (Rollins *et al.* 2012). Barotrauma is characterized by a drop in atmospheric pressure along the top of a rotating turbine blade, which causes thoracic, abdominal, and pulmonary injury to bats when passing through the low pressure area (Baerwald *et al.* 2008).

Much of the established literature has not attempted to elucidate the causes of bat mortality but has instead reported on the magnitude of mortalities. In Canada, EC reports that bat fatalities outnumber bird fatalities (EC *et al*. 2012). This causes concern as bats are long-lived and have low reproductive rates (Arnett *et al.* 2007).

Research suggests that migratory tree-roosting species suffer the highest fatalities at wind farms (Kunz *et al.* 2007a; Kuvlesky *et al.* 2007; Cryan and Barclay 2009), although deaths of Tri-colored bats constituted 25.4% of total bat fatalities at wind facilities in the eastern United States (as cited in Arnett *et al.* 2007). Migratory species, including Hoary bat, Eastern red bat, and Silver-haired bat, accounted for 71% of 2,270 bat fatalities recorded at wind energy facilities across Canada between 2006 and 2010 (EC *et al.* 2012). Most bat fatalities are reported in the late summer months (Johnson 2005) coinciding with the start of swarming and autumn migration (Arnett *et al.* 2007: EC *et al.* 2012). Periods of high mortality may therefore be linked with the timing of large-scale insect migrations when bats feed at altitudes consistent with wind turbine heights (Rydell *et al.* 2010). It has been found that bat fatalities increase exponentially with wind tower height, with turbine towers 65 m or taller having the highest fatality rates (Barclay *et al.* 2007). This hypothesis is also supported by the findings of Horn *et al.* (2008), who reported that bats were not being struck by turbine blades when flying in a straight line en route to another destination, but were struck while foraging in and around the rotor-swept zone of the turbine.

Temporal variation in bat activity and subsequent fatality rates can be influenced by weather variables, as well as the characteristics of the facility (Baerwald and Barclay 2011). Although bats exhibit species-specific responses to environmental variables (Baerwald and Barclay 2011), in general they appear to be more active when wind speeds are low, which increases the risk of collisions with rotating turbine blades (Arnett *et al.* 2007) and mortality resulting from barotrauma.

Sensory Disturbance

Increased human presence may also disturb roosting bats (Arnett *et al.* 2007), but it is unknown if this disturbance is sufficient to disrupt normal behaviour or physiology. Sensory disturbance to bats is most likely during the site preparation/construction and decommissioning phase of the Project, during which the presence of on-site personnel and equipment will be the highest. During hibernation, bats are sensitive to human presence, and human intrusion into hibernacula can lead to increased arousals leading to a premature depletion of fat reserves (Thomas 1995). Siting wind-energy facilities away from hibernacula is therefore recommended in the design phases of these projects.

It is unknown if noise associated with the operational phase of wind energy projects has any measureable effect on bats, although it is thought that bats may become acoustically disoriented by the low-frequency noise emitted from rotating turbines (Kunz *et al.* 2007a). Bats have been shown, experimentally, to avoid foraging in areas with intense, broadband noise (Schaub *et al.* 2008), however this research was not conducted in the context of wind-energy development and other studies indicate that bats have been shown to forage in close proximity to operational turbines (Horn *et al.* 2008).

General Mitigation Measures

The following specific mitigative measures will be implemented to avoid and mitigate any potential effects on bats:

- Use of lighting during construction and on turbine hubs and blades will be limited to minimum levels while still meeting requirements of Transport Canada.
- Where possible, placement of Project infrastructure in habitats significant to bat species will be avoided. These include hibernacula, wetlands, and lands directly adjacent to open bodies of water.
- Post-construction monitoring will be implemented under direction from NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.

13.3 Environmental Effects Analysis

The following tables (Tables 13.4 to 13.6) identify and evaluate the significance of residual effects for each phase of the Project on each VEC. Accidents and malfunctions are also analyzed. As most of the mitigation is the same for avifauna and bats, these VECs are considered together to decrease repetition.

Table 13.4: Environmental Effects Analysis – Construction Phase

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
SOCI	• Sensory disturbance • Habitat loss/alteration/degradation and/or fragmentation. • Effects to fish passage/migration • Mortality.	*General Mitigation Measures* • Implementation of the EPP. • Minimize the footprint of physical disturbance to the extent possible. • Avoid disturbing sensitive/significant habitats during construction to the extent possible. • Minimize vegetation clearing, wherever possible. • Prompt restoration of cleared areas post-construction. • Maintain efficient timelines to complete Project activities within the shortest amount of time possible. *Species-specific Mitigation* • The EPP for the Project will require Project personnel to report any Mainland moose sightings to NSDNR. • Avoid disturbance to mature forest stands (fisher). • Leave coarse woody debris and standing deadwood intact (fisher). • Avoid disturbance to dispersal corridors, particularly riparian areas (fisher). • Avoid disturbance to talus slope habitat (Long-tailed shrew). • Should large congregations of Monarchs be found at the Project site, Project activities in the area should cease until the migrating group has left the Project site. • Leave adequate, permanent buffers of vegetation around important Wood turtle habitat. • In the event that Wood turtles are confirmed at the site, an appropriate mixture of shrubs and trees will be planted to create a buffer.	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
		• Any wood turtles found will be relocated outside of the construction zone (as per guidelines outlined in MacGregor and Elderkin 2003, and NSTPW 2007). • Report any sightings of wood turtle to the NS Wood Turtle Recovery Team (1-866-727-3447. • All watercourses on the Project site will be treated as fish bearing during all phases of the Project. • All in-stream work will be conducted "in-the-dry" and adhere to timing windows (fish SOCI). • Crossing structures will be designed and installed in consultation with DFO and NSE to ensure fish passage is facilitated (fish SOCI).			
Avifauna and Bats	• Habitat loss/Alteration • Mortality • Sensory disturbance.	• Implementation of the EPP. • Conduct vegetation clearing outside of the breeding and nesting season for birds (April to August). • If this is not possible, a mitigation plan will be developed in consultation with NSDNR and CWS prior to clearing activities. • Limit the use of lighting during construction to minimum acceptable levels. • Avoid placement of Project infrastructure in habitats significant to bird and bat species. These include wetlands, hibernacula, mature forests, land directly adjacent to open water and areas with large, hollow trees.	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No residual effect anticipated	Not applicable

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
Accidents and Malfunctions	• Accidental spill/release. • Failure of erosion and sediment /control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

Table 13.5: Environmental Effects Analysis – Operation/Maintenance Phase

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
SOCI	• Sensory disturbance • Collision mortality	*General Mitigation Measures* • Implementation of the EPP. • Implementation of Safe Work Practices and strict adherence to speed limits and warning signs to avoid traffic collisions. • Minimize road traffic to the extent possible. • Implement efficient timelines to complete Project activities within the shortest possible time frame. • To the extent possible, plan operation and maintenance activities to avoid sensitive habitats and minimize time on-site. *Species-specific Mitigation* • In-stream maintenance activities will be conducted "in-the-dry", and adhere to timing windows (fish SOCI).	Scope: Local Duration: Long-term Frequency: Intermittent Magnitude: Negligible	No residual effect anticipated	Not applicable
Avifauna and Bats	• Mortality from collision (avifauna and bats) or barotrauma (bats). • Sensory disturbance.	• Implementation of the EPP. • To the extent possible, plan operation and maintenance activities to minimize time on-site. • Avoid routine vegetation clearing during breeding and nesting season. • Avoid all unnecessary lighting at the Project site. Lighting will only be used when technicians are working on-site. • Limit lighting on turbine hubs and blades to minimum levels while still meeting requirements of Transport Canada.	Scope: Local Duration: Long-term Frequency: Continuous Magnitude: Low	It is expected that birds will avoid the immediate area of the turbines (but not the Project site and surrounding area), which will reduce the number of bird collisions. Bird and bat fatalities due to turbine collisions are not expected to be significant.	Low

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
		• Implement post-construction monitoring under direction of NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.			
Accidents and Malfunctions	• Accidental release. • Failure of erosion and sediment control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

Table 13.6: Environmental Effects Analysis – Decommissioning Phase

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
SOCI	• Sensory disturbance. • Habitat alteration and/or degradation. • Mortality.	• Implementation of the EPP. • Minimize of the footprint of physical disturbance to the extent possible. • Avoid disturbing sensitive habitats during decommissioning. • Prompt restoration of cleared areas post-construction. • Maintain efficient timelines to complete Project activities within the shortest amount of time possible. • Limit access to existing roads only. • Avoidance of known significant habitat, where possible. *Species-specific Mitigation* • In-stream decommissioning work will be conducted "in-the-dry" and adhere to timing windows (fish SOCI). • Stream banks will be promptly re-stabilized and re-vegetated post-decommissioning (fish SOCI).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible	No residual effect anticipated	Not applicable
Avifauna and Bats	• Sensory disturbance.	• Implementation of the EPP • Limit access to existing roads only. • Limit time on site. • Avoid decommissioning activities during breeding/nesting season, to the extent possible. • Restore vegetation promptly following decommissioning. • Limit the use of lighting during decommissioning to minimum	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible	No residual effect anticipated	Not applicable

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
		acceptable levels			
Accidents and Malfunctions	• Accidental release. • Failure of erosion and sediment control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans (as necessary).	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

13.4 Follow-up Measures

A potential residual effect for avifauna and bats was noted in Table 14.5. The potential effect of collisions and/or fatalities to these VECs will be addressed in post-construction monitoring programs that will be implemented to assess the effects of the operation of the proposed wind farm.

14.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Environmental factors that have the potential to have damaging effects on wind turbines include:

- Extreme wind (typically associated with hurricanes);
- Hail;
- Ice storms/ ice formation;
- Heavy snow;
- Lightning; and
- Fire.

The primary mitigative measure employed during the construction and operation of the Project will be to educate and train site personnel. Environmental and safety orientations will be conducted prior to the start of construction and all staff will be informed of the potential effects of the environment on the Project. Staff responsible for the operation and maintenance of the Project will be trained on the design and operation of the turbine, including applicable operating procedures, safety protocols and evacuation plans.

Modern wind turbines are equipped with a number of mechanisms to reduce damage caused by extreme weather and are designed to shut down when certain thresholds are detected (CanWEA 2011). Further, best practices and industry standards will be applied to the operation of the Project to manage risks of damage from extreme events. Table 14.1 demonstrates potential effects resulting from environmental events and the mitigation associated with each.

Table 14.1 Effects of Environmental Events and Associated Mitigation

Event	Environmental Effect	Mitigation
Hurricane/ Extreme winds	Damage to blades	• Turbine design equipped to shut down.
Hail	Damage to blades.	• Turbine maintenance according to best practices and industry standards.
Ice Storms	Ice formation. Potential ice throw.	• Turbine design equipped to shut down. • Appropriate safety protocol. • Restrict use of Project site. • Signage to indicate potential falling ice.
Heavy Snow	Damage to turbines/blades.	• Turbine design equipped to shut down.
Lightning Strike	Potential fire during operation. Damage to electrical systems.	• Turbine design equipped with built-in grounding system. • Appropriate safety protocol.
Fire	Damage to the turbine, forest fire.	• Appropriate safety protocol. • Fire prevention plan. • Evacuation plan. • Local training of first responders.

15.0 CUMULATIVE EFFECTS ASSESSMENT

Concerns are often raised about the long-term changes that may occur not only as a result of a single action but of the combined effects of each successive action on the environment (Hegman *et al.*1999).

The cumulative effects assessment focuses only on adverse effects of the Project remaining after the application of mitigation measures (*i.e.*, only residual effects). For this Project, the only VECs identified to have a potential residual effect are avifauna and bats (*i.e.*, collision mortality). Therefore, known or anticipated activities within a 20 km radius of the Project site were reviewed to identify the potential for cumulative effects on avifauna and bats.

A search for existing or proposed wind farm developments was completed within the 20 km radius of the Project site. A 6.0 MW wind project, the Martock Ridge Community Wind Project, is located approximately 8 km to the west, which has the potential to act cumulatively with this Project. Both Projects are of relatively small size, and consist of 10 turbines in total; therefore the potential for cumulative effects related to avifauna and bat mortality as a result of both Projects are considered not significant.

16.0 OTHER APPROVALS

In addition to the EA Approval, several other permits and/or approvals may be required prior to the start of construction (Table 16.1).

Table 16.1: Future Approvals

Approval/Notification/Permit Required	Government Agency
Municipal	
Large Wind Turbine Development Agreement	Municipality of the District of West Hants
Provincial	
EPP/Sediment and Erosion Control Plan	NSE
Watercourse Alteration Approval	NSE
Wetland Alteration Approval	NSE
Notification of Blasting (if required)	NSE
Overweight/Special Move Permit	Service Nova Scotia
Access Permit	NSTIR
Work within Highway Right-of-Way	NSTIR
Use of Right-of-Way for Pole Lines	NSTIR
Elevator/Lift License	Nova Scotia Department of Labour and Advanced Education
Federal	
Blasting Near Watercourses Approval (if required)	DFO
Notification of Project (awaiting response)	RCMP
Approval/Notification/Permit Required	
Aeronautical obstruction clearance	Transport Canada
Lighting design for navigational purposes	Transport Canada
Final design location and height of turbine (awaiting response)	NRCan

Approval/Notification/Permit Required	Government Agency
EMI consultation re. civilian ATC radars (awaiting response)	NAV Canada
Land Use Clearance (awaiting response)	NAV Canada

17.0 CONCLUSIONS

In accordance with “A Proponent’s Guide to Wind Power Projects: Guide for Preparing an Environmental Assessment” (NSE 2012a), the studies, regulatory assessments, and VEC evaluations described within this document have been considered both singularly and cumulatively.

The results indicate that there are no significant environmental concerns or impacts that may result from the Project that cannot be effectively mitigated or monitored.

Best practices and standard mitigation methods will be implemented during all phases of the Project, to ensure methods and practices are comprehensive and are adhered to. Furthermore, an EPP will be developed and communicated to all employees working on the Project.

The proposed capacity of the turbines will produce enough energy to power 4,500 households and will contribute to reaching Nova Scotia’s renewable energy commitments.

18.0 REFERENCES

Allen, A.W. 1983. *Habitat suitability index models: fisher*. Fish and Wildlife Service, U.S. Department of the Interior. p 29.

Álvares F., Rio-Maior H., Roque S., Nakamura M., Cadete D., Pinto S. and F. Petrucci-Fonseca. 2011. Assessing ecological responses of wolves to wind power plants in Portugal: Methodological constrains and conservation implications. *Proceedings, Conference on Wind Energy and Wildlife Impacts*, Trondheim, Norway, 2–5 May 2011.

Arnett, E.B., Inkley, D.B., Johnson, D.H., Larkin, R.P., Manes, S., Manville, A.M., Mason, J.R., Morrison, M.L., Strickland, M.D., and R. Thresher. 2007. Impacts of wind energy facilities on wildlife and wildlife habitat. *Wildlife Society Technical Review* 07-2. The Wildlife Society, Bethesda, Maryland, USA. 49 pp.

ACCDC (Atlantic Canada Data Conservation Centre). 2013. *Data Report 5066: St. Croix, NS*. Atlantic Canada Conservation Data Centre, New Brunswick Canada.

Baerwald, E.F., D'Amours, G.H., Klug, B.J., and R.M.R. Barclay. 2008. Barotrauma is a significant cause of bat fatalities at wind turbines. *Current Biology* 18: R695-R696.

Baerwald, E.F. and R.M.R. Barclay. 2011. Patterns of activity and fatality of migratory bats at a wind energy facility in Alberta, Canada. *Journal of Wildlife Management* 75: 1103-1114.

BAMP (Boreal Avian Modeling Project). 2013a. Ovenbird. Retrieved November 2013 from http://www.borealbirds.ca/avian_db/accounts.php/Seiurus+aurocapilla

BAMP (Boreal Avian Modeling Project). 2013b. Canada Warbler. Retrieved October 2013 from http://www.borealbirds.ca/avian_db/accounts.php/Cardellina+canadensis.

Barclay, R. M. R., Baerwald, E.F. and J. C. Gruver. 2007. Variation in bat and bird fatalities at wind energy facilities: assessing the effects of rotorsize and tower height. *Canadian Journal of Zoology, 85*, 381–387.

Beazley, K.F., Snaith, T.V., MacKinnon, F., and D. Colville. 2004. Road density and potential impacts on wildlife species such as American moose in mainland Nova Scotia. *Proceedings of the Nova Scotian Institute of Science* 42: pp339-357.

Bradford, R.G., P. Bentzen, D.M. Campbell, A.M. Cook, A.F.J. Gibson and J. Whitelaw. 2010. Update Status Report for Atlantic Whitefish (Coregonus huntsmani). Can. Sci. Advis. Sec. Res. Doc. 2010/005. vi + 39 p.

Broders, H.G., and G.J. Forbes. 2004. Interspecific and intersexual variation in roost-site selection of Northern long-eared and Little brown bats in the Greater Fundy National Park ecosystem. *Journal of Wildlife Management* 68: 602-610.

Broders, H.G., Quinn, G.M., and G.J. Forbes. 2003. Species status, and the spatial and temporal patterns of activity of bats in southwest Nova Scotia, Canada. *Northeastern Naturalist* 10: 383-398.

Broders, H.G., Coombs, A.B., and J.R. McCarron. 2012. Ecothermic responses of moose (*Alces alces*) to thermoregulatory stress on mainland Nova Scotia. Alces 48: 53-61.

Brody, A. J., and M. R. Pelton. 1989. Effects of roads on black bear movements in western North Carolina. Wildlife Society Bulletin 17:5–10.

Caceres, M.C., and R.M.R. Barclay. 2000. *Myotis septentrionalis*. *Mammalian Species* Account No. 634: P 4.

CEAA (Canadian Environmental Assessment Act) 2012. Regulations Designating Physical Activities. Retrieved from http://laws-lois.justice.gc.ca/eng/regulations/SOR-2012-147/page-1.html

CanWEA (Canadian Wind Energy Association). 2006a. *Community Benefits, Why Wind is Right – Right Now*. Retrieved from http://www.CanWEA.ca/images/uploads/File/12_community.pdf.

CanWEA (Canadian Wind Energy Association). 2006b. North Cape Wind Farm. Retrieved from http://www.canwea.ca/images/uploads/File/Case_studies/North_Cape_e.pdf

CanWEA (Canadian Wind Energy Association). 2011. *An Introduction to Wind Energy Development in Canada.* Ottawa, Ontario: CanWEA.

Carter, J. 2011. The effect of wind farms on residential property values in Lee County, Illinois. Illinois State University. 36 pp.

Colligan, M., Collins, M., Hecht, A., Hendrix, M., Kahnle, A., Laney, W., St-Pierre, R., Santos, R., and T. Squires. 1998. Status Review of Atlantic Sturgeon *Acipenser oxyrinchus oxyrinchus.* Retrieved from http://www.nmfs.noaa.gov/pr/pdfs/statusreviews/atlanticsturgeon.pdf

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2002. COSEWIC Assessment and Status Report on the Eastern Ribbonsnake *Thamnophis sauritus* in Canada. 24 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2004. COSEWIC Assessment and Status Report on the Striped Bass *Morone saxatilis* in Canada. 43 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2005. COSEWIC Assessment and Update Status Report on the Blanding's Turtle *Emydoidea blandingii* in Canada. 40 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2006. COSEIWIC Assessment and Update Status Report on the Southern Flying Squirrel *Glaucomys volans* [Atlantic (NS) and Great Lakes Plains Populations] in Canada. 33 pp.

COSEWIC ((Committee on the Status of Endangered Wildlife in Canada). 2008. COSEWIC Assessment and Status Report on the Canada Warbler Wilsonia Canadensis in Canada. 35 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010a. COSEWIC Assessment and Status Report on the Atlantic Salmon *Salmo salar* in Canada. 136 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2010b. COSEWIC Assessment and Status report on the Monarch *Danaus plexippus* in Canada. 43 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011a. COSEWIC Status Report on the Atlantic Sturgeon *Acipenser oxyrinchus* in Canada. 50 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2011b. COSEWIC Status Report on the Atlantic Whitefish *Coregonus huntsmani* in Canada. 41 pp.

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012a. Wildlife Species Search. Retrieved from http://www.cosewic.gc.ca/eng/sct1/index_e.cfm

COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2012b. Assessment and Status Report on the American Eel. *Anguilla rostrata*. 109 pp.

Cryan, P.M., and R.M.R. Barclay. 2009. Causes of Bat Fatalities at Wind Turbines: Hypotheses and Predictions. *Journal of Mammalogy* 90: 1330-1340.

CWS (Canadian Wildlife Service). 2007. *Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds*. 33pp.

Daborn, G.R and M. Brylinsky. 2004. *Fish Population Studies of the Avon Estuary, Pesaquid Lake and Lower Avon River, 2003.* Report Prepared for Nova Scotia Department of Transportation and Public Works. Acadia Centre for Estuarine Research Publication No. 76

Davis, D., and S. Browne. 1996. *The Natural History of Nova Scotia*. Nova Scotia Museum, Halifax, NS. 304 pp.

Davis MacIntyre and Associates Ltd. 2013. *St. Croix Wind Project; Archaeological Resource Impact Assessment*. *Report # A2013NS111.*

De Lucas, M., Janss, G.F.E., Whitfield, D.P., and M. Ferrer. 2008. Collision Fatality of Raptors in Wind Farms Does Not Depend on Raptor Abundance. *Journal of Applied Ecology* 45: 1695-1703.

Devereux, C.L., Denny, M.J.H., and M.J. Whittingham. 2008. Minimal Effects of Wind Turbines on the Distribution of Wintering Farmland Birds. *Journal of Applied Ecology* 45: 1689-1694.

Drewitt, A.L., and R.H.W. Langston. 2006. Assessing the impacts of wind farms on birds. *Ibis* 148: 29-42.

DFO (Fisheries and Oceans Canada), 2007. Science Information on Avon River Fish Species. DFO Can. Sci. Advis. Sec. Sci. Resp. 2007/014.

DFO (Fisheries and Oceans Canada). 2008. Recovery potential assessment for Inner Bay of Fundy Atlantic salmon. Canadian Science Advisory Secretariat Science Report 2008/050.

DFO (Fisheries and Oceans Canada). 2010a. *Blasting – Fish and Fish Habitat Protection.* Retrieved from http://www.nfl.dfo-mpo.gc.ca/e0005460

DFO (Fisheries and Oceans Canada). 2010b. Recovery strategy for the inner bay of Fundy Atlantic Salmon [Final].

Drewitt, A.L., and R.H.W. Langston. 2006. Assessing the impacts of wind farms on birds. *Ibis* 148: 29-42.

Eigenbrod, F., Hecnar, S., and L. Fahrig. 2008. Accessible habitat: an improved measure of the effects of habitat loss and roads on wildlife populations. *Landscape Ecology* DOI: 10.1007/s10980-007-9174-7

Endangered Species Act, 1998, SNS, 1998, c 11, as amended by 2010, c 2, s 99.

Environment Act, 1994-95, SNS, 1994-95, c 1, s 1, as amended by 2011, c 61.

Environmental Assessment Regulations, NS Reg 26/95, as amended by 2013, NS Reg 18/2013.

EC (Environment Canada). 2011a. *National Climate Data and Information Archive.* Retrieved from http://climate.weatheroffice.gc.ca/climate_normals/results_e.html?stnID=6512&lang=e&dCode=0&province=NS&provBut=Search&month1=0&month2=12

EC (Environment Canada). 2011b. *National Climate Data and Information Archive.* Retrieved from http://climate.weatheroffice.gc.ca/climate_normals/results_e.html?stnID=6358&lang=e&dCode=1&province=NS&provBut=Search&month1=0&month2=12

EC (Environment Canada). 2011c. *Air Quality Health Index – Kentville.* Retrieved from http://weather.gc.ca/airquality/pages/nsaq-002_e.html

EC (Environment Canada), Canadian Wind Energy Association, Bird Studies Canada and the Ontario Ministry of Natural Resources. 2012*. Wind Energy Bird and Bat Monitoring Database: Summary of the Findings from Post-construction Monitoring Reports*. p 22.

Farrow, L.J. 2007. Distribution of the Tri-colored Bat (Perimyotis subflavus) in Southwest Nova Scotia Relative to Landscape Factors*.* M.Sc. Thesis, Saint Mary's University, Halifax, Nova Scotia, Canada. P. 114.

Farrow, L.J., and H.G. Broders. 2011. Loss of Forest Cover Impacts the Distribution of the Forest-dwelling Tri-colored Bat (*Perimyotis subflavus*). *Mammalian Biology* 76: 172-179.

Fenton, M.B., and R.M.R. Barclay. 1980. *Myotis lucifugus*. *Mammalian Species Account No. 142*. 8 pp.

Fisheries Act. RSC, 1985, c F-14, as amended by 2012.

Forman, R.T. and L.E. Alexander. 1998. Roads and their Major Ecological Effects. *Annu. Rev. Ecol. Syst*. 29:207-31.

Fox, D., Robinson, C., and M. Zentilli. 1997. Pyrrhotite and associated sulphides and their relationship to acid rock drainage in the Halifax Formation, Meguma Group, Nova Scotia. *Atlantic Geology* 33: 97-103.

Fujita, M.S., and T.H. Kunz. 1984. *Perimyotis subflavus*. *Mammalian Species Account No. 228*. 6 pp.

Garroway, C.J. and H.G. Broders. 2008. Day Roost Characteristics of Northern Long-eared Bats (*Myotis septentrionalisi)* in Relation to Female Reproductive Status. *Ecoscience* 15: 89-93.

Gibson, A.J.F., P.G. Amiro, and K.A. Robichaud-LeBlanc. 2003. Densities of juvenile Atlantic salmon (Salmo salar) in inner Bay of Fundy rivers during 2000 and 2002 with reference to past abundance inferred from catch statistics and electrofishing surveys. DFO. Can Stock Assess. Sec. Res. Doc. 2003/121. ii + 61p.

Gilhen, J., Jones, A., McNeil, J., & A.W. Tanner. 2012. A Significant Range Extension for the Eastern Ribbonsnake, *Thamnus sauritus*, in Nova Scotia, Canada. *Canadian Field Naturalist* 126: 231-233.

Government of Canada. 2012. *Species at Risk Public Registry*. Retrieved from http://www.sararegistry.gc.ca/default_e.cfm.

Grindal, S.D., and R.M. Brigham. 1998. Short-term Effects of Small-scale Habitat Disturbance on Activity by Insectivorous Bats. *Journal of Wildlife Management* 62: 996-1003.

Grodsky, S.M., Behr, M.J., Gendler, A., Drake, D., Dieterle, B.D., Rudd, R.J., and N.L. Walrath. 2011. Investigating the causes of death for wind-turbine associated bat fatalities. *Journal of Mammalogy* 92: 917-925.

Gulden, W.E., 2011. A review of the current evidence regarding industrial wind turbines and property values from a homeowner's perspective, *Bulletin of Science, Technology, and Society* **31**: 363-368.

Hau, E. 2006. *Wind Turbines, Fundamentals, Technologies, Application, Economics*, 2nd Ed. Berlin, Germany: Springer Verlag.

Hegmann, G., C. Cocklin, R. Creasey, S. Dupuis, A. Kennedy, L. Kingsley, W. Ross, H. Spaling and D. Stalker. 1999. Cumulative Effects Assessment Practitioners' Guide. Retrieved from http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=43952694-1&printfullpage=true

Helldin, J.O., Jung, J., Neumann, W., Olsson, M., Skarin, A. and F. Widemo. 2012. *The Impacts of Wind Power on Terrestrial Mammals: A Synthesis. Report 6510*. Swedish Environmental Protection Agency, Stockholm.

Hinman, J.L. 2010. *Wind Farm Proximity and Property Values: A Poole Hedonic Regressions Analysis of Property Values in Central Illinois.* Normal, Illinois: Illinois State University.

Hoen, B., Wiser, R., Cappers, P., Thayer, M., and S. Gautam. 2009.*The Impact of Wind Power Projects on Residential Property Values in the United States: A Multi-Site Hedonic Analysis.*Lawrence Berkeley National Laboratory. Prepared for the Office of Energy Efficiency and Renewable Energy Wind and Hydropower Technologies Program, U.S. Department of Energy, Washington, D.C. December, 2009. Retrieved from http://eetd.lbl.gov/ea/ems/reports/lbnl-2829e.pdf.

Hoen, B., Wiser, R., Cappers, P., Orlando, E., Thayer, M., and G. Sethi. 2010. Wind energy facilities and residential properties: the effect of proximity and view on sales prices. American Real Estate Society Annual Conference, Naples, Florida.

Hoen, B., Brown, J.P., Jackson, T., Wiser, R., Thayer, M. and P. Cappers. 2013*. A Spatial Hedonic Analysis of the Effects of Wind Energy Facilities on Surrounding Property Values in the United States*. Ernest Orlando Lawrence Berkeley National Laboratory, Environmental Energy Technologies Division. Retrieved from http://emp.lbl.gov/sites/all/files/lbnl-6362e.pdf

Horn, J.W., Arnett, E.B., and T.H. Kunz. 2008. Behavioural responses of bats to operating wind turbines. *Journal of Wildlife Management* 72: 123-132.

IBA (Important Bird Areas) Canada. 2012. *Important Bird Areas in Canada*. Available from http://www.ibacanada.ca/

IPCC (International Panel on Climate Change). 2007. *Summary for Policymakers. In: Climate Change 2007: Impacts, Adaptation and Vulnerability.* Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change, M.L. Parry, O.F. Canziani, J.P. Palutikof, P.J. van der Linden and C.E. Hanson, Eds., Cambridge University Press, Cambridge, UK, 7-22.

Johnson, G.D. 2005. A Review of Bat Mortality at Wind-energy Developments in the United States. *Bat Research News* 46: 45-49.

Keppie, J.D. (compiler). 2000. *Geological Map of the Province of Nova Scotia.* Nova Scotia Department of Natural Resources, Minerals and Energy Branch, Map ME 2000-1, scale 1:500 000. Available online as DP ME 43, version 2, 2006 at http://www.gov.ns.ca/natr/meb/download/dp043.htm.

Kerlinger, P. Gehring, J.L., Erickson, W.P., Curry, R., Jain, A., and J. Guarnaccia. 2010. Night Migrant Fatalities and Obstruction Lighting at Wind Turbines in North America. *The Wilson Journal of Ornithology* 122: 744-754.

Kingsley, A., and B. Whittam. 2005. Wind Turbines and Birds: A Background Review for Environmental Assessment. 81 pp.

Kirkland, Jr., G.L. 1981. *Sorex dispar* and *Sorex gaspensis*. Mammalian Species **155**: 1-4.

Kunz, T.H., Arnett, E.B., Cooper, B.M., Erickson, W.P., Larkin, R.P., Mabee, T., Morrison, M.L., Strickland, M.D., and J.M. Szewczak. 2007a. Assessing Impacts of Wind-Energy Development on Nocturnally Active Birds and Bats: A Guidance Document. *Journal of Wildlife Management, 71*(8), 2449-2486.

Kunz, T. H., Arnett, E.B., Erickson, W.P., Hoar, A.R., Johnson, G.D., Larkin, R.P., Strickland, M.D., Thresher, R.W. and M. D. Tuttle. 2007b. Ecological impacts of wind energy development on bats: questions, research needs, and hypotheses. *Frontiers in Ecology and the Environment, 5*, 315–324.

Kuvlesky W.P. Jr, Brennan L.A., Morrison M.L., Boydston K.K., Ballard B.M. and F.C. Bryant. 2007. Wind Energy Development and Wildlife Conservation: Challenges and Opportunities. *Journal of Wildlife Management* 71: 2487–2498.

Laposa, S.P., and A. Mueller. 2010. Wind farm announcements and rural home prices: Maxwell Ranch and rural northern Colorado. *Journal of Sustainable Real Estate* **2**: 383-402.

Lavers, A.J. 2004. Spatial Ecology in a Northern Disjunct Population of Southern Flying Squirrel, *Glaucomys volans*. M.Sc. Thesis, Department of Biology, Acadia University. 184 pp.

Leddy, K.L., Higgins, K.F., and D.E. Naugle. 1999. Effects of wind turbines on upland nesting birds on conservation reserve program grasslands. *The Wilson Bulletin* 111: 100-104.

MacGregor, M.K and M.F. Elderkin. 2003. *Protecting and Conserving Wood Turtles: A Stewardship Plan for Nova Scotia*. Published by the Biodiversity Program, Wildlife Division. 23 pp.

Madsen, J., and D. Boertmann. 2008. Animal Behavioral Adaptation to Changing Landscapes: Spring-Staging Geese Habituate to Wind Farms. *Landscape Ecology* 23: 1007-1011.

MBBA (Maritime Breeding Bird Atlas). 2012. *Maritime Breeding Bird Atlas – Second Edition*. Accessed on July 31, 2012 from http://www.mba-aom.ca/english/index.html.

Maritime Butterfly Atlas Online. 2012. *Monarch, Monarque, Danaus plexippus*. Retrieved from http://www.ontarioinsects.org/maritimesbutterflyatlas/atlas_online_mba.html.

Market and Opinion Research International. 2002. *Tourist Attitudes Toward Windfarms.* Retrieved from http://www.bwea.com/pdf/MORI.pdf

McCarty, John P. 1996. Eastern Wood-Pewee (Contopus virens), The Birds of North America Online (A. Poole, Ed.). Ithaca: Cornell Lab of Ornithology; Retrieved from the Birds of North America Online: http://bna.birds.cornell.edu/bna/species/245
doi:10.2173/bna.245

MTRI (Mersey Tobeatic Research Institute). 2008. *Species at Risk in Nova Scotia: Identification and Information Guide*. 100 pp.

Meyer, R. 2007. *Martes pennanti*. In: *Fire Effects Information System* (online). US Department of Agriculture, Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory. Retrieved from http://www.fs.fed.us/database/feis/animals/mammal/mape/all.html#BIOLOGICAL DATA AND HABITAT REQUIREMENTS.

MBCA (Migratory Birds Convention Act), 1994, S.C. 1994, Ch. 22, as amended 2010. (Published by the Minister of Justice). Retrieved from http://laws-lois.justice.gc.ca/PDF/M-7.01.pdf

Moseley, M. 2007. Records of Bats (Chiroptera) at Caves and Mines in Nova Scotia. Curatorial Report Number 99, Nova Scotia Museum, Halifax. 21 pp.

MTO (Ministry of Transportation of Ontario). 2009. Environmental Guide for Fish and Fish Habitat, Section 5: Impact Assessment and Mitigation. Retrieved from http://www.raqsb.mto.gov.on.ca/techpubs/eps.nsf/8cec129ccb70929b852572950068f16b/0aa15a0ed6652b50852572f3006a6bfd/$FILE/MTO%20Fish%20Guide%20Sec%205%20Impact%20Assess%20Mit_June09_FINAL.pdf

Municipality of the District of West Hants 2008a. As amended 2012. *Municipality of the District of West Hants Municipal Planning Strategy*. Retrieved from http://www.westhants.ca/planning.html

Municipality of the District of West Hants. 2008b. As amended 2012. *Municipality of the District of West Hants Land Use By-Law*. Retrieved from http://www.westhants.ca/planning-documents.html

NOAA (National Oceanic and Atmospheric Administration). 2006. *Status of fishery resources off the northeastern US. Atlantic and Shortnose sturgeons*. Prepared by the Resource Evaluation and Assessment Division.

NRC (National Research Council). 2007. *Environmental Impacts of Wind-Energy Projects.* National Research Council of the National Academies. Washington, DC: The National Academies Press. 394 pp.

NRCan (Natural Resources Canada). 2003. *Wind Power Production Incentive (WPPI). Environmental Impact Statement Guidelines for Screening of Inland Wind Farms Under the Canadian Environmental Assessment Act.* Retrieved from http://publications.gc.ca/collections/Collection/M144-9-2003E.pdf

NRCan (Natural Resources Canada). 2009. *About Renewable Energy*. Retrieved from http://www.nrcan.gc.ca/energy/renewable/1297

NSDE (Nova Scotia Department of Energy). 2007. Nova Scotia Wind Atlas. Retrieved from http://www.nswindatlas.ca/.

NSDE (Nova Scotia Department of Energy). 2008. *Renewable Energy – Wind Turbine Noise*. Retrieved from http://www.gov.ns.ca/energy/renewables/public-education/wind/turbine-noise.asp

NSDE (Nova Scotia Department of Energy). 2009. *An Approach to Regulating Electricity Sector Greenhouse Gas and Air Pollutant Emissions in Nova Scotia: A Discussion Paper*. Retrieved from http://www.gov.ns.ca/nse/dept/docs/Discussion.Paper.Environment.GreenhouseGas.pdf

NSDE (Nova Scotia Department of Energy). 2010. Renewable Electricity Plan: A Path to Good Jobs, Stable Prices and a Cleaner Environment. Retrieved from http://www.gov.ns.ca/energy/resources/EM/renewable/renewable-electricity-plan.pdf

NSDE (Nova Scotia Department of Energy). 2011. *Why Wind Energy: Climate Change. Rising Energy Prices. Energy Security. Sustainability*. Retrieved from http://www.gov.ns.ca/energy/renewables/public-education/wind/why-wind.asp

NSDE (Nova Scotia Department of Energy). 2012. *Renewable Electricity Plan: About the Plan*. Retrieved from https://nsrenewables.ca/about-plan

NSDNR (Nova Scotia Department of Natural Resources). 2010. *Wild Species – The General Status of Species in Nova Scotia*. Retrieved from http://www.gov.ns.ca/natr/wildlife/genstatus/

NSDNR (Nova Scotia Department of Natural Resources). 2011a. Nova Scotia Pumping Test Database.

NSDNR (Nova Scotia Department of Natural Resources). 2012a. Nova Scotia Forest Inventory – Current Cycle.

NSDNR (Nova Scotia Department of Natural Resources). 2012b. *Wet Areas Mapping and Flow Accumulation Channels*. Retrieved from http://novascotia.ca/natr/forestry/gis/wamdownload.asp.

NSDNR (Nova Scotia Department of Natural Resources). 2012c. *Nova Scotia Significant Species and Habitats Database*. Retrieved from http://www.gov.ns.ca/natr/wildlife/habitats/hab-data/

NSDNR (Nova Scotia Department of Natural Resources). 2012d. *Hunter and Trapper Harvest Statistics Index*. Retrieved from http://novascotia.ca/natr/hunt/furbearerharvests.asp#bycounty

NSDNR (Nova Scotia Department of Natural Resources). 2012e. *Endangered Mainland Moose Special Management Practices*. Retrieved from http://www.gov.ns.ca/natr/wildlife/habitats/terrestrial/pdf/SMP_Mainland_Moose.pdf

NS Department of Fisheries and Aquaculture. 2007. Atlantic Salmon (*Salmo salar*)._Retrieved from http://www.gov.ns.ca/fish/aquaculture/species/salmon.shtml

NSE (Nova Scotia Environment). 2009a. *A Proponent's Guide to Environmental Assessment*. February 2001 (Revised September 2009). Retrieved from http://www.gov.ns.ca/nse/ea/docs/EA.Guide-Proponents.pdf

NSE (Nova Scotia Environment). 2009b. *Guide to Addressing Wildlife Species and Habitat in an EA Registration Document*. 8 pp.

NSE (Nova Scotia Environment). 2011a. *Well Logs Database – Groundwater (log data from 1966-2011).*Retrieved from http://www.gov.ns.ca/nse/welldatabase/wellsearch.asp.

NSE (Nova Scotia Environment). 2011b. *NS Groundwater Observation Well Network; Wolfville 010*. Retrieved from http://www.gov.ns.ca/nse/groundwater/groundwaternetwork.asp

NSE (Nova Scotia Environment). 2012a. *A Proponent's Guide to Wind Power Projects: Guide for Preparing an Environmental Assessment Registration Document.* 20 pp. Retrieved from http://www.gov.ns.ca/nse/ea/docs/EA.Guide-Proponents-WindPowerProjects.pdf

NSE (Nova Scotia Environment). 2012b. *Nova Scotia Lake Inventory (Survey) Program*. *Lake Chemistry Data Spreadsheet*. Retrieved from https://www.gov.ns.ca/nse/surface.water/lakesurveyprogram.asp

NS*EA (Nova Scotia Environment Act*). 1994-1995. *Environmental Assessment Regulations.* Retrieved from http://nslegislature.ca/legc/statutes/envromnt.htm

NS *ESA (Nova Scotia Endangered Species Act*). 2013. Retrieved from http://www.gov.ns.ca/natr/wildlife/biodiversity/species-list.asp.

NSPI (Nova Scotia Power Inc.). 2013. *A cleaner megawatt: Discussing Renewable Energy in Nova Scotia*. Retrieved from http://cleaner.nspower.ca/

NSTIR (Nova Scotia Transportation and Infrastructure Renewal). 2009. *Nova Scotia Temporary Workplace Traffic Control Manual*. Retrieved from http://www.gov.ns.ca/tran/tcm/Traffic%20Control%20Manual%2020100515.pdf

NSTPW (Nova Scotia Transportation and Public Works). 2007. Generic Environmental Protection Plan (EPP) for the Construction of 100 Series Highways. Retrieved from http://www.gov.ns.ca/tran/works/enviroservices/EPP100series/Generic%20EPP_July%202007.pdf

O'Farrell, M.J., Miller, B.W., and W.L. Gannon. 1999. Qualitative Identification of Free-flying Bats Using the ANABAT Detector. *Journal of Mammalogy* 80: 11-23.

OMNR (Ontario Ministry of Natural Resources). 2000. Conserving the forest interior: a threatened wildlife habitat. 12 pp.

Parker, G. 2003. *Status report on the Eastern Moose (Alces alces americana Clinton) in Mainland Nova Scotia*. 77 pp.

Pearce-Higgins, J.W., Stephen, L., Langston, R.H.W., Bainbridge, I.P., and R. Bullman. 2009. The Distribution of Breeding Birds Around Upland Wind Farms. *Journal of Applied Ecology* 46: 1323-1331.

Province of Nova Scotia. 2013. *Nova Scotia Community Counts web page - data modeled from Statistics Canada, National Household Survey, 2011*. Retrieved from https://novascotia.ca/finance/communitycounts/profiles/community/defaultp.asp?gnum=com801&gnum2=chb92&gname=&gview=1&glevel=chb&gtype=&ptype=geo&gsel=5&acctype=

Public Highways Act, RSNS, 1989, c 371, s 20.

Quinn, G.M., and H.G. Broders. 2007. Roosting and Foraging Ecology of Tri-colored Bat (Perimyotis subflavus) in SW Nova Scotia. Report prepared for the Nova Scotia Habitat Conservation Fund, c/o Nova Scotia Department of Natural Resources. 34 pp.

Randall, J.H. 2011.Identification and characterization of swarming sites used by bats in Nova Scotia. MES Thesis, Dalhousie University, Halifax, NS. 63 pp.

Rollins, K.E., Meyerholz, D.K., Johnson. G.D., Capparella, A.P., and S.S. Loew. 2012. A Forensic Investigation Into the Etiology of Bat Mortality at a Wind Farm: Barotrauma or Traumatic Injury? *Veterinary Pathology* 49: 362-371.

Rulifson, R. and M. Dadswell. 1995. Life History and Population Characteristics of Striped bass in Atlantic Canada. *Transactions of the American Fisheries Society* 124: 407-577.

Rydell, J., Bach, L., Dubourg-Savage, M.J., Green, M., Rodrigues, L., and A. Hedenström. 2010. Mortality of Bats at Wind Turbines Links to Nocturnal Insect Migration? *European Journal of Wildlife Research* 56: 823-827.

Schaub, A., Ostwald, J., and B. M. Siemers. 2008. Foraging Bats Avoid Noise. *Journal of Experimental Biology* 211: 3174-3180.

Scott, F.W. 1987. First record of the Long-tailed shrew, *Sorex dispar*, for Nova Scotia. *Canadian Field Naturalist* 101: 404-407.

Service Nova Scotia 2013. *Property Online*. Retrieved from http://www.gov.ns.ca/snsmr/property/default.asp?mn=282.46.1064

Shafer, A.B.A., and D.T. Stewart. 2006. A disjunct population of *Sorex dispar* (Long-tailed shrew) in Nova Scotia. *Northeastern Naturalist* **13**: 603-608.

Snaith, T.V. and K.F. Beazley. 2004. The Distribution, Status, and Habitat Associations of Moose in Mainland Nova Scotia. *Proceedings of the Nova Scotian Institute of Science* 42: 263-317.

SARA (Species at Risk Act), 2002, SC 2002, c 29, as amended by 2012.

Statistics Canada. 2012. West Hants, Nova Scotia (Code 1208001) and Nova Scotia (Code 12) (table). Census Profile. 2011 Census. Statistics Canada Catalogue no. 98-316-XWE. Ottawa. Released October 24, 2012. Retrieved from http://www12.statcan.gc.ca/census-recensement/2011/dp-pd/prof/index.cfm?Lang=E

Stea, R.R., Conley, H., and Y. Brown. 1992. *Surficial Geology Map of the Province of Nova Scotia*. Nova Scotia Department of Natural Resources, Minerals and Energy Branch, Map ME 1992-3, scale 1:500 000. Available online as DP ME 36m version 36, 2006 at http://www.gov.ns.ca/natr/meb/download/dp036.asp.

Sulphide Bearing Material Disposal Regulations, NS Reg 57/95.

Telfer, E.S. 1970. Winter habitat selection by moose and white-tailed deer. Journal of Wildlife Management 34:553-559.

TBTRT (The Blanding's Turtle Recovery Team). 2012. *National Recovery Plan for the Blanding's Turtle (Emydoidea blandingii) Nova Scotia Population*. Nova Scotia, Canada. 73 pp.

Thomas, D.W. 1995. Hibernating bats are sensitive to nontactile human disturbance. *Journal of Mammalogy* 76: 940-946.

Transportation of Dangerous Goods Act, 1992. S.C. 1992, c. 34.

Trescott, Peter C. 1969. Groundwater Resources and Hydrogeology of the Windsor-Hantsport-Walton Area, Nova Scotia. Province of Nova Scotia, Department of Mines Groundwater Section; Report 69-2. Pp.65.

Trombulak, S.C., and C.A. Frissell. 2000. Review of Ecological Effects of Roads on Terrestrial and Aquatic Communities. *Conservation Biology* 14: 18-30.

USDE (United States Department of Energy). 2008. 20% Wind Energy by 2030: Increasing Wind Energy's Contribution to U.S. Electricity Supply. Retrieved from:
at http://www.nrel.gov/docs/fy08osti/41869.pdf

Walter, W.D., Leslie Jr., D.M., and J.A. Jenks. 2006. Response of Rocky Mountain Elk (*Cervus elaphus*) to Wind-Power Development. *The American Midland Naturalist* 156: 363-375.

Webb, K.T. and I.B. Marshall. 1999. *Ecoregions and Ecodistricts of Nova Scotia. Crops and Livestock Research Centre, Research Branch, Agriculture and Agri-Food Canada, Truro, Nova Scotia*; Indicators and Assessment Office, Environmental Quality Branch, Environment Canada, Hull, Quebec. P 13.

Woolaver, L.G., Elderkin, M.F., and F.W. Scott. 1998. *Sorex dispar* in Nova Scotia. *Northeastern Naturalist* 5: 323-330.

Wright, D.G. and G.E. Hopky (DFO). 1998. *Guidelines for the Use of Explosives in or Near Canadian Fisheries Waters*. Canadian Technical Report of Fisheries and Aquatic Sciences 2107. Retrieved from http://www.dfo-mpo.gc.ca/Library/232046.pdf

Zimmerling, J.R., Pomeroy, A.C., d'Entremont, M.V., and C.M. Francis. 2013. Canadian estimate of bird mortality due to collisions and direct habitat loss associated with wind turbine development. *Avian Conservation and Ecology* 8: 10.

Personal Communication

M. Elderkin, personnel communications. June 13, 2012. Bat Monitoring.