8.8 Bats

Information regarding the bat community in the vicinity of the Project site, including any *SOCI*, was obtained through a combination of desktop review and field studies. The desktop component included a review of the NS Significant Species and Habitat Database (NSDNR 2012c) and ACCDC data (ACCDC 2012) on species recorded within a 100 km radius of the Project site, and the comparison of habitat mapping data (Section 8.4) to known habitat requirements for species expected to occur within the area and for all species of conservation interest. Field surveys of bat migration/habitat use were carried out from September 4 to September 20, 2012 using an AnaBat SD2 Detector deployed at the Project site.

8.8.1 Desktop Review

Seven species of bats have been recorded in Nova Scotia (Broders *et al.* 2003) including:

- Little brown bat (*Myotis lucifugus*);
- Northern long-eared bat (*Myotis septentrionalis*);
- Big brown bat (*Eptesicus fuscus*);
- Eastern red bat *(Lasiurus borealis*);
- Hoary bat (*Lasiurus cinereus*);
- Silver-haired bat (*Lasinycteris noctivagans*); and
- Tri-colored bat (*Perimyotis subflavus*).

Of these, only Little brown bat, Northern long-eared bat, and Tri-colored bat have known significant populations in Nova Scotia (Broders and Forbes 2004). The most common resident species, the Little brown bat and the Northern-long eared bat, are typically active from May until August, at which time the two species return to caves and mine openings, referred to as hibernacula, and commence swarming behaviours prior to over-wintering.

Tri-colored bats also overwinter in the province and typically use the same type of habitat, but less is known about this species' hibernating ecology. Other bat species, including Hoary bat and Silver-haired bat, migrate from the province in the fall months and over-winter in the southern United States (Moseley 2007).

The Significant Species and Habitats database (NSDNR 2012c) indicates that 15 features related to bats and bat habitat are present within a 100 km radius of the Project site. These relate to both Little brown bat observations and bat hibernacula. Moseley (2007) provided an overview of the known bat hibernacula in the caves and mines of Nova Scotia. This research indicates 15 known hibernacula within a 100 km radius of the Project site (Table 8.13).

Table 8.13: Known Bat Hibernacula within 100km of the Project Site

Hibernacula	Distance from Project Site (km)	Direction
Frenchman's Cave	7.18	E/NE
Woodville Ice Cave	18.78	NE
Cheverie Cave	25.5	N
Centre Rawdon Gold Mine	32.21	NE
Walton Barite Mine	34.6	N
Peddlar's Tunnel	39.24	N/NE
Minasville Ice Cave	44.82	N/NE
Cave of the Bats	52.36	E
Hayes Cave	55.43	NE
Gayes River Gold Mine	61.27	E
Black Brook	64.01	E/NE
The Ovens	66.91	SW
Lear Shaft	72.68	N/NE
Vault Cave	74.75	W
Lake Charlotte Gold Mine	90.2	E/SE

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 over 25 km to the north. This dissolutional cave in gypsum is thought to support 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 55.4 km to the northeast (Moseley 2007). Up to 6,000 bats enter this cave in September and reside until June (Davis and Browne 1996). Due to its importance to the bat population of Nova Scotia, public access to Hayes Cave is currently restricted.

Table 8.14 presents bat species recorded within a 100 km radius of the Project site, according to ACCDC.

Table 8.14: Bat Species Recorded within a 100 km Radius of the Project Site

Common Name	Scientific Name	NSDNR Status[1]	COSEWIC Status[2]	SARA Status[3]	NSESA Status[4]
Hoary Bat	*Lasiurus cinereus*	Undetermined	Not Listed	Not Listed	Not Listed
Little Brown Myotis	*Myotis lucifugus*	Yellow	Endangered	Not Listed	Not Listed
Northern Long-eared Myotis	*Myotis septentrionalis*	Yellow	Endangered	Not Listed	Not Listed
Tri-colored Bat	*Perimyotis subflavus*	Yellow	Endangered	Not Listed	Not Listed

Source: ACCDC 2012

[1]NSDNR 2010; [2]COSEWIC 2012; [3]SARA 2012; [4]NSESA 2007

8.8.2 Field Surveys

Field surveys of bat migration/habitat use were carried out from September 4 to September 20, 2012 using an AnaBat SD2 Detector (Titley Electronics, Columbia, Missouri) deployed at the Project site.

Suitable locations for the detector were limited at the Project site due to the prevalence of heavily forested areas with high canopies that can potentially prevent acoustic signals from reaching the microphone. As such, the detector was deployed in a small treed swamp adjacent to an access road, as this location featured a distinct clearing. The detector was located 278 m east/southeast of Turbine 1, 541 m north of Turbine 2, and 1,247 m north of Turbine 3 (Drawing 8.6).

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; Broders 2011), so these calls were not identified to species.

In total, 6,184 files were recorded, of which only 35 files were determined to be bat generated ultrasound.

Most echolocation calls were recorded between September 4 and 7, and were associated with *Myotis* species bats (i.e. Little brown myotis and Northern long-eared myotis) (Table 8.15). Thirteen of the 35 calls identified were categorized as unknown species. These calls were clearly bat generated ultrasound; however, the quality of the files was not sufficient to render a positive identification. However, most of the unknown calls were likely *Myotis* sp. due to the frequency and slope.

Table 8.15: Number of Echolocation Calls Recorded at Project Site (Sept 4th – 20th)

Date	Echolocation Calls		
	***Myotis* sp.**	**Unknown species**	**Total**
9/4/2012	4	2	6
9/5/2012	0	1	1
9/6/2012	4	0	4
9/7/2012	7	9	16
9/8/2012	2	0	2
9/9/2012	0	0	0
9/10/2012	0	0	0

Date	**Echolocation Calls**		
	***Myotis* sp.**	**Unknown species**	**Total**
9/11/2012	0	0	0
9/12/2012	2	0	2
9/13/2012	2	0	2
9/14/2012	1	1	2
9/15/2012	0	0	0
9/16/2012	0	0	0
9/17/2012	0	0	0
9/18/2012	0	0	0
9/19/2012	0	0	0
9/20/2012	0	0	0
Totals	**22**	**13**	**35**

An average of 2.1 echolocation calls per night were detected during the monitoring period. The highest recorded activity occurred on the night of September 7 during which 16 of 35 (45.7%) of echolocation calls were detected. Increased activity on this night may have been due to the presence of one bat, likely *Myotis* sp., continuously foraging in close proximity to the detector over the course of the evening. It is not necessarily an indication of bat abundance but may indicate that there was an abundance of insects in the area surrounding the detector on that particular night. Unfortunately, there is no way to determine whether bat abundance is high at the Project site without direct observation.

As expected, average nightly bat activity peaked between 19:00 and 20:00 coinciding with sunset and resultant bat emergence due to insect availability.

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 bat species include:

- Little brown myotis – "Yellow" (NSDNR 2010), "Endangered" (COSEWIC 2012);
- Northern long-eared myotis– "Yellow" (NSDNR 2010), "Endangered" (COSEWIC 2012); and
- Tri-colored bat – "Yellow" (NSDNR 2010), "Endangered" (COSEWIC 2012)

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; Moseley 2007).

ACCDC records indicate that the closest sighting of the Little brown myotis to the Project site is 3±10 km and three hibernacula are known to occur within a 30 km radius. Field surveys identified *Myotis* sp. at the Project site in September, and although not conclusively determined, it is likely that at least some of these echolocation calls 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 solitarily 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±10 km away, and this species has been identified at two known hibernacula within 30 km of the Project site. Field surveys identified *Myotis* sp. at the Project site in September, and although not conclusively determined, it is likely that at least some of these echolocation calls 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). 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).

Tri-colored bat was recorded at Cheverie Cave located 26 km away from the Project site (Moseley 2007). ACCDC data indicates that the closest observation of this species to the Project site was 3±10 km away. Although Tri-colored bat was not detected during field studies, it is likely that this species is present at the Project site, either during the breeding season or during late-summer movements to hibernacula.

9.0 SOCIO-ECONOMIC ENVIRONMENT

9.1 Local Demographics and Industry

The Project site is located in the community of Three Mile Plains within the Municipality of the District of West Hants. The Municipality occupies the western half of Hants County, extending from the Minas Basin to the boundary with Halifax County. The largest towns in West Hants are Windsor (pop. 3,785) and Hantsport (pop. 1,191) (Statistics Canada 2006). The nearest communities to the Project site are Three Mile Plains (3 km), Falmouth (8 km), Windsor Forks (6 km) and St. Croix (7 km).

9.1.1 Demography

Population statistics for West Hants and Windsor from the 2011 census are summarized in Table 9.1.

Table 9.1: Population in West Hants and the Town of Windsor

Population Statistics	West Hants	Windsor
Population in 2011	14,165	3,785
Population in 2006	13,871	3,709
Population change from 2006-2011 (%)	2.1	2.0
Total private dwellings in 2011	6,205	1,669
Land area (square km)	1,241.95	9.06
Population density per square kilometer	11.4	417.8

Source: Statistics Canada 2011

The age distribution in West Hants and the Town of Windsor reveal slightly older populations with a median age of 42.3 years and 45.7 years, respectively compared to the median age of the Province of Nova Scotia (41.8), and HRM (39.0) (Statistics Canada 2006). A breakdown of age distribution in West Hants and the Town of Windsor is outlined in Table 9.2 below.

Table 9.2: Age in West Hants and the Town of Windsor

Age Statistics	West Hants	Windsor
0 - 14 years	2,345 (16.9%)	565 (15.3 %)
15 - 64 years	9,550 (68.8%)	2,165 (58.6 %)
65+ years	1,990 (14.3%)	965 (26.1 %)
Total Population	**13,885 (100%)**	**3,695 (100%)**

Source: Statistics Canada 2006

Windsor’s average housing cost is $168,442, higher than West Hants at $134,281 and the provincial average of $158,000 (Statistics Canada 2006). As for median earnings for full-time, full year earners, Nova Scotians ($36,917) have lower earnings than the national median ($41,401) (Statistics Canada

2006). West Hants fall below the provincial median earnings of $36,917 for Full-Time, Full Year Earners (Statistics Canada 2006) (Table 9.3).

Table 9.3: Household Costs and Median Earnings for Full-Time, Full Year Earners

Jurisdictions	Average Housing Cost	Median Earnings
West Hants	$134,281	$34,561
Town of Windsor	$168,442	n/a
Province of Nova Scotia	**$158,000**	**$36,917**

Source: Statistics Canada 2006

9.1.2 Health Care and Emergency Services

The Town of Windsor has a fire department serving the citizens of Windsor and part of the surrounding Municipality of the District of West Hants. The department has 85 members working out of one main station and one substation to cover some 155 km^2 radius.

Health services in the region include the Hants Community Hospital which serves the communities of Windsor, Hantsport, the Municipality of West Hants and portions of the Municipality of East Hants. Hants Community Hospital is located in the Town of Windsor.

9.1.3 Industry and Employment

Employment and unemployment rates for March 2012 in the Annapolis Valley (includes West Hants) Economic Region indicate that the unemployment rate was 10.1%, which is higher than the provincial average of 9.2% (Statistics Canada 2012). The Annapolis Valley employment rate of 50.3% is lower than the provincial rate of 56.9% (Statistics Canada 2012).

A breakdown of the labour force within West Hants County and Windsor is provided in Table 9.4. The highest proportion of workers in both West Hants County and Windsor fall into the “other services” category (17.4% and 21.8%, respectively). While Statistics Canada does not specifically list tourism as an industry, it likely falls under the “other services” heading. The high proportion of workers listed as working within “other services” and “retail trade” is reflective of the tourism industry. Other significant industries include business services, and construction (Statistics Canada 2006).

Table 9.4: Labour Force by Industry in West Hants and Windsor

Industry	Total West Hants	Industry	Total Windsor
Total experienced labour force 15 years +	6,940	Total experienced labour force 15 years +	1,465
Other services	1,205	Other services	320
Business services	1,110	Retail trade	230
Construction	875	Business services	220
Retail trade	775	Health care and social services	215
Manufacturing	775	Educational services	120

Industry	Total West Hants	Industry	Total Windsor
Health care and social services	705	Construction	105
Agriculture and other resource based industries	515	Manufacturing	105
Educational services	430	Agriculture and other resource-based industries	50
Wholesale trade	300	Finance and real estate	50
Finance and real estate	240	Wholesale trade	40

Source: Statistics Canada 2006

A review of businesses located within 5 km of the Project site is outlined in Table 9.5.

Table 9.5: Local Businesses and Proximity to Project Site

Business	Distance and direction to project area*
Ski Martock	3.5 km west of Project Site, on Martock Road
Mason JW & Sons Ltd	3.2 km north of the Project Site, on Windsor Back Road
Mike Oulton Meat Store	3.9 km north of Project Site, on Highway 14

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

Economic effects as a result of the Project will include job creation and increased revenue for the Town of Windsor and the Municipality of the District of West Hants.

The types of jobs created will consist of:

- Direct employment involved in construction, operations, and maintenance activities;
- Indirect employment consisting of supplied commodities and services to the Project (i.e. turbine tower manufacturing); and
- Induced employment derived from the spending of those directly and indirectly employed by the wind farm (Gagnon *et al*. 2009).

Further, specific skills required for the Project include trades, such as electricians, welders, heavy machine operators, cement and aggregate extraction and production workers, truck drivers, crane operators, labourers, engineers, and scientists. Local resources will be sourced to the greatest extent possible and economically feasible. Since construction and manufacturing are large sectors in West Hants County, it is expected that resources will be readily available within the surrounding communities. Due to Project proximity to Halifax, professional services from scientists, engineers, and large general contractors would be easily accessible.

The Project site land is owned by the Town of Windsor and as such, the Project will be leasing the land from the Town.

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 (CPI) rises. Based on a 2% annual increase in CPI, the $5,500/MW wind turbine facility tax rate from 2006-2007 would increase to $6,468 at the Projects' commissioning in 2013-2014.

9.2 Land Use and Value

Presently, the area surrounding the Project property is primarily zoned as "Water Supply". The property on which the wind farm is proposed to be built is entirely owned by the Town of Windsor and is currently not being used for other economic activities.

The impact of wind farms on property values is a local concern. Recently, media coverage in Canada, especially from Ontario, has raised concerns about reduced property values as a result of nearby wind farm developments. In this coverage, a reduction in property values is claimed to be as a result of perceived ill environmental and health effects as well as the visual esthetics of turbines. It is important to note that a person's desire to live near a wind farm is completely subjective making it difficult to generalize wind development impacts on property values. Notably, few peer-reviewed, comprehensive, and statistically rigorous studies have been conducted on the effect of wind developments on property values, signaling a need for more research on the topic. A review of the recent literature revealed only two such publications, to be discussed below.

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. Hinman (2010) concludes that wind farms do not necessarily negatively influence the value or appreciation rate of properties in there vicinity.

The most comprehensive study to date on the impact of wind farms on property values was completed by Hoen *et al*. (2009). Here research analyzed data on nearly 7,500 sales of single family homes situated within 10 miles of 24 existing wind farms. 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 (Hoen *et al*. 2009). Hoen *et al*. (2009) admit that their analysis has little relevance to individual properties situated close to wind farm developments, and suggest that a person's decision to live near a wind farm is completely subjective (Hoen *et al*., 2009). Both studies call for more statistically rigorous peer reviewed research.

Ultimately, each wind development is different, making it difficult to accurately predict effects on property values for those residing near the Project. However, where this Project consists of three turbines and is located greater than 2.0 km from a permanent residence, negative impacts on residential property values are not expected.

9.3 Recreation and Tourism

Existing outdoor recreation in the community includes hunting, fishing, skiing, and hiking. Recreation associations and clubs serving the area include the Hants West Wildlife Association, The Big Game Society of Nova Scotia, and Glooscap Archery Club. For hiking, the Avon Peninsula Westbrook Trail and Elderidge Settlement Road provide trails throughout West Hants. Ski Martock is located 3.5 km west of the Project site and offers numerous downhill skiing and cross country routes. Fort Edward National Historic Site is located 6.6 km north of the Project site.

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 communities of Hantsport, South Rawdon and Windsor, in the Fundy Shore Annapolis Valley Region were examined. 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%**	
Hantsport	2%	4%
South Rawdon	0%	1%
Windsor	5%	14%

Source: NSDERDT 2011

The data shows tourism in Hantsport and South Rawdon is not a major economic driver. Comparatively Windsor is a slightly more popular destination. Windsor is the first town upon entering the Annapolis Valley and is known as the local service centre and nucleus of the West Hants Municipal District. Tourist attractions in the area include Ski Martock, Avon Valley Golf and Country Club, Mermaid Theatre, Windsor-West Hants Summer Fest, Pumpkin Regatta, Hants County Exhibition and the West Hants Historical Society Museum and Genealogy Center.

The Project site is owned by the Town of Windsor. The area is primarily for source water protection and as such access is restricted, at the Windsor Water Treatment Plant, for both tourism and recreation.

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 get upwards of 60,000 visits a 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 2006). 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 2006).

A 2002 study from MORI (Market & 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 (MORI 2002).

No impacts are expected to the broader recreational community and the turbines will be located off of an extended road that services the Windsor Water Treatment Plant.

9.2 Human Health

Occupational health and safety concerns regarding wind developments include shadow flicker, electromagnetic fields (EMF), electromagnetic interference (EMI), air quality, and ice throw/shedding.

9.2.1 Shadow Flicker

Rotating wind turbine blades interrupt the sunlight producing unavoidable flicker bright enough to pass through closed eyelids, and moving shadows cast by the blades on windows can affect illumination inside buildings. This effect is commonly known as shadow flicker (TSFWV 2012). 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).

Shadow flicker can be mitigated by siting wind turbines at sufficient distance from residences likely to be affected. Flicker effects have been reported to occur only within ten rotor diameters of a turbine (Office of the Deputy Prime Minister 2004). A Land Use Planning for Wind Energy document was developed by EDS Consulting for Manitoba in 2009. The report suggests that at 500 m and more, shadow flickers occurs only at sunrise and sunset and at distances exceeding 900 m, shadow flicker is considered to be insignificant (EDS 2009). Based on a conservative approach, with a diameter blade of 100 m, the potential shadow flicker effect could be felt up to 1,000 m from a turbine.

Desktop resources and site reconnaissance was used to develop a list of potential shadow flicker receptors within 2 km of the Project. Four year-round buildings were identified: three buildings associated with the Windsor Water Treatment Plant and a building associated with a gravel pit operation, with the nearest building located 1.45 km from a proposed turbine location. In addition, 12 seasonal woods camps were identified; the closest camp is 433 m. No permanent residential dwellings were identified within 2 km of a proposed turbine.

Due to the distance between Project infrastructure and the residential receptors, no adverse impacts to residential receptors are expected.

9.2.2 Electromagnetic Fields

EMFs are a type of energy that occurs naturally and is also created through the use of electrical appliances and equipment (i.e. cell phone usage, radio towers, etc.) (City of Toronto 2011). A guidebook to Wind Energy Development was produced in 2011 and identified transmission lines, wind turbine generators, generator transformers and underground cables as the four potential sources of EMFs as a result of wind farm operations (CanWEA 2011). The guidebook goes on to suggest that EMF exposure is not significant due to low emission levels produced by wind farm operations and indicates that generator transformers likely generate the highest levels of EMFs. Similar conclusions have been made by Health Canada and the World Health Organization (Chief Medical Officer of Health of Ontario Report 2010).

In 2007, a study was completed to assess the possible effects of EMFs on human health. It was concluded that there is little evidence to support the theory that EMFs cause long term health issues (SCENIHR 2007). As well, a study led by the National Institute of Environmental Health Sciences (NIEHS) assessed scientific evidence spanning over 6 years, to determine whether exposure to EMF could result in a potential risk to human health. Results indicated that there were no consistent patterns of biological effects with animals or with cells (EMF RAPID 2002).

Health Canada states that "research has shown that EMFs from electrical devices and power lines can cause weak electric currents to flow through the human body. However, these currents are much smaller than those produced naturally by your brain, nerves and heart, and are not associated with any known health risks" (Health Canada 2010). Health Canada goes on to state that EMFs are strongest when close to their source. As you move away from the source, the strength of the fields fades rapidly and that that humans need not engage in specific actions to minimize risk including those located just outside the boundaries of power line corridors (Health Canada 2010).

9.2.3 Electromagnetic Interference (EMI)

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 outline a consultation based assessment protocol that establishes areas, called "consultation zones", around transmission systems, based on the system's type and function.

The EMI study for this Project was completed in accordance with the RABC/CanWEA published guidelines. Location information and frequency details were obtained from the Technical and Administrative Frequency Lists (TAFL) 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, Environment Canada, NAV CANADA, Natural Resources Canada, and Industry Canada. Results are provided in Table 9.7.

Table 9.7: Radar Transmission Array Interference Consultation Results

	Operator	Required/ Suggested Consultation Zone Radius	Location Relative to Project Site	Consultation Results
Television - Broadcast and Reception				
Analog Television Broadcast (Private)	n/a	1 km	23 km	None required – interference unlikely.
Analog TV Broadcast (Public)	CBC	89 km	47.76 km	Additional analysis required to determine specific interference to the CBC broadcast system.
Analog Television Receivers	n/a	4.5 km	n/a	Consultation may be required to evaluate the effects of the Project on analog TV reception within 4.5 km radius. However, analog signal transmission has been predominantly replaced. The majority of TV broadcast operators have converted their analog NTSC TV stations to the ATSC North American digital standard, as required by a decision of the CRTC (Public Notice CRTC 2007-53).
Radio Broadcasting				
AM Radio (Private)	n/a	1 km	7.5 km	None required – interference unlikely.
AM Radio (Public)	CBC	5 km	n/a	None required – interference unlikely.
FM Radio (Private)	n/a	1 km	38 km	None required – interference unlikely.
FM Radio (CBC)	CBC	5 km	n/a	No receivers located within consultation n zone.
Radar , Navigation and Communications				
Air defense and air control radar systems	DND	100 km	Throughout coastal and inland regions	No objections or concerns.
DND Radio Communications	DND	n/a	Various locations	No objections or concerns.
Maritime vessel traffic system radars	Canadian Coast Guard	60 km	Throughout coastal regions	No objections or concerns.
Radar communication systems	RCMP	N/A	The closest station is 14 km away	The RCMP has no concerns regarding the Project's impact on their satellite communication system.

	Operator	Required/ Suggested Consultation Zone Radius	Location Relative to Project Site	Consultation Results
VHF omnidirectional range and primary air traffic control surveillance radar	Nav Canada	60km	16 km southeast	No objection to the project as submitted.
Weather radar instillation array: Gore Weather Radar	EC	80 km	38 km northwest	Do not anticipate the Project to have any severe impact on radar view.
Aeronautical Obstruction Clearance Form	Transport Canada	N/A		
Seismic monitoring stations	NRCan	80 km	52 km southeast	Awaiting response.

Relevant correspondence from operators is provided in Appendix E.

9.2.4 Air Quality

The development and construction phases of a wind energy project may affect local air quality, by increasing air borne dust associated with on –site equipment, and vehicles. Emissions from vehicles and equipment can also contribute to a reduction in local air quality.

AWEA (2010) states that the generation of electricity from the wind does not result in any air emissions. Similarly, the US Environmental Protection Agency (EPA) recognizes that the emissions associated with wind technology are negligible because no fuels are combusted. Therefore, wind energy production offsets more polluting forms of energy generation and can actually improve air quality and our health.

9.2.5 Ice Throw and Ice Shedding

Under appropriate temperature and humidity conditions, ice can build up on the rotor blades, nacelle and tower of a wind turbine, which can lead to two types of risk:

- ice fragments dislodge and are shed from the rotor of the operating turbine due to aerodynamic and centrifugal forces; and
- ice fragments dislodge from the structure and fall to the ground when it is shut down or idling without power production (CWEA 2007).

As part of a project prepared by the Finnish Meteorological Institute entitled “Wind Energy in Cold Climates (WECO)”, a set of safety guidelines for wind developments in ice prone areas was developed. A risk assessment methodology demonstrated that the risk of being struck by ice thrown from a turbine is diminishingly small at distances greater than approximately 250 m from the turbine in a climate where moderate icing occurs (Morgan *et al*. 1998). With proper setbacks and on-sight safety awareness, hazards are minimized (Colby 2008; MassDEP & MBPH 2012).

Turbines are located greater than 2.8 km from the nearest provincial road (Windsor Back Road), 1.45 km from the nearest year-round building (Windsor Water Treatment Plant), and 433 m from the nearest seasonal woods camp, mitigating the risk of ice harming nearby workers and drivers. In addition, the following mitigation strategies will be implemented:

- physical and visual warnings (i.e. signs and fences);
- turbine deactivation during periods of ice accumulation; and
- restriction of access to trained site personnel (Wahl and Giguere 2006).

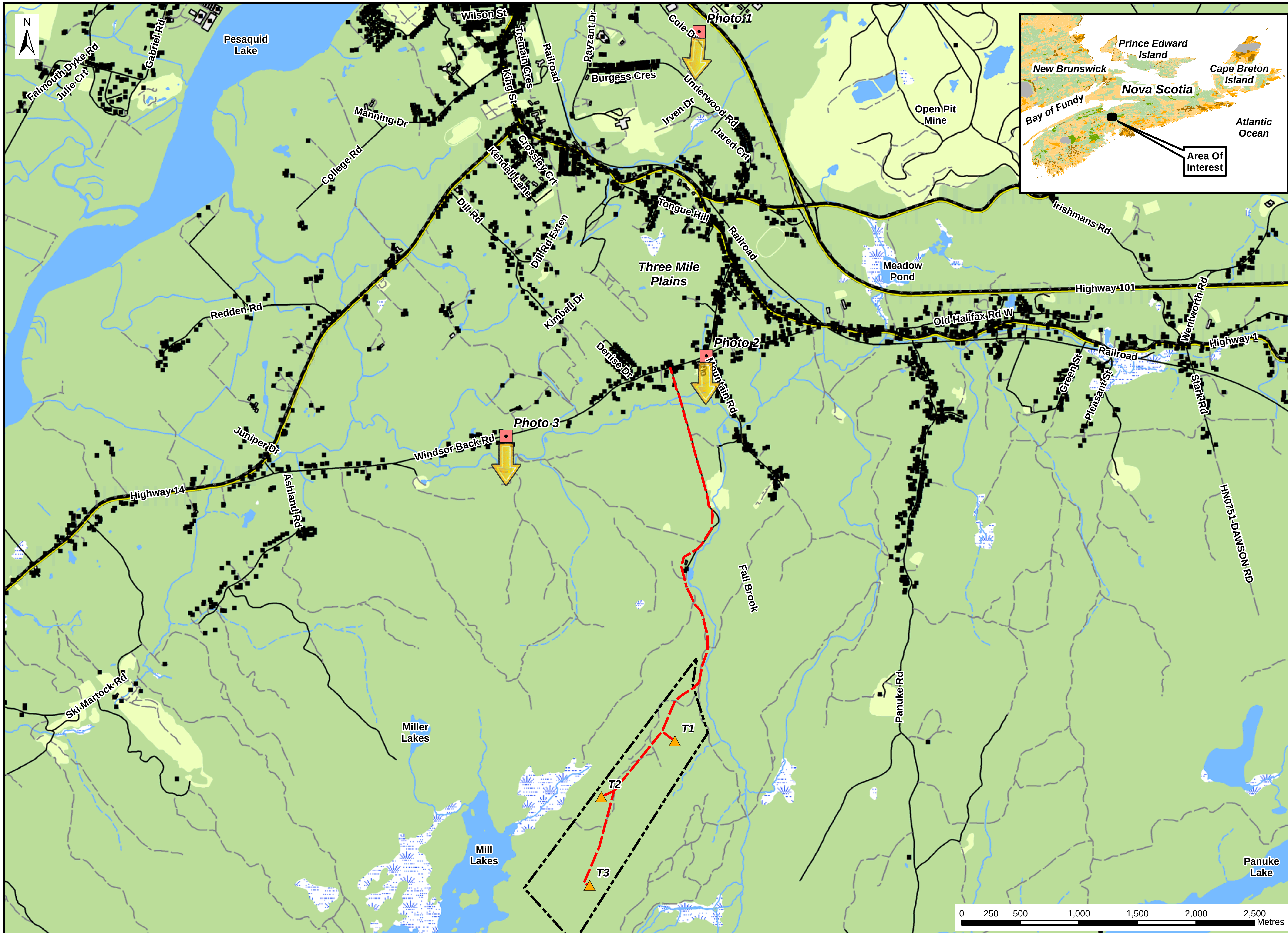
9.2.6 Visual Impacts

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 (VIA).

Photographs were collected around the Project Area. Geographical Information System (GIS) software was used to plot the photo locations and construct bearing lines to assist in the construction of a 3D model generated using Google SketchUp. Views captured in the photographs were recreated in the 3D model, and .jpeg files were exported. Using Adobe Photoshop, the digital photographs were overlaid on the model renderings, aligned by matching the dominant ridge line. Proposed turbine locations and specifics regarding the height of the turbines were used to position and model the proposed turbines. Simulated wind turbines were added to the digital photographs consistent with the location and scale represented in the 3D renderings.

Photos were taken from three locations as shown in Drawing 9.1. Simulated results are provided in Figures 9.1-9.3.



Notes:

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

Legend:

- Proposed Turbine
- Visual Assessment Locations
- Proposed Road
- Project Site Boundary
- Building
- Major Roads and Highways
- Roads
- Access Roads / Trails
- Large Structure
- Mapped Stream
- Indefinite Stream
- Water Bodies
- Mapped Wet Area
- Cleared Area

Visual Assessment

Strum ENVIRONMENTAL

Date: January 2013	Project #: 12-4402
Scale: 1:30,000	Drawing #: 9.1
Drawn By: H. Serhan	
Checked By: A. Walter	

Figure 9.1: View looking south/southwest, from the Super 8 Motel

Figure 9.2: View looking south, near the junction of Windsor Back Road and Mountain Road

Figure 9.3: View looking south along Windsor Back Road

-

9.2.7 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 noise 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 noise can depend on their hearing acuity and their tolerance for particular noise types (Committee on Environmental Impacts of Wind Energy Projects, National Research Council 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) (as cited in Committee on Environmental Impacts of Wind Energy Projects, National Research Council 2007).

Apart from noise generated during the operation of wind energy facilities, noise is also produced during the construction, maintenance, and decommissioning phases. This noise is usually associated with such activities as equipment operation, blasting, and the movement of traffic to and from the facility (Committee on Environmental Impacts of Wind Energy Projects, National Research Council 2007). Equipment expected to be used within the Project Area will include: back hoes, bulldozers, flatbed trailers, cranes, dump trucks, ready mix trucks, and smaller maintenance vehicles.

Infrasound

Infrasound is very low-frequency sound, typically defined as being between 1-20 Hz, and is below what human ears can normally hear, though the 16-20 Hz range can be audible at very high volumes. Low frequency sound and infrasound are everywhere in the environment and are emitted from natural sources (e.g. wind, rivers) and from artificial sources including road traffic, aircraft, and ventilation systems. The most common source of infrasound is vehicles (CMHO 2010). Under many conditions, low frequency sound below 40 Hz from wind turbines cannot be distinguished from environmental background noise (CMHO 2010).

Concern about infrasound from wind turbines may have originated from the experience of neighbours of early wind turbine designs with downwind rotors (rotors downwind of the tower), which created objectionable levels of infrasound. In contrast, all modern utility scale wind turbines have upwind rotors that produce significantly lower infrasound emissions (Bastasch *et al*. 2006).

There is no evidence of adverse health effects from infrasound below the sound pressure level of 90 dB. Studies conducted to assess wind turbine noise indicates that infrasound and low frequency sounds from modern wind turbines (typically at 50 dB to 70 dB) are well below the level where known health effects can occur (Leventhall 2006).

A scientific advisory panel with expertise in audiology, acoustics, otolaryngology, occupational/ environmental medicine, and public health was assembled in early 2009 to conduct a review of current literature available on the issue of perceived health effects of wind turbines (Colby *et al*. 2009). Following their review and analysis of the information, the panel reached consensus on the following conclusions:

- There is no evidence that the audible or sub-audible sounds emitted by wind turbines have any direct adverse physiological effects.
- The ground-borne vibrations from wind turbines are too weak to be detected by, or to affect, humans.
- The sounds emitted by wind turbines are not unique. There is no reason to believe, based on the levels and frequencies of the sounds and the panel’s experience with sound exposures in occupational settings, that the sounds from wind turbines could plausibly have direct adverse health consequences.

The Chief Medical Officer of Health in Ontario also conducted a review of papers and reports (from 1970 to date) on wind turbines and health from scientific bibliographic databases, grey literature, and from a structured Internet search. The report concluded that “low frequency sound and infrasound from current generation upwind model turbines are well below the pressure sound levels at which known health effects occur. Further, there is no scientific evidence to date that vibration from low frequency wind turbine noise causes adverse health effects” (CMHO 2010).

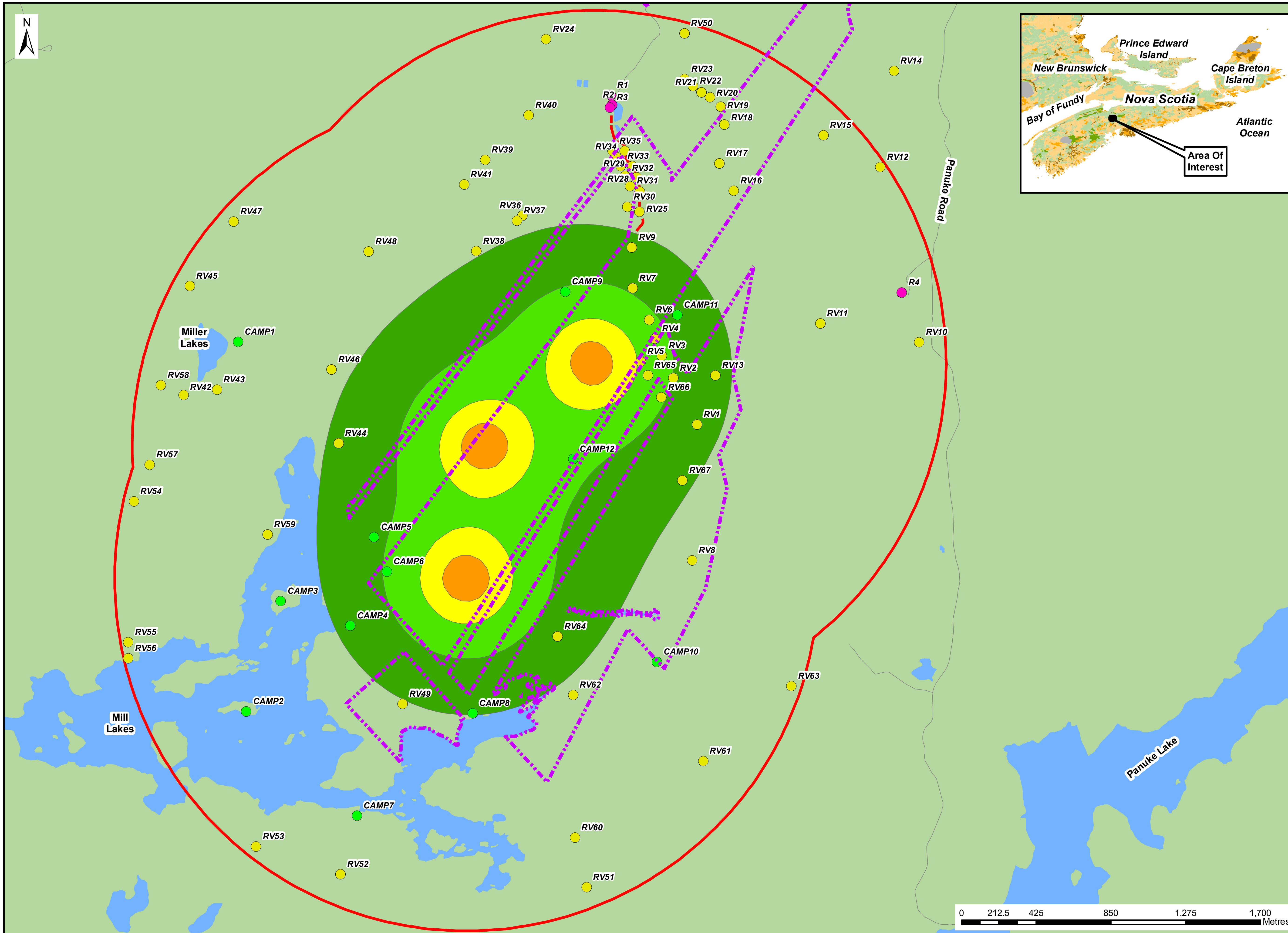
Acoustic Assessment
An acoustic assessment was conducted for the Project to predict sound pressure levels at identified receptors within a 2 km radius of the proposed turbine locations. The model followed ISO 9613-2 Acoustics – Attenuation of sound during propagation outdoors – Part 2: General method and calculations, and was based on the following input information:

- UTM coordinates for the wind turbines;
- 1/1 Octave band sound power level data for the wind turbines;
- tonality and uncertainty analysis for the proposed wind turbines (tonality guarantee provided by the manufacturer);
- UTM coordinates for receptors (all properties within a 2 km radius of the Project site, including vacant sites, were evaluated – 83 receptors in total); and
- topographic data for the surrounding area.

As there are no specific sound guidelines for wind farms in Nova Scotia, sound level limits from the Ontario Ministry of the Environment (MOE) publication, "*Noise Guidelines for Wind Farms*", dated October 2008 were used. Predicted off-site sound levels were evaluated against the MOE guideline of 40 decibels (dBA) for permanent residential dwellings. Mapping illustrating the predicted sound levels relative to receptors is provided in Drawing 9.2.

No permanent residential dwellings were identified within a 2 km radius of any turbine. Four year-round buildings were identified: three buildings associated with the Windsor Water Treatment Plant and a building associated with a gravel pit operation, with the nearest receptor located 1.45 km from a proposed turbine location. The remaining 79 receptors consist of 12 seasonal woods camps and 67 vacant lots.

The results of the assessment identified six vacant lot and three woods camp receptors with predicted sound levels that exceed 40 dBA (range from 40.4 to 44.3 dBA). Three of the vacant lot and two of the woods camp receptors are located on land owned by the Town of Windsor, a participating land owner in Project. Predicted sound levels for all permanent residential dwellings are below 40 dbA. Detailed results are provided in Appendix F.



Notes:

1. Reference: Digital Topographic Mapping By Nova Scotia Geomatics Centre. Sound Modelling by WindPro v. 2.8.
2. Projection: NAD83(CSRS), UTM Zone 20 North.

Legend:

- Town of Windsor Lands
- Proposed Turbine
- Vacant Lot Receptors
- Existing Receptors
- Identified Camps
- Proposed Road
- 2 km Turbine Buffer

Sound Modelling Results

Noise (dBA)

- 35
- 40
- 45
- 50
- Roads
- Highways
- Water Body

Sound Modelling Results

Strum ENVIRONMENTAL

Date: Dec. 2012	Project #: 12-4402
Scale: 1:20,000	Drawing #: 9.2
Drawn By: G. Gregory	
Checked By: M. Smith	

9.3 Transportation Study

A detailed transportation study will be completed by the turbine supplier as part of the design phase to determine appropriate routes and means for equipment and materials to be delivered to Project site. It is anticipated that as many resources and components as possible will be purchased from local suppliers and manufacturers. Upon completion, the study will be provided to Nova Scotia Transportation and Infrastructure Renewal (NSTIR) for review and comment.

The following permits are expected to be required:

- Work Within Highway Right of Way Permit: required if removing access signs and guard rails.
- Overweight Special Moves Permit from Service NS and Municipal Relations: to transport oversized and overweight components. In some cases, due to the size and weight of the components, some may only be transported on Sundays.
- Road weight restrictions, especially Spring Weight Restrictions, for heavier equipment and materials that will be transported to the Project site.
- Access points will be designed with proper height and width to accommodate large trucks and will adhere to commercial stopping sight distances.

The transportation route is expected to require a few slight road modifications, mostly involving the removal of signage and guardrails. To mitigate any negative effects on motorists where modification is required, a notice will be placed in public areas to inform local residents of signage removal or road infrastructure alterations. Removed signage and guardrails will be immediately replaced and appropriate temporary signage will be provided as necessary to ensure travelling public safety. Upgrades will also be made to roads and overhead wires, branches, and signs if conflicts arise. For areas requiring modifications, these will be completed to their specifications and any areas requiring reinstatement will also be completed as requested.

To the extent possible, transportation through Halifax will avoid high traffic times (7-9 am and 3-6 pm; Monday to Friday). All travel will be conducted using safe work practices for transporting oversized loads.

Transport of equipment will be via a minimum number of vehicles to minimize impacts to road-way flow and impacts on air quality due to exhaust.

During the Project's construction phase, trucks and other vehicles will be frequently visiting the Project site resulting in increased vehicular sound. To mitigate this effect, vehicles will only be visiting and working on-site during normal daytime hours of operation and will avoid high-traffic times of day to reduce local traffic congestion.

10.0 CULTURAL AND HERITAGE RESOURCES

10.1 Archeological Resource Impact Assessment

Davis MacIntyre & Associates Limited conducted an archeological resource impact assessment (ARIA) for the Project. The purpose of the assessment was to determine the potential for historic and pre-contact period archeological resources within the Project site through background research and site reconnaissance. The area encompassing the Project site would have afforded very little to attract settlers due to unsuitable land for agriculture, and there appears to be no roads historically mapped for the area (Davis MacIntyre & Associates Ltd., 2012). Therefore, apart from some early 20th century logging activities around Mill Lake and the lakes south of the Project site, it is evident that no historical land-use in the area exists (Davis MacIntyre & Associates Ltd., 2012).

A field survey completed in (September) 2012 concluded that there is a low potential for First Nations archaeological resources. The field assessment also revealed a modern day camp located between proposed turbines 1 and 2, in addition to a camp of unknown age and significance to the north of proposed turbine 3, adjacent to a proposed access road (Davis MacIntyre & Associates Ltd., 2012). The final Project layout will avoid these areas; therefore, no impacts to cultural and heritage resources are expected.

11.0 MI'KMAQ ECOLOGICAL KNOWLEDGE STUDY

A MEKS is required for the Project and will be completed by cultural consultant, Nathan Sack, upon execution of the power purchase agreement.

12.0 CONSULTATION AND ENGAGEMENT

12.1 Martock Communications Coordinator

A Communications Coordinator position, Ms. Gay Harley, has been established for the Project to coordinate meetings, address community concerns, and act as a liaison between the community and the Project team.

12.2 Consultation Summary

The Project team has delivered presentations to the Municipality of the District of West Hants, Windsor Town Council, Windsor Watershed Committee and local residents. For a summary of the presentations, meetings, and events held thus far, refer to Table 12.1 below.

Table 12.1: Public Consultation Meetings and Events

Date	Activity
August 15, 2011	Meeting with Town Chief Administration Officer (CAO) to introduce the Project
September 13, 2011	Presentation to the Mayor and Council of Windsor. Received approval to lease Town lands.
September 19, 2011	Letter of support received from the Town of Windsor.
September 31, 2011	Meeting with senior Town staff (CAO, Dept. Directors and Mayor) to discuss the Project.

Date	Activity
November 21, 2011	Meeting with Town council for final approval of the option to lease agreement.
December 6, 2011	Option reviewed and signed by Town lawyer.
February 2, 2012	Project update meeting with Town staff.
February 28, 2012	Project update presentation to Town council.
March 26, 2012	Presentation to the Watershed Committee to introduce the Project.
April 27, 2012	Project update meeting with CAO.
June 1, 2012	Meeting with District of West Hants Planner to introduce the Project and discuss approval process.
June 6, 2012	Meeting with Town Director of Public Works regarding use of existing access roads.
June 21, 2012	Presentation to District of West Hants Public Advisory Committee to introduce the Project.
August 15, 2012	Public Open House
September 6, 2012	Project update meeting with Town CAO
September 17, 2012	Meeting with West Hants Planner to discuss the Development Agreement (DA) application
December 12, 2012	Meeting with West Hants Planner to officially make application for approval by DA.

Open House

One community open house was held in Windsor on August 15, 2012 from 7-9 pm to inform the public on the Project and to hear local comments and concerns. To inform local citizens of the open house, invitations were mailed to landowners within 3 km of the Property Boundary and advertised in the local paper.

Information gathered at the open house registration desk indicated that at least 35 people attended the open house in Windsor.

The open house featured posters that provided information about the Project and associated studies that were underway. Copies of the posters from the open house are provided in Appendix G. Attendees had the opportunity to speak one on one with Project team members and submit written comments and/or questions.

The Project Team will continue to help address any concerns raised by local citizens over the duration of the Project's development and has planned a community meeting to promote investment opportunities in late January 2013, and another open house in May 2013.

Website

A website for the Project has been developed and can be accessed at: http://www.scotianwindfields.ca/wind/comFIT/martock-ridge-community-wind-project. The website provides an overview of the Project, shares information on upcoming meetings, and Project news, as well as allows interested public to pose questions to the Project team. Project newsletters (Appendix G) are also posted on the website.

12.3 First Nations Engagement
Preliminary Project details were submitted to the Kwilmu'kw Maw-klusuaqn Negotiation Office during the COMFIT application program. Nathan Sack, a cultural consultant has been acquired to assist with ongoing First Nation community engagement.

13.0 EFFECTS ASSESSMENT

Based on the discussion in Section 7, the following VECs have been identified for additional assessment:

- SOCI;
- 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 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**	**Avifauna**	**Bats**
Site Preparation/ Construction			
Surveying and Siting/Land Clearing	X	X	X
Road Construction/Upgrades	X	X	X
Equipment Delivery	X	X	X
Turbine Pad/Laydown Area Construction	X	X	X
Grid Connection			
Tower & Turbine Assembly	X	X	X
Temporary Storage			
Operation & Maintenance			
General Operation and Maintenance	X	X	X
Vegetation Management		X	
Decommissioning			
Turbine/Associated Equipment Removal	X	X	X
Access Road Removal	X	X	X
Site Re-instatement	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
	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), as shown in 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. Accidents and malfunctions are also considered for each phase.

13.2.1 SOCI

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; Kuvlevsky, Jr. *et al.* 2007). 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 terrestrial wildlife are related to sensory disturbance, habitat loss (i.e., the removal of vegetation) and fragmentation due to road construction and collision mortality.

Terrestrial wildlife are sensitive to sensory disturbance from a variety of anthropogenic sources, including aircraft (Maier *et al.* 1998); recreational vehicles (Neumann 2009); and non-motorized, recreational use of habitat (Anderson *et al.* 1996). Disturbance impacts are typically most significant during the construction phase of wind energy projects, which involves the increased presence of on-site personnel, vehicles, and heavy equipment (Helldin *et al.* 2012). Few studies have investigated the response of terrestrial fauna to wind energy construction related disturbance. Avoidance impacts related to the construction phase have been reported for large mammals in two cases [e.g., Rocky Mountain Elk (*Cervus elaphus*) and wolves (Walter *et al.* 2006; Álvaras *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.

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 critical habitat elements for certain terrestrial wildlife species may altered/removed during site preparation activities, such as clearing, for turbine pads and access roads. The effects may be negligible if the habitat is in adequate supply in the general project area (Arnett *et al.* 2007); however, if critical habitat for a species at risk is present, alteration/removal of that habitat may have deleterious effects on that species, at least on a local scale.

Road construction is likely to have the most impact on terrestrial wildlife. The construction of roads in wildlife habitat 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).

It is, however, important to distinguish wind energy facility road networks from high-use motorways. 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 a wind energy development, where road traffic is limited. Furthermore, the road network for this Project will have a small footprint due to the overall size of the Project, so the magnitude of any effects will also be low.

Increased vehicle and heavy equipment traffic during the site preparation and construction 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 (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.

The potential effects of the Project on terrestrial wildlife during the operational phase are likely to be less severe, although fragmentation effects due to roads may persist. Sensory disturbance during this phase will be limited to the presence of on-site personnel conducting maintenance on Project infrastructure. Mortality events during this phase will be limited to collisions with on-site vehicles, but these events will be minimized by the implementation of safe work practices (strict adherence to speed limits, obeying all warning signs, etc.). Collisions, should they occur, will be infrequent and will not have a significant effect on population levels.

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 area, including White-tailed deer and potentially Mainland moose, will be permanently displaced.

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). Noise generated by operating turbines has been shown to influence antipredator behavior in California ground squirrels (*Spermophilus beecheyi*) although no population level effects were observed (Rabin *et al.* 2006). This research, however, points out the potential for intraspecific communication to be interrupted by noise generated by operating turbines.

Impacts to terrestrial fauna 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. Increased vehicular traffic may result in collisions with wildlife, although these events will be minimized by the implementation of safe work practices (strict adherence to speed limits, obeying all warning signs, etc.).

Aside from surface disturbance and the possible removal of regenerated vegetation, decommissioning will not include additional habitat loss/alteration. Therefore, the impacts to terrestrial fauna during this phase of the Project are not expected to be significant in magnitude nor long-term in duration.

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, design and construct access roads to avoid environmentally sensitive habitats, where possible, and ensure the most efficient means to access turbines is achieved.
  - Maintenance of a buffer around sensitive habitats such as watercourses and wetlands, where possible.
  - Minimization of routine vegetation clearing:
    - clearing of land only if required for construction area footprint;
    - restoration of areas of disturbance where possible, post construction; and
    - location of all site construction compounds 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 species of conservation interest have revealed several priority 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.

Common snapping turtle:

- Watercourse alterations will be limited and will be subject to approval from NSE.

- Where possible, watercourse alterations will avoid Common snapping turtle nesting habitat, including sand and gravel banks, as well as over-wintering habitat such as over-hanging stream banks (COSEWIC 2008).

Fisher:

- Project activities will be planned to minimize disturbance to Fisher habitat at the Project site, particularly mature, mixed wood stands featuring large, hollow trees for suitable for denning (Gilbert *et al.*1997).

Mainland moose:

- A pre-construction Mainland moose survey will be conducted at the Project site. Should evidence of habitation be found at the Project site, the proponent will consult with NSDNR regarding strategies to minimize and mitigate potential impacts.

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.

Southern Flying Squirrel:

- Project activities should be planned to avoid large, mast-bearing trees, as well as large trees with natural cavities, where possible.

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 shall 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).
    - Adequate, permanent buffers of vegetation shall be left around important Wood turtle habitat. If necessary (i.e., in the event that Wood turtles are confirmed at the site), an appropriate mixture of shrubs and trees shall be planted to create a buffer.

Many of the mitigation measures described above are considered to be standard best practices, and are expected to address potential impacts.

13.2.2 Avifauna

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 (i.e. habitat alteration), most potential effects on avifauna are mainly related to operation. Potential effects 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 also 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 (turbine pads, roads, associated buildings, etc.) (Kuvlevsky *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 (Kuvlevsky *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. 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. The landscape of the general Project area features a myriad of forest stands that would appear to provide suitable alternative habitat to any bird species displaced due to habitat alteration at the Project site.

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).

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.

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.

The following specific 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.
- Existing access roads will be used to the greatest extent possible.
- Use of lighting 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 will be avoided in habitats significant to bird species as identified through the Project avian surveys. These include wetlands, mature forests, and areas with large, hollow trees.
- Implement post-construction monitoring under direction from NSE and in consultation with CWS and NSDNR to monitor for significant mortality trends.

13.2.3 Bats

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. Potential effects 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).

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. Regardless of the specific cause, large numbers of bat fatalities have been reported at wind energy facilities, particularly along forested ridgetops, in the eastern United States (Kunz *et al.* 2007a). In Canada, bat fatalities outnumber bird fatalities by 2.4:1 (EC *et al.* 2012). Since bats are long-lived and have low reproductive rates, such mortalities can potentially contribute to precipitous population decline, and can increase the risk of local extinctions (Arnett *et al.* 2007).

Research suggests that migratory tree-roosting species suffer the highest fatalities at wind farms (Kunz *et al.* 2007a; Kuvlevsky *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. Increasing the turbine cut-in speed, the minimum wind speed at which the turbine blades are permitted to begin rotating, has been shown to greatly reduce bat fatality because bats are less active at these wind speeds (Arnett *et al.* 2011).

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).

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

- Existing access roads will be used to the greatest extent possible.
- Use of lighting on turbine hubs and blades will be limited to minimum levels while still meeting requirements of Transport Canada.

- Where possible, placement of Project infrastructure will be avoided in habitats significant to bat species. These include hibernacula, wetlands, and open bodies of water.
- Implement post-construction monitoring 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 (13.4 to 13.6) identify and evaluate the significance of residual effects for each phase of the Project on each VEC: SOCI, Avifauna, and Bats. Accidents and malfunctions are also analyzed. As most of the mitigation is the same for avifauna and bats, these VECs are considered together in order 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	• Removal or disruption of habitat. • Mortality.	• Avoid identified important habitat areas. • Minimize Project footprint. • Implementation of the EPP. • Restore habitat to the extent possible following construction. • Survey for mainland moose.	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable
Avifauna and Bats	• Removal or disruption of habitat. • Sensory disturbance. • Mortality. • Increased chance of collision from construction lighting.	• Avoid important habitat areas to the extent possible (wetlands, mature trees). • Minimize vegetation clearing. • Complete vegetation clearing outside of nesting season, to the extent possible. • Implementation of the EPP. • Limit site activities to designated workspaces. • Reduce or avoid construction lighting.	Scope: Local Duration: Short-term Frequency: Once Magnitude: Low	No residual effect anticipated	Not applicable
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	• Increased human activity on-site. • Mortality.	• Implementation of the EPP. • To the extent possible, plan operation and maintenance activities to avoid sensitive habitats and minimize time on-site.	Scope: Local Duration: Long-term Frequency: Intermittent Magnitude: Negligible	No residual effect anticipated	Not applicable
Avifauna and Bats	• Mortality from collision or barotrauma (bats). • Sensory disturbance. • Lighting (turbines and associated infrastructure).	• Implementation of the EPP. • To the extent possible, plan operation and maintenance activities to avoid sensitive habitats and minimize time on-site. • Avoid routine vegetation clearing during breeding and nesting season. • Lighting on administration building(s) and substation will be "on-demand" lighting. • Lighting on turbines will be minimized, strobe and approved by both Transport Canada and CWS.	Scope: Local Duration: Long-term Frequency: Continuous Magnitude: Low	It is expected that birds and bats will avoid the immediate area of the turbines (but not the broader Project Area), which will reduce the number of bird collisions. Bird and bat fatalities due to turbine collisions are not expected to be significant.	Low-Medium

Table 13.6: Environmental Effects Analysis – Decommissioning Phase

Environmental Component	Potential Effect	Mitigation Summary	Significance Criteria	Residual Effects	Significance of Residual Effect
Mammal SAR	• Increased activity on site. • Mortality.	• Avoidance of known critical habitat, where possible. • Limit access to existing roads only. • Limit time on site.	Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible	No residual effect anticipated	Not applicable
Birds and Bats	• Sensory disturbance.	• Limit access to existing roads only. • Limit time on site. • Avoid activities during breeding/nesting season, to the extent possible. • Restore habitat to the extent possible following decommissioning.	Scope: Local Duration: Short-term Frequency: Intermittent Magnitude: Negligible	No residual effect anticipated	Not applicable
Accidents and Malfunctions	• Accidental release. • Failure of erosion and sediment control measures.	• Implementation of the EPP, including the spill prevention plan and contingency plans.	Scope: Local Duration: Short-term Frequency: Once Magnitude: Negligible-Low	No residual effect anticipated	Not applicable

13.4 Follow-up Measures

As noted in Table 13.4 to 13.6, the Proponent recognizes the need to complete a pre-construction Mainland moose survey to determine the presence/absence of this SOCI. This survey will be completed in winter 2013.

A residual effect for avifauna and birds will be addressed in post-construction monitoring programs to assess the effects of the operation of the wind farm. The protocol for these programs is provided in Appendix H. Monitoring is scheduled to begin in 2014.

A MEKS has also been commissioned and will be completed in spring 2013 as an Addendum to this EA.

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 educating and training 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

Environmental Event	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; and • Signage to indicate potential falling ice.
Heavy snow	Damage to turbines.	• Turbine design equipped to shut down.
Lightning strike	Potential fire during operation. Damage to electrical systems.	• Turbine design equipped with built-in grounding system; and • Appropriate safety protocol.
Fire	Fire during construction due to materials and machinery	• Appropriate safety protocol; • Fire prevention plan; • Evacuation plan; and • 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. 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.

15.1 Activities Near the Project

The Project is located within a rural setting in Nova Scotia with limited commercial/industrial development in close proximity to the Project site. The nearest town is Windsor (7 km). The Windsor Water Treatment Centre is located approximately 1.45 km north from the nearest turbine. Commercial development within 5 km consists of a ski hill, an apple growing operation, and a meat shop. Additionally, the South Canoe Wind Project (34 turbines, 102 MW) has been proposed near the community of Vaughan, approximately 19 km from the Project.

Activities that could potentially interact cumulatively with the Project are evaluated in Table 15.1.

Table 15.1: Potential Interactions with the Project

Activity	Status	Location of Activity	Potential Cumulative Effect on Avifauna/Bats
South Canoe Wind Project	Future	Approximately 2,790 ha approximately 19 km from nearest Project site boundary.	Avifauna/bat fatality and habitat fragmentation.

15.2 Significance of Cumulative Effects

Avifauna and bat fatality has been identified as a residual effect of the Project. Evidence cited by Erickson *et al.* (2001), NAS (2007) and Manville (2009) in NWCC (2010), state that although only general estimates are available, the number of birds killed in wind developments is substantially lower, relative to estimated annual bird casualty rates from a variety of other anthropogenic factors including vehicles, buildings, and windows, power transmission lines, communication towers, toxic chemicals (including pesticides), and feral and domestic cats (NWCC 2010). Therefore, the incremental contribution of the Project to avifauna and bat mortality is unlikely to result in a population based cumulative effect.

The proposed Project will be located approximately 19 km northeast of the proposed South Canoe Wind Project site boundary. Since the Project footprint will be relatively small, the incremental contribution of the Project to habitat fragmentation is unlikely to result in population based cumulative effect.

Based on the discussion above, cumulative effects to avifauna and bats, is 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
EPP/Sediment and Erosion Control Plan	NSE
Watercourse Alteration Approval	NSE
Wetland Alteration Approval	NSE
Notification of Blasting (if required)	NSE
Special Move Permit	Service Nova Scotia
Access Permit	NSTIR
Access Road/Wood Removal Within Mill Lakes Protected Water Area	NSE
Work within Highway Right-of-Way	Nova Scotia Transportation and Infrastructure Renewal
Final design location and height of turbine	NRCan
Lighting design for navigational purposes	Transport 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 has been developed and will be communicated to all employees working on the Project.

The proposed capacity of the turbines will produce enough energy to power 2,000 households and will contribute to reaching Nova Scotia's renewable energy commitments.

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