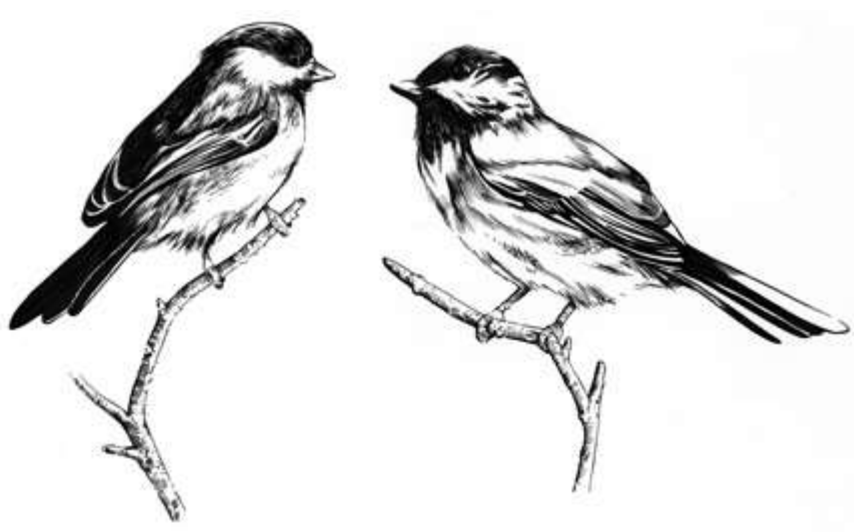
Appendix G

Breeding Bird Survey

LIMEROCK, NOVA SCOTIA WIND FARM

BREEDING BIRD SURVEY



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INTRODUCTION

Wind is one of the fastest growing renewable energy sources in the world. It offsets emissions from fossil fuel plants, and encourages a cleaner way of living. Various concerns have been raised on wind turbine effects on wildlife and the environment, particularly on avian and bat species (Canadian Wind Energy Association, 2008). With these concerns in mind, the Nova Scotia Environment Act states that an environmental assessment must be conducted prior to the construction of a wind farm. These types of assessments will cover various elements, such as; wildlife, ecology, botany, and geology.

This report focuses on the avian portion of an environmental study being executed on the Limerock wind project site in Pictou County, Nova Scotia. This assessment will provide information regarding population estimates of birds, and help to ensure the proposed turbines are not being built in bird migration routes. It will also ensure that there are no endangered or threatened species in the area, and that the Limerock location is not a common breeding site.

The avian study which was conducted used the area point count method to record species, and numbers of species found throughout the duration of the study. This avian study was conducted over a 52 week period. Area point counts are used to find population abundance as well as species composition within a specific area.

METHODS

The monitoring protocols established in this document were designed using information from two documents published by the Canadian Wildlife Service:

Environment Canada (2006) Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds.
Environment Canada (2006) Wind turbines and birds: A Guidance Document for Environmental Assessment.

On 22 April 2012, Wildlife Technicians began work at Limerock Wind Project, Pictou County, NS. Technicians set up an area point count for avian species in the area. This point count was part of an environmental assessment being conducted which will be used to determine the population estimate of avian species found in the area, and will also help to determine if four wind turbines will be erected at the Limerock location.

The survey locations were given to the technicians prior to the set-up of the point count. The coordinates for the three turbines are as follows (All coordinates are UTM zone 20T): Turbine 1 –0514460E 5043210N, Turbine 2 –0514033E 5043117N, Turbine 3 - 0513784E 5042872N, Turbine 4 – 0513895E 5042530E.

Using each of the survey locations as center points, 100 (m) was measured in each cardinal direction, north (0°), east (90°), south (180°) and west (270°). Using these new locations as a center points, four additional points were established 50 (m) away in each cardinal direction and marked with flagging tape. The area within these four points was the monitoring area for each turbine. A total of four points per turbine were established and monitored (Figure 1).

For the following 52 weeks, bird populations were monitored once a week, monitoring would begin 30 minutes before sunrise and would last for approximately 3 – 4 hours. Monitoring would not take place during rainy days, or days with high wind speeds as birds are not active during these types of weather conditions. A total of five minutes was spent monitoring at each point location. During the five minutes, any birds seen or heard within the monitoring location were recorded on tally sheets. Recording would include species of bird, number of birds, and location.

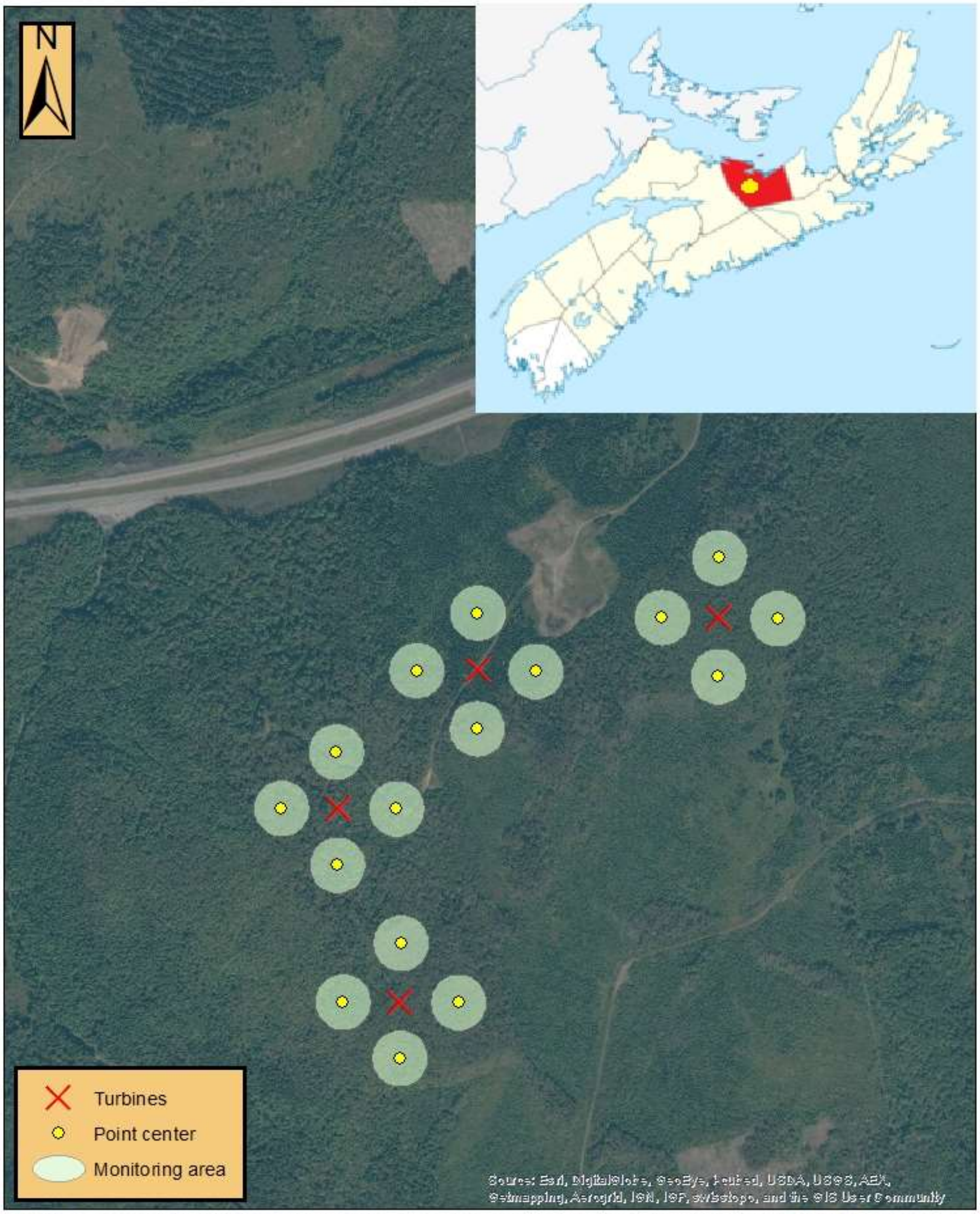

Figure 1. Locations of purposed turbines, as well as monitoring points found throughout the Limerock wind farm, Pictou County, NS. Map drawn by Black Bird Environmental Consulting, 2013.

RESULTS

Throughout the study of the Limerock Wind Project location, a total of 39 different bird species were recorded. Within these 39 species, four were listed as below S5 (Table 1). The Killdeer, the Eastern Wood Pewee, the boreal chickadee and the Wilsons snipe are listed sub-nationally as S3S4B; all other recorded species are listed by the ACCDC as S5. For a complete list of species and their Sub-national ranks (S-Ranks) found through the duration of the study, refer to Table 2. (Atlantic Canada Conservation Data Centre, 2010).

Table 1. Uncommon species sub-national and global ranks as defined by the Atlantic Canada Conservation Data Centre found throughout the Limerock wind project location, Pictou County, Nova Scotia, data collected by Black Bird Environmental Consulting, April - March, 2012-13.

UNCOMMON SPECIES			
Common Name	**Scientific Name**	**Global Rank**	**Sub-National Ranks**
Killdeer	*Charadrius vociferus*	G5	S3S4B
Eastern Wood Pewee	*Contopus virens*	G5	S3S4B
Boreal Chickadee	*Poecile hudsonica*	G5	S3
Wilson's Snipe	*Gallinago delicata*	G5	S3S4B

*** S3B** - Uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences), Breeding (Migratory species).

*** S4B** - Usually widespread, fairly common, and apparently secure with many occurrences, but of longer-term concern (100+ occurrences), Breeding (Migratory species).

*** G5** - Very common, secure under present conditions.

Table 2. Complete list of bird species observed during the 52 week study of the Limerock wind project location, Pictou County, Nova Scotia, data collected by Black Bird Environmental Consulting, April - March 2012-2013.

COMPLETE SPECIES LIST			
Common Name	**Scientific Name**	**Global Ranks**	**Sub-National Ranks**
American Robin	*Turdus migratorius*	G5	S5B*
Blue Jay	*Cyanocitta cristata*	G5	S5
Common Grackle	*Quiscalus quiscula*	G5	S5B
Mourning Dove	*Zenaida macroura*	G5	S5
Herring Gull	*Larus argentatus*	G5	S4S5
Common Raven	*Corvus corax*	G5	S5
American crow	*Corvus brachyrhynchos*	G5	S5
European Starling	*Sturnus vulgaris*	G5	SNA*
white-throated Sparrow	*Zonotrichia albicollis*	G5	S5B
Song Sparrow	*Melospiza melodia*	G5	S5B
Belted Kingfisher	*Megaceryle alcyon*	G5	S5B
Killdeer	*Charadrius vociferus*	G5	S3S4B
Pileated Woodpecker	*Dryocopus pileatus*	G5	S5
Downy Woodpecker	*Picoides pubescens*	G5	S5
Hairy Woodpecker	*Picoides villosus*	G5	S5
Northern Flicker	*Colaptes auratus*	G5	S5B
Yellow-bellied Sapsucker	*phyrapicus varius*	G5	S4S5B
Red-breasted Nuthatch	*Sitta canadensis*	G5	S4S5
Black-throated Green Warbler	*Dendroica virens*	G5	S4S5B
Black-and-White Warbler	*Mniotilta varia*	G5	S4S5B
Eastern Wood Pewee	*Contopus virens*	G5	S3S4B
Ovenbird	*Seiurus aurocapillus*	G5	S5B
Winter Wren	*Troglodytes troglodytes*	G5	S5B

*** S3B** - Uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences), Breeding (Migratory species).

*** S4B** - Usually widespread, fairly common, and apparently secure with many occurrences, but of longer-term concern (100+ occurrences), Breeding (Migratory species).

*** G5 -** Very common, secure under present conditions.

*** NA -** Not Applicable: A conservation status is not applicable because the species is either: a) exotic, b) not definitively known to occur in the province or c) a hybrid not considered to be conservation significance.

Table 3. Complete list of bird species observed during the 52 week study of the Limerock wind project location, Pictou County, Nova Scotia, data collected by Black Bird Environmental Consulting, April - March 2012-2013.

COMPLETE SPECIES LIST (CONTINUED)			
Common Name	**Scientific Name**	**Global Ranks**	**Sub-National Ranks**
Black-capped Chickadee	*Poecile atricapilla*	G5	S5
Alder Flycatcher	*Empidonax alnorum*	G5	S5B
Dark-eyed Junco	*Junco hyemalis*	G5	S4S5
Red-eyed Vireo	*Vireo olivaceus*	G5	S5B
Common Yellowthroat	*Geothlypis trichas*	G5	S5B
American Redstart	*Setophaga ruticilla*	G5	S5B
Northern Parula	*Parula americana*	G5	S5B
Ruffed Grouse	*Bonasa umbellus*	G5	S4S5B
Ring-necked Pheasant	*Phasianus colchicus*	G5	SNA
Wilson's Snipe	*Gallinago delicata*	G5	S3S4B
Bald eagle	*Haliaeetus leucocephalus*	G5	S4
American Goldfinch	*Carduelis tristis*	G5	S5
Purple Finch	*Carpodacus purpureus*	G5	S4S5
Swainson's Thrush	*Catharus ustulatus*	G5	S4S5
Yellow-rumped Warbler	*Dendroica coronata*	G5	S5
White-breasted Nuthatch	*Sitta carolinensis*	G5	S4

*** S3B** - Uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences), Breeding (Migratory species).

*** S4B** - Usually widespread, fairly common, and apparently secure with many occurrences, but of longer-term concern (100+ occurrences), Breeding (Migratory species).

*** G5** - Very common, secure under present conditions.

*** NA** - Not Applicable: A conservation status is not applicable because the species is either: a) exotic, b) not definitively known to occur in the province or c) a hybrid not considered to be conservation significance.

Figure 2 shows the population trends throughout the duration of the study. The highest population count was found during the month of May with approximately 470 birds recorded. The population then drops slightly each month, with the largest drop in population from November at approximately 200 birds, to December at approximately 45 birds. The lowest population count was found during the month of March with approximately 10 birds recorded.

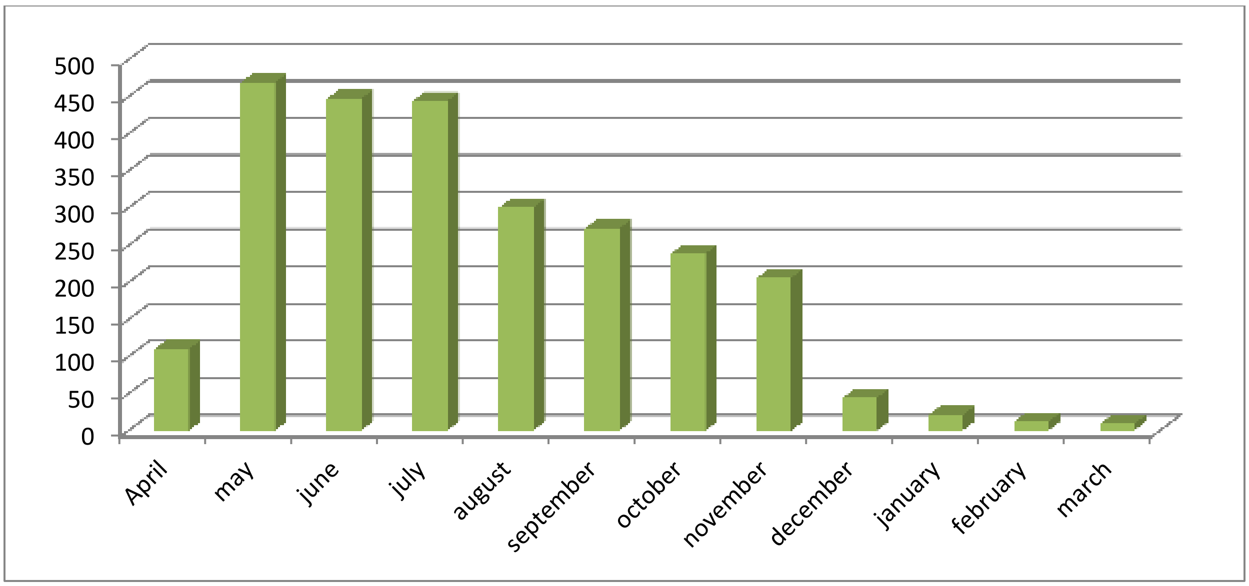

Figure 2. Total bird counts found during the study of the 52 week Limerock wind project location, Pictou County, Nova Scotia, data collected by Black Bird Environmental Consulting, April – March 2012-2013.

Four different habitat types were observed within the Limerock study area; immature softwood, immature hardwood, over mature softwood and mature softwood. Total bird count percentages were highest in the immature softwood habitat type with approximately 40% of the total count found within this habitat. The lowest percentage of the bird count was found within the over mature softwood habitat with approximately 16% of the total birds recorded. The immature hardwood habitat contained approximately 20% of the population recorded, where the mature softwood habitat contained approximately 20%.

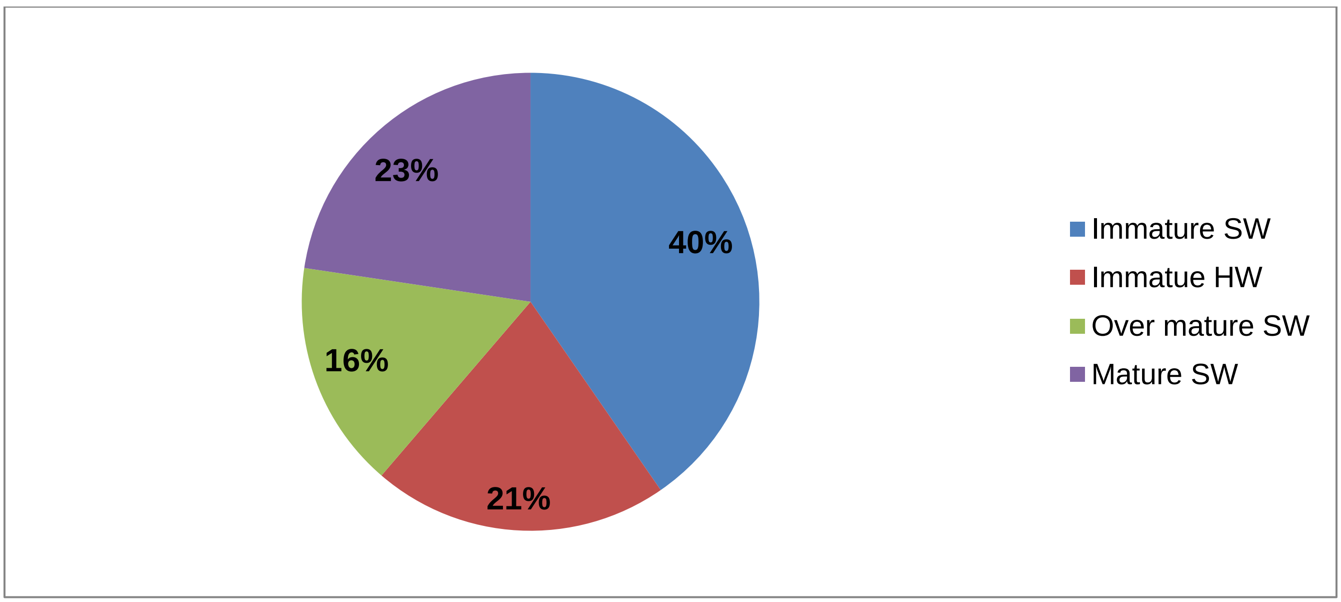

Figure 3. Percentage of total birds recorded throughout four habitat types found within the Limerock wind project location, Pictou County, Nova Scotia, data collected by Black Bird Environmental Consulting, April - March, 2012-2013.

* HW- Hardwood
* SW – Softwood

DISCUSSION

SPECIES OF CONCERN

During the study at the Limerock wind farm location, 39 avian species were observed. With the exception of four species, all other species had an S-Rank of S5 which is defined by the ACCDC as: widespread, abundant, and secure, under present conditions. This is the highest possible S-Rank so these species are typically less susceptible to having a small development impact the population. The Eastern Wood Pewee (*Contopus virens*), the Killdeer (*Charadrius vociferous*), boreal chickadee (*Poecile hudsonicus*) and the Wilson's snipe (*Gallinago delicate*) share an S-Rank of S3S4B. The ACCDC defines S4 as: usually widespread**,** fairly common, and apparently secure with many occurrences, but of longer-term concern (100+ occurrences). S3 as: Uncommon, or found only in a restricted range, even if abundant at some locations (21 to 100 occurrences). The eastern wood pewee breeds in about every type of wooded habitat, and will use both deciduous and coniferous forest. It is often associated with forest clearings and edges all of which are present throughout this study area. The killdeer can be found in open grasslands, wetlands, fields, croplands and pastures. The killdeer recorded in this study area was found near a grassy meadow which bordered on a large rock quarry. The boreal chickadee is usually found deep in spruce/fir forests away from human disturbance. These birds live off the insects and larva typically found in softwood trees. They are able to live in the spruce/fir forests all year round here in Nova Scotia as they are the type of bird that stores food away in the fall so it has food for the winter. It is not uncommon to see them at a bird feeder in the winter if food does become scares throughout the long winter months. The boreal chickadees were recorded in both the immature and mature softwood habitat types. The Wilson's snipe is typically found in wet marshy areas, they will forage in wet meadows, fields, and marshy areas. Although there were not an abundance of wet areas throughout this study area, this bird may have just been passing through. The snipe was only recorded once throughout the entire study. Although these species are not at a critical level of risk, pressure on this species may push these ranks down and result in further diminishing these populations.

POPULATION TRENDS

The migration period of birds found throughout Atlantic Canada can extend over several months; however, population increases dramatically during May and June, this coincides with the breeding season of most native species. It is extremely difficult to predict the exact migration times of species. Many factors such as weather conditions or other environmental factors may push migration times ahead or behind slightly. There was a dramatic increase in population during the months of May and June, which are the core migration periods, as well as the breeding season of the majority of species found within Nova Scotia. This tells us that there is a breeding population of various species within the Greenfield study area. There was also a slow drop in population each month as the temperature dropped, and the winter weather moved in. This is typical behavior for birds at this time of year, as the colder weather moves in; the migratory species finish breeding and start migrating south for the winter months. For a complete list of species total counts, refer to appendix 1.

HABITAT TYPES

The Limerock Wind Project location consists of four habitat types: immature hardwood which consists of red maple (*Acer rubrum*), trembling aspen (*Populous Tremuloides*), large-tooth aspen (*Populous grandidentata*), and white birch (*Betula papyrifera*); immature softwood which consists of red spruce (*Picea rubens*), white spruce (*Picea glauca*), Norway spruce (*Picea abies*) and balsam fir (*Abieas balsemea*); mature softwood which consists of red spruce (*Picea rubens*), white spruce (*Picea glauca*), Norway spruce (*Picea abies*) and balsam fir (*Abieas balsemea*); and, overmature softwood which consists of red spruce (*Picea rubens*), white spruce (*Picea glauca*), and balsam fir (*Abieas balsemea*). The majority of the immature softwood habitat has plantations that had been pre-commercially thinned in the previous years.

The majority of birds found throughout the four habitat types were found in the immature softwood habitat type at approximately 40%. This type of habitat attracts a variety of bird species with an abundant food source as well as adequate cover. Immature softwood stands are home to millions of species of insects, the most common food source of bird species found in Nova Scotia. The thick canopy of the softwood trees provides excellent cover for birds both for avoiding prey, as well as building nests.

The least populated habitat type found within this study was the overmature habitat type at approximately 16%. Some cavity nesting species as well as some woodpecker species thrive in overmature habitat types, but the majority of woodland species seek out the dense canopy of immature to mature softwood trees for cover. The large open canopy of overmature hardwood forests does not provide the cover or protection required for most woodland species.

CONCLUSION

If the wind turbine project continues as planned, a post monitoring period will commence immediately after construction. There will then be a correlation between the pre and post population assessments, which will help to determine whether there was an effect on population numbers in the study area and any necessary mitigation measure that may be required of the development.

After concluding this 52 week pre-assessment, it was found that there were three species of special concern found in the area. The eastern wood pewee, Wilson's snipe and the killdeer all have a stable population (100+ occurrences) throughout NS. This stability in population numbers indicates that there is no need for special precautions to be set into place. However, during the post-assessment treatment, technicians should pay extra attention while monitoring for these species. The access roads and turbine areas will not impact a great amount of actual disturbance, and should not be cleared during the months of May – August to avoid unnecessary impacts to the local avian population

The Limerock wind farm location is an adequate representation of a heavily harvested Acadian forest found throughout Nova Scotia. There are no habitat types or bird species of a unique nature found throughout this study area. There are no threatened or endangered species found throughout the area. Based on the increased bird counts during the breeding months, there are most likely breeding populations of birds found within the Limerock area, however, as stated above, clearing and construction should not take place during breeding season, and the habitat types are not unique; therefore if birds need to relocate nesting grounds, there are suitable habitat types in close proximity.

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APPENDICES

Appendix 1. List of species and total counts found throughout the Limerock wind farm study area, Pictou County, NS. Drawn by Black Bird Environmental Consulting, April 2012-March 2013.

TOTAL COUNT BY SPECIES			
Species	**Total Count**	**Species**	**Total Count**
American crow	284	Hairy Woodpecker	29
Black-capped Chickadee	239	Eastern Wood Pewee	19
Blue Jay	208	Song Sparrow	19
white-throated Sparrow	161	Yellow-rumped Warbler	19
American Goldfinch	158	Magnolia Warbler	17
American Robin	145	Boreal Chickadee	14
Ovenbird	126	Northern Flicker	14
Swainson's Thrush	116	Grat Jay	11
Black-throated Green Warbler	114	Yellow-bellied Sapsucker	6
Dark-eyed Junco	106	Black-throated Blue Warbler	5
Herring Gull	83	American Redstart	4
Mourning Dove	71	Common Grackle	4
Northern Parula	69	Downy Woodpecker	4
Ruffed Grouse	67	Pileated Woodpecker	4
Winter Wren	53	Yellow Bellied Flycatcher	4
Red-eyed Vireo	51	American Woodcock	2
Common Yellowthroat	45	Bald eagle	2
Alder Flycatcher	40	Ring-necked Pheasant	2
Black-and-White Warbler	40	Ruby crowned kinglet	2
Golden crowned kinglet	38	Belted Kingfisher	1
Killdeer	35	Common Raven	1
Red-breasted Nuthatch	35	White-breasted Nuthatch	1
European Starling	33	Wilson's Snipe	1

Appendix H

Archaeological Resource Impact Assessment

Limerock Wind Project

Archaeological Resource Impact Assessment

Heritage Research Permit A2013NS087

Davis MacIntyre & Associates Limited
109 John Stewart Drive, Dartmouth, NS B2W 4J7

Limerock Wind Project

Archaeological Resource Impact Assessment

Heritage Research Permit A2013NS087

Principal Investigator: April MacIntyre
Report Compiled by: April MacIntyre & Stephen Davis

Submitted to:
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-and-

Coordinator, Special Places
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Cover Image: One of four field clearing stone piles located near the east end of the development area.

Executive Summary

Davis MacIntyre & Associates Limited conducted an archaeological resource impact assessment of the proposed Limerock Wind Project in Pictou County. The purpose of the assessment was to determine the potential for archaeological resources within the study area and to provide recommendations for mitigation, if necessary. The assessment included a historic background study and reconnaissance. The study concluded that, while the property had been granted as early as the late 18th century, there was likely no settlement in this area until the early 19th century when Scottish immigrants took up the lands. Crown land grant records indicate that these lands were escheated from the original grantees and turned over to Scottish immigrants in 1813 and 1815. Historic maps from the third and fourth quarters of the 19th century show that there were settlers in the area at that time and that many of them had erected houses on their lands. The reconnaissance revealed that there was, indeed, historic agricultural activity in the area, particularly along Salem Road and an old unnamed road to the west which is now used for ATV traffic. However, the only remnants of that activity that were encountered were field clearing stone piles which are not considered to be archaeologically significant. It is possible that the associated buildings lie outside the study area or were impacted by 20th century clear cutting in this area. Other stone piles were located along the access road between turbines #1 and #2 but these appear to be related to more recent endeavors, possibly 20th century silviculture and are not considered archaeologically significant. Likewise, recent activity was encountered near turbine #3 which is considered insignificant. Finally, archaeologists were alerted to the presence of historic foundation outside the study area near the far northwestern end of the access road. It is believed that this may relate to early pioneer settlement and is, therefore, archaeologically significant. However, it is not expected to be impacted by construction.

No active mitigation is recommended for the development area at this time. However, in the event that additional archaeological resources are encountered during ground disturbance activities, it is required that all activity cease and the Coordinator of Special Places (902-424-6475) be contacted immediately. In the event that development plans change so that areas not assessed during this investigation are to be impacted, it is recommended that those areas be subjected to an archaeological assessment.

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1.0 Introduction

Davis MacIntyre & Associates Limited was contracted by RMS Energy to conduct an archaeological resource impact assessment of a proposed wind project near Limerock, Pictou County. The purpose of the assessment was to determine the potential for archaeological resources within the impact area, and to provide recommendations for further mitigation if necessary.

The assessment was conducted under Category C Heritage Research Permit A2013NS087(Appendix A). This report conforms to the standards of the Nova Scotia Department of Communities, Culture and Heritage and the Heritage Research Permit requirements as per the Special Places Protection Act (*R.S., c. 438, s. 1.).*

2.0 Study Area

The study area is located 2.5 kms east southeast of the center of Limerock in Pictou County. RMS Energy proposes to construct a 4.8 to 4.99 MW wind farm which will include three turbines and necessary access roads. The foundation excavation for each turbine will be approximately 2 meters deep and 15 meters in diameter. Access roads will be 10 meters wide. A portion of the access road will follow an existing road to the extent practical and new roads will be required to link the turbines (Figure 2.0-1).

Limerock is located in the Pictou Rivers sub-Unit of the Pictou Valleys theme region (Figure 2.0-2). It lies within the Pictou coalfield, a late Carboniferous feature that underlies an area approximately 5 kms by 16 kms beneath New Glasgow, Stellarton, and Trenton. Part of the East River is a fossil valley. The Pictou River sub-Unit falls within three tertiary watersheds draining the East River, Middle River and West River into Pictou Harbour. There are extensive floodplains along the East River. Soils in the region are derived from shales and sandstones and in the Pictou Rivers sub-Unit soils are predominantly well-drained gravelly clay loams. White Spruce and Balsam Fir have established on old fields and pastures while Sugar Maple, Yellow Birch, American Beech, Red Maple and aspen grow on slopes. The West, Middle, and East Rivers support significant salmon stocks.[1]

[1] Davis and Browne, 1996: 140-141.

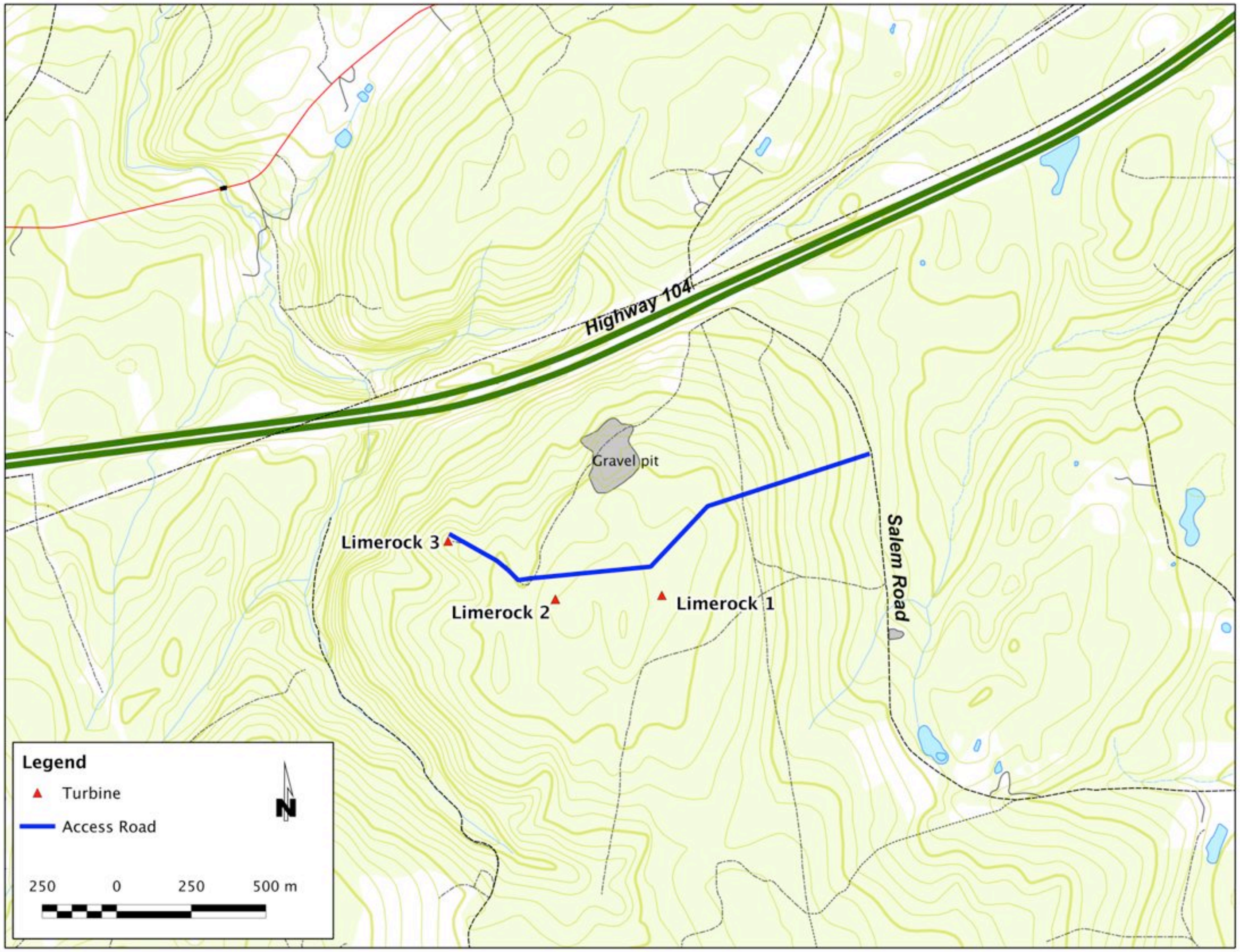

Figure 2.0-1: Map of the proposed wind project development.

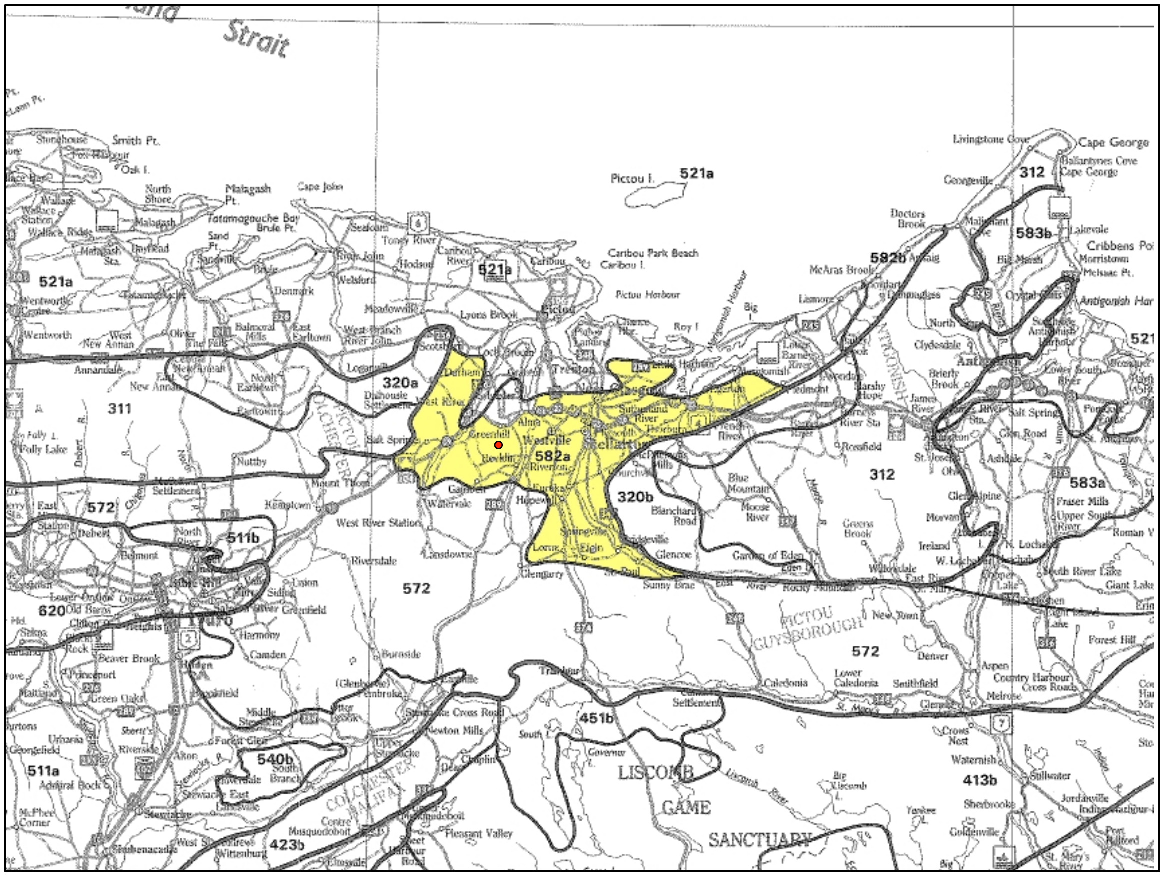

Figure 2.0-2: Natural Theme Regions of Nova Scotia, showing region #582a (highlighted in yellow) – Pictou Valleys, Pictou Rivers sub-unit.[2] The approximate location of the study area is indicated by a red ellipse.

3.0 Methodology

A historic background study was conducted by Davis MacIntyre & Associates Limited in October 2013. Historical maps and manuscripts and published literature were consulted as well as previous archaeological assessments in the general vicinity. The Maritime Archaeological Resource Inventory, a database of known archaeological resources in the Maritime region, was searched to understand prior archaeological research and known archaeological resources neighboring the study area. Finally, a field reconnaissance was conducted in order to further evaluate the potential for archaeological resources.

[2] Adapted from Davis and Browne, 1996.

3.1 Maritime Archaeological Resource Inventory

The Maritime Archaeological Resource Inventory was consulted in order to determine if known archaeological sites or resources exist within or near the study area. The closest known site to the study area is located approximately 1.3 kilometers from the study area. Two other sites have been reported within a 2.5 km radius of the study area. All three sites represent 19th century Scottish settlement. No sites have been reported directly within the study area. However, the area has not likely been subjected to a previous archaeological assessment and sites may well exist in or near the proposed project footprint.

3.2 Historic Background

3.2.1 The Precontact Period

The history of human occupation in Nova Scotia has been traced back approximately 11,000 years ago, to the Palaeo-Indian period or *Sa'qewe'k L'nu'k* (11,000 – 9,000 years BP). The only significant archaeological evidence of Palaeo-Indian settlement in the province exists at Debert/Belmont in Colchester County.

The *Saqiwe'k Lnu'k* period was followed by the *Mu Awsami Kejikawe'k L'nu'k* (Archaic period) (9,000 – 2,500 years BP), which included several traditions of subsistence strategy. The Maritime Archaic people exploited mainly marine resources while the Shield Archaic concentrated on interior resources such as caribou and salmon. The Laurentian Archaic is generally considered to be a more diverse hunting and gathering population.

The Archaic period was succeeded by the Woodland/Ceramic period or *Kejikawek L'nu'k* (2,500 – 500 years BP). Much of the Archaic way of subsistence remained although it was during this period that the first exploitation of marine molluscs is seen in the archaeological record. It was also during this time that ceramic technology was first introduced.

The Woodland period ended with the arrival of Europeans and the beginning of recorded history. The initial phase of contact between First Nations people and Europeans, known as the Protohistoric period, was met with various alliances particularly between the Mi'kmaq and French.

The Mi'kmaq inhabited the territory known as *Mi'kma'ki* or *Megumaage*, which included all of Nova Scotia including Cape Breton, Prince Edward Island, New Brunswick (north of the Saint John River), the Gaspé region of Quebec, part of Maine and southwestern Newfoundland (Figure 3.2-1). Antigonish and Pictou Counties were known to the Mi'kmaq as *Eskikewa'kik* or "skin-dressers' territory".[3]

[3] Confederacy of Mainland Mi'kmaq, 2007:11.

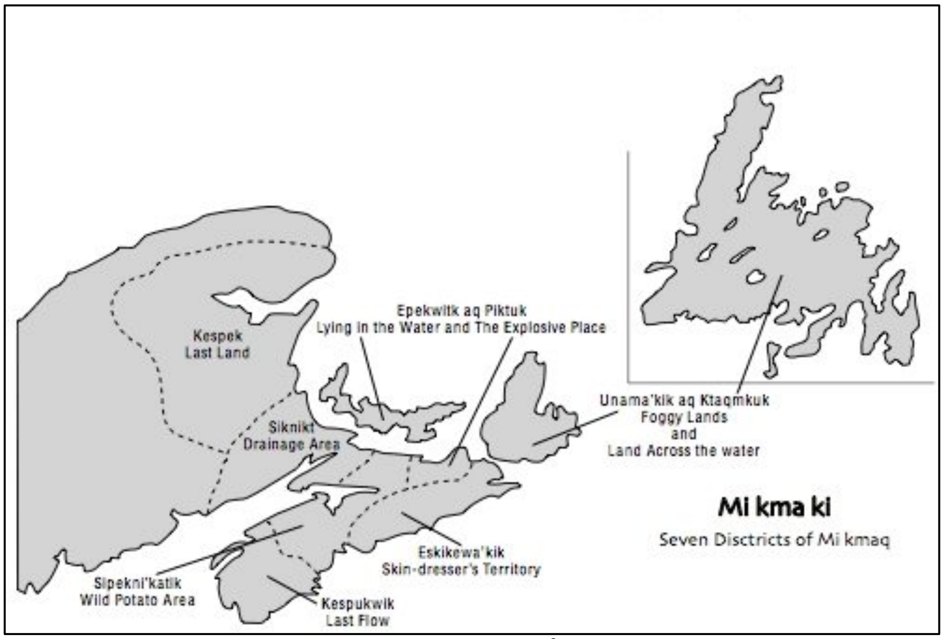

Figure 1.2-1: Map of the Mi'kmaki territories.[4]

The Mi'kmaq had encampments on the east and west banks of the East River of Pictou. On a point a little lower down the river was another burial ground where a large iron cross about 10 feet tall stood until well into the 18th century. This area is now known as Indian Cross Point but was known to the Mi'kmaq as *Soonunagrade* or rotting place. In the late 19th century, the graves could still be seen, marked by rows of flat stones which originally covered the graves. In the late 19th century, some of the graves here could be found eroding out of the bank.[5]

The Mi'kmaq had, for some time, been at war with an Abenaki tribe out of Maine and New Hampshire. In around 1760, it is said that at Little Harbour, two Abenaki brothers had built two blockhouses "constructed of logs, raised up around a vault first dug in the ground. The buildings were covered over, had each a heavy door, and were quite a safe fortification in Indian warfare. At the mouth of Barney's River, near the site of the burying ground, the Micmac [sic] were entrenched in a similar fort."[6] The Mi'kmaq were attacked by the Abenaki at Little Harbour and many were killed, their bodies set afire. The Mi'kmaq quickly retaliated and attacked one of the blockhouses at Little Harbour, sending out large parties from Merigomish and burning one of the Abenaki fortifications.[7]

4 Confederacy of Mainland Mi'kmaq, 2007:11.
5 Patterson 1877:27-28.
6 Meacham, 1879:5.
7 Meacham, 1879:5-6.

3.2.2 European Settlement

The first recorded mentions of Pictou are found in the early French voyages of the 17th century when Nicholas Denys described the area in his *The Description and Natural History of the Coasts of North America* (1672). Although the French inhabited the territory known as Acadia for about a century and a half, they left little documentation or evidence of their settlement in Pictou County. The only evidence that exists comes from what the English settlers found upon their later arrival in the county. The largest French settlement appears to have been on Merigomish Island where the remains of several dwellings were found. There were other smaller settlements at the head of French River, at Little Harbour, and at Caribou. The French appear to have been engaged principally in the fishery so the settlements were based along the shore and on the islands, although small settlements have also been found further inland on the mainland where the French were engaged in lumbering for supply to the garrison at Louisburg.[8]

The French had a small settlement at the upper part of Little Harbour where they were engaged in fishing. Remains of dwellings have been found here as well as in many places along the shores of Pictou Harbour. Merigomish was the largest of the French settlements in the county, however.

The English and French were at war for over 150 years over the ownership and occupation of Acadia (Nova Scotia, New Brunswick, PEI and part of Gaspe). In 1763, peace was drawn and the English took control of the colony. French Acadians were expelled from the colony in the 1750s and beginning in the 1760s, many New Englanders took up the lands recently vacated by the Acadians.

New Englanders first settled Pictou in 1765. On October 31 of that year, a grant of 200,000 acres was given which was known as the Philadelphia Grant.[9] The grant encompassed the greater portion of the township of Pictou as well as a large portion of Colchester County including part of River John and Brule Point, a large part of New Annan, all of Earltown and Kemptown, and a considerable portion of Stewiacke. The grant was escheated in 1784.[10]

In May 1767, the agents dispatched a ship, the *Hope*, from Philadelphia to settle the Grant. Among the passengers were twelve heads of families, about 20 children, and one convict servant. The town was laid out on a point in Pictou Harbour and the grantees were given a ½ acre town lot as well as a farm lot behind the town and extending into the interior.[11] The ship *Hector*, out of Scotland, arrived in 1773. Emigrants were promised free passage, a farm lot and a year's provisions. Agent John Ross convinced 33 families and 25 unmarried men to embark. The immigrants settled on the lands around the East, West and Middle Rivers of Pictou on lands previously escheated from Colonel Alexander McNutt. However, a grant was never officially made to them until August 1783. It

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[8] Patterson 1877:24-40.
[9] Patterson 1877:49.
[10] PANS RG 20 Series C, Book 7, page 35.
[11] Patterson 1877:49-61.

contained the names of 44 persons, some of who had arrived later.[12] On March 22, 1813 Andrew MacKay and John MacLean Jr. were granted 100 and 390 acres, respectively.[13] Between 1815 and 1818, much of the original Philadelphia grant was turned over to settlers from Dumfrieshire, Scotland.[14] Among them were John Stevenson and James Haggart who, along with several others, were granted a total of 22,882 acres of land which were originally part of the Philadelphia grant.[15] It is these grants on which the wind project will be developed.

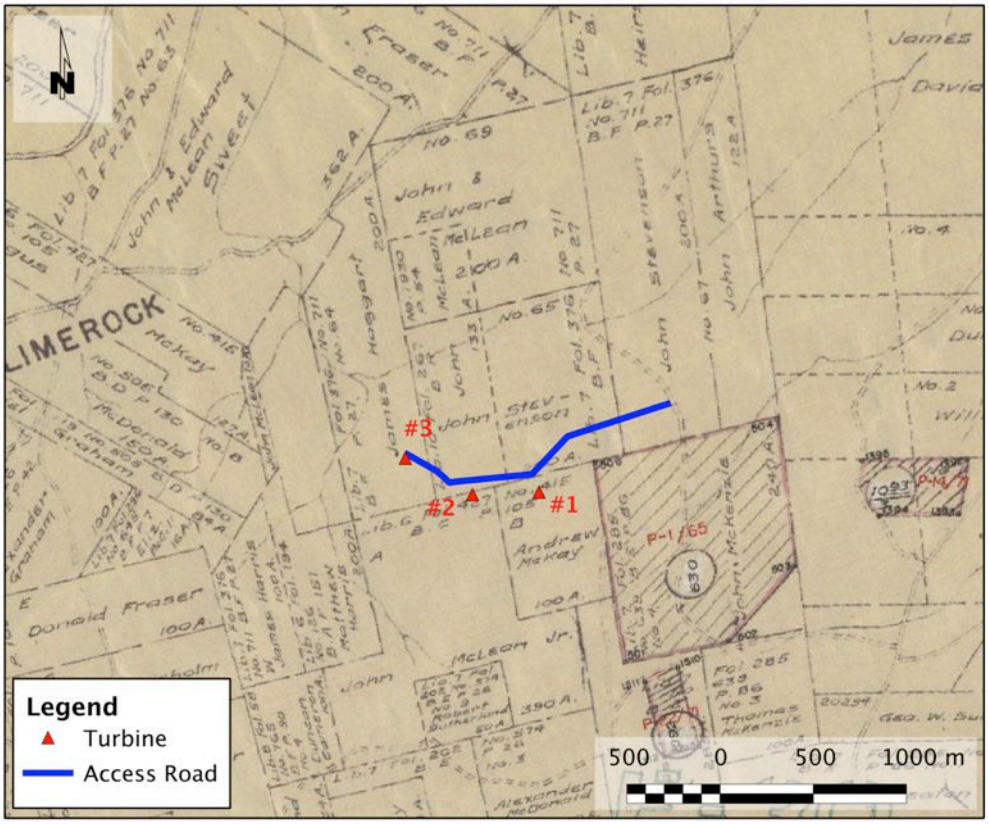

Figure 3.2-2: Georeferenced map of original land grants in Pictou from the Crown with the proposed development overlaid.[16]

Ambrose F. Church's map of Pictou County in 1867 indicates that there was settlement immediately near the study area. In fact, an exercise in georeferencing shows that turbine #1 lies very near the location of the 19th century residence of one D. Curry and that J. Hart was settled approximately 300 meters to the northeast (Figure 3.2-3). Near the east end of the proposed access road, just north of it, were the residences of A. McKay and M. Arthur Sr.

[12] Patterson 1877:79-91.
[13] Crown Land Grants, Book C, page 105.
[14] Watt, 1992:10.
[15] Crown Land Grants, Book F, page 27.
[16] Nova Scotia Department of Lands and Forests, 2009.

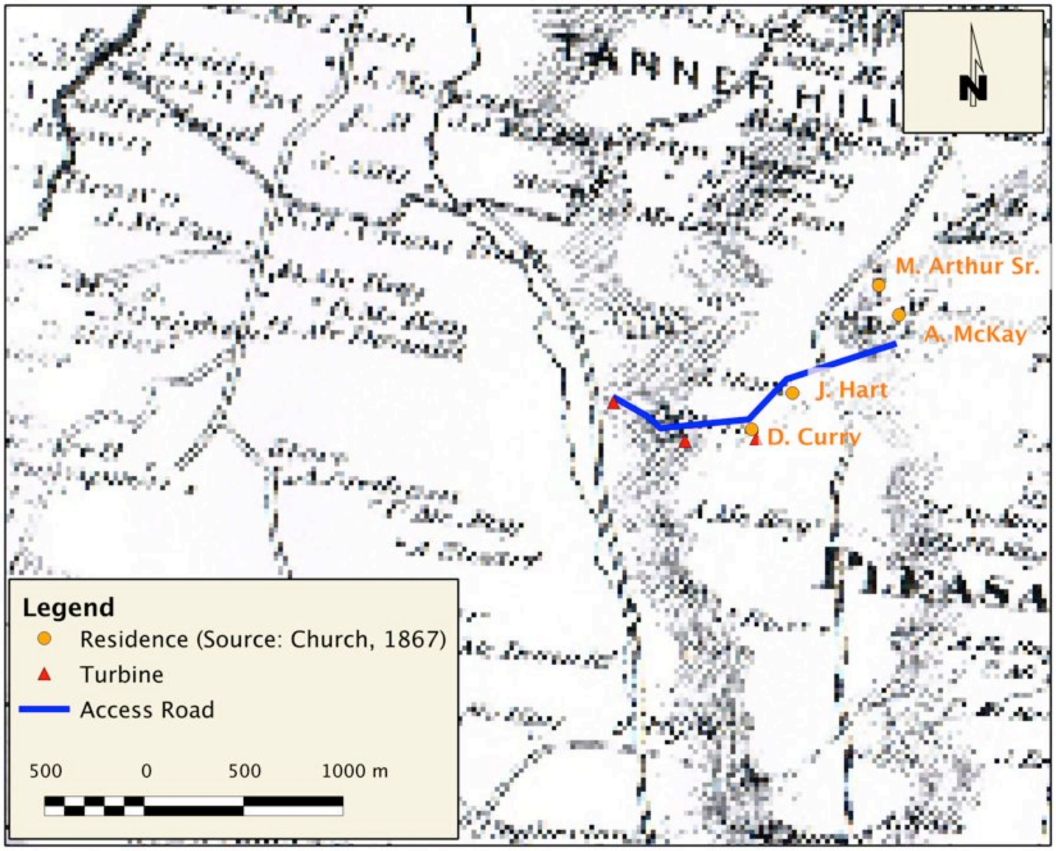

Figure 3.2-3: Georeferenced part of Ambrose F. Church's map of Pictou County in 1867 with the proposed development overlaid. The locations of nearby residences have been highlighted.

Meacham's atlas of Pictou County, published in 1879, shows that one Alexander MacKay, possibly a descendent of Andrew MacKay, lived on the land on which much of the development is planned. The east end of the access road runs along the property line of three other parcels. MacKay's house appears to be located approximately 150 meters east of the proposed turbine #1 (Figure 3.2-4).

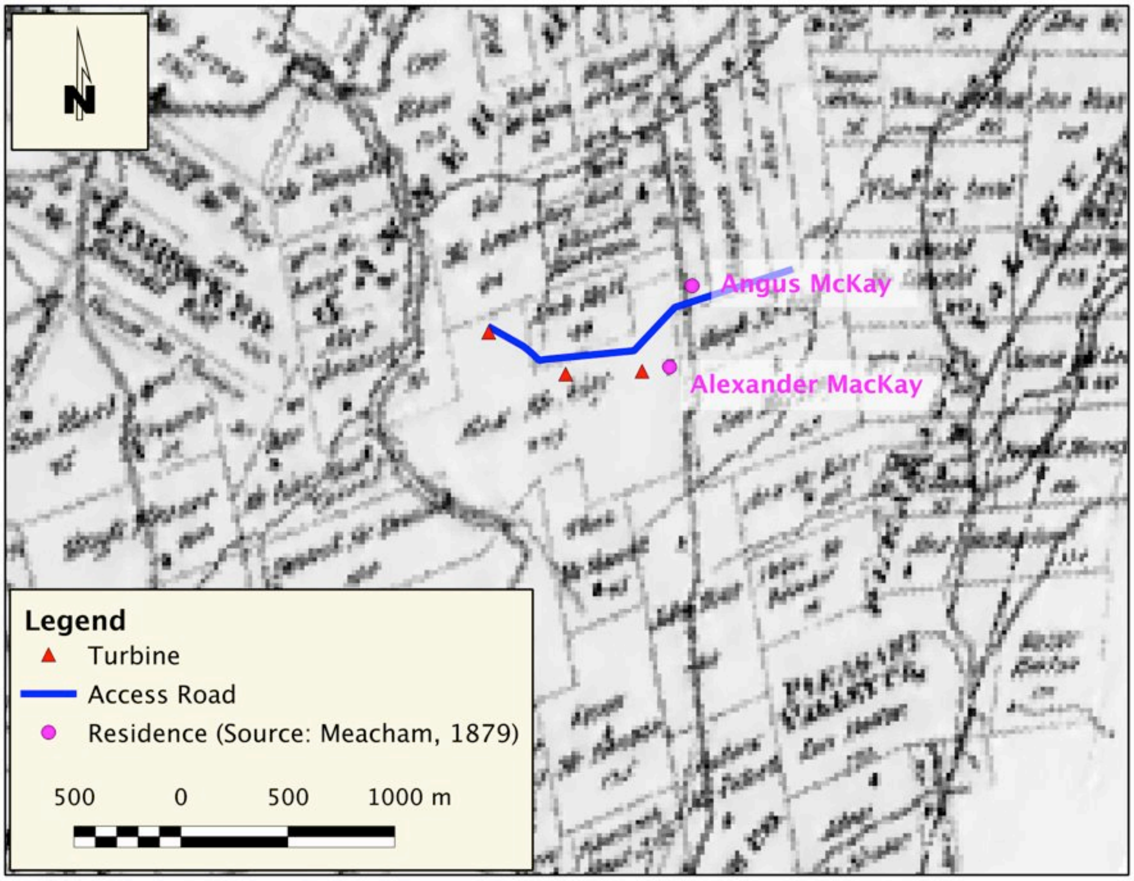

Figure 3.2-4: Part of Meacham's atlas of Pictou County in 1879 with the proposed development overlaid. Nearby residences are highlighted.

The 1902 GSC map shows that the area was no longer inhabited and the focus of settlement was along the main roads to the east and west of the proposed turbines, and to the north at Tanner Hill (Figure 3.2-5).

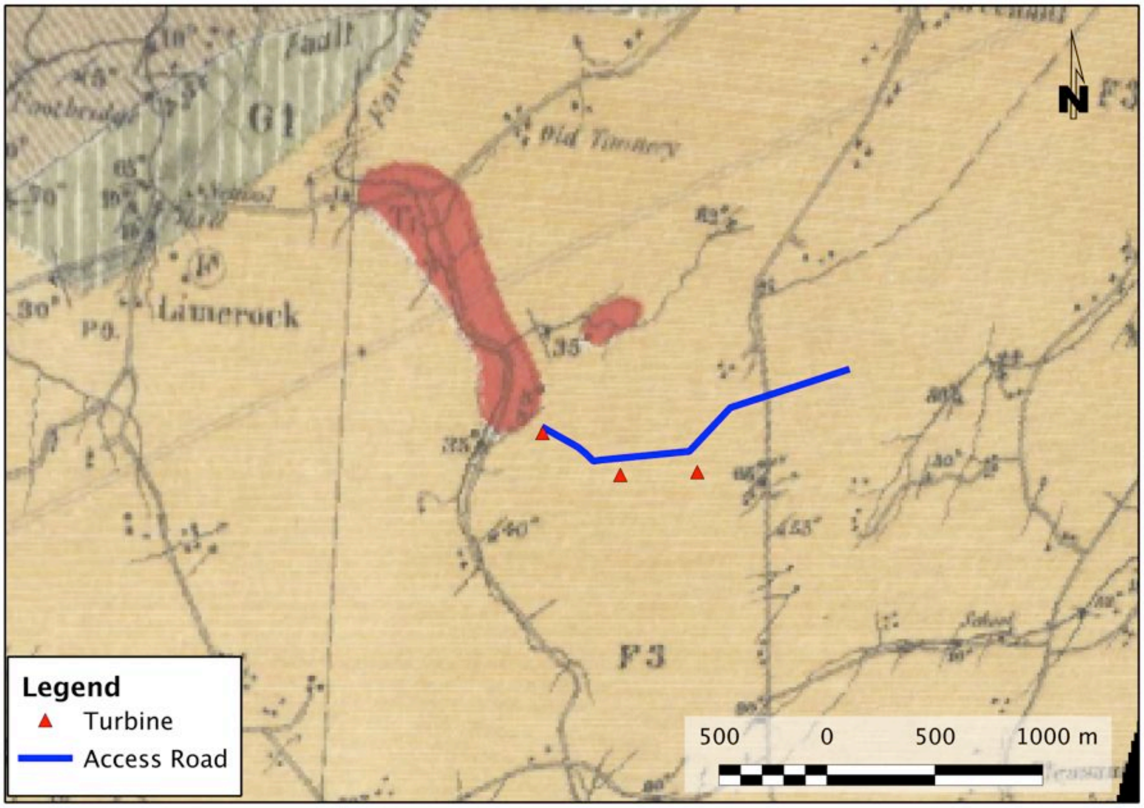

Figure 3.2-2: Georeferenced part of the Geological Survey of Canada map of the Westville area, Pictou and Colchester Counties, in 1902 with the proposed development overlaid.

3.3 Field Reconnaissance

An archaeological field reconnaissance was conducted on 7 October 2013. The reconnaissance was facilitated by a hand-held GPS and GPS data supplied by the proponent. Detailed field notes and photographs were taken. A 50-meter-wide corridor along the 1.5 kms of proposed access road was surveyed, as well as the three proposed turbine sites. A previously-identified foundation to the east of turbine #3 was also investigated to determine if any associated heritage resources may exist within the 50-meter corridor for the access road. Several areas of cultural activity were noted during the reconnaissance. The GPS coordinates of those activity areas are listed in Table 3.3-1.

On the west side of Salem Road, along the proposed corridor for the access road, are at least four field clearing stone piles which appear to be related to historic agricultural activities (Figure 3.3-1: *Stone piles 1, 2, 3, and 7*) (Plates 1 and 2). At least three of them are located within the 50-meter-side access corridor while the forth lies just outside, at 30 meters north of the centerline. Much of the surrounding land for the first 350 to 400 meters appears to have been cleared and cultivated in the past, though more recent clear-cutting within the past 35 to 40 years has obscured some of that evidence. Several old

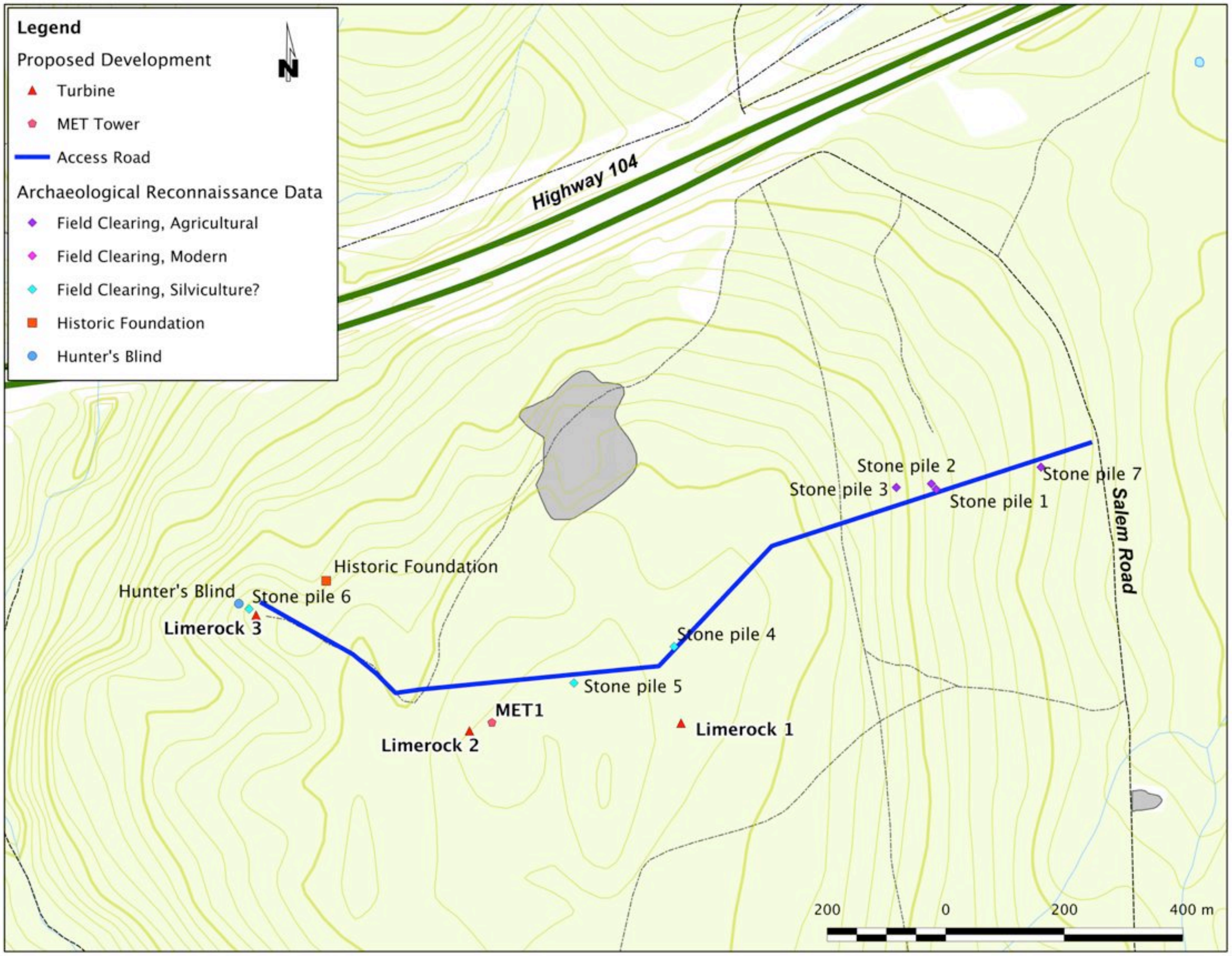

Figure 3.3-1: Map of the archaeological resources encountered during the reconnaissance in relation to the development.

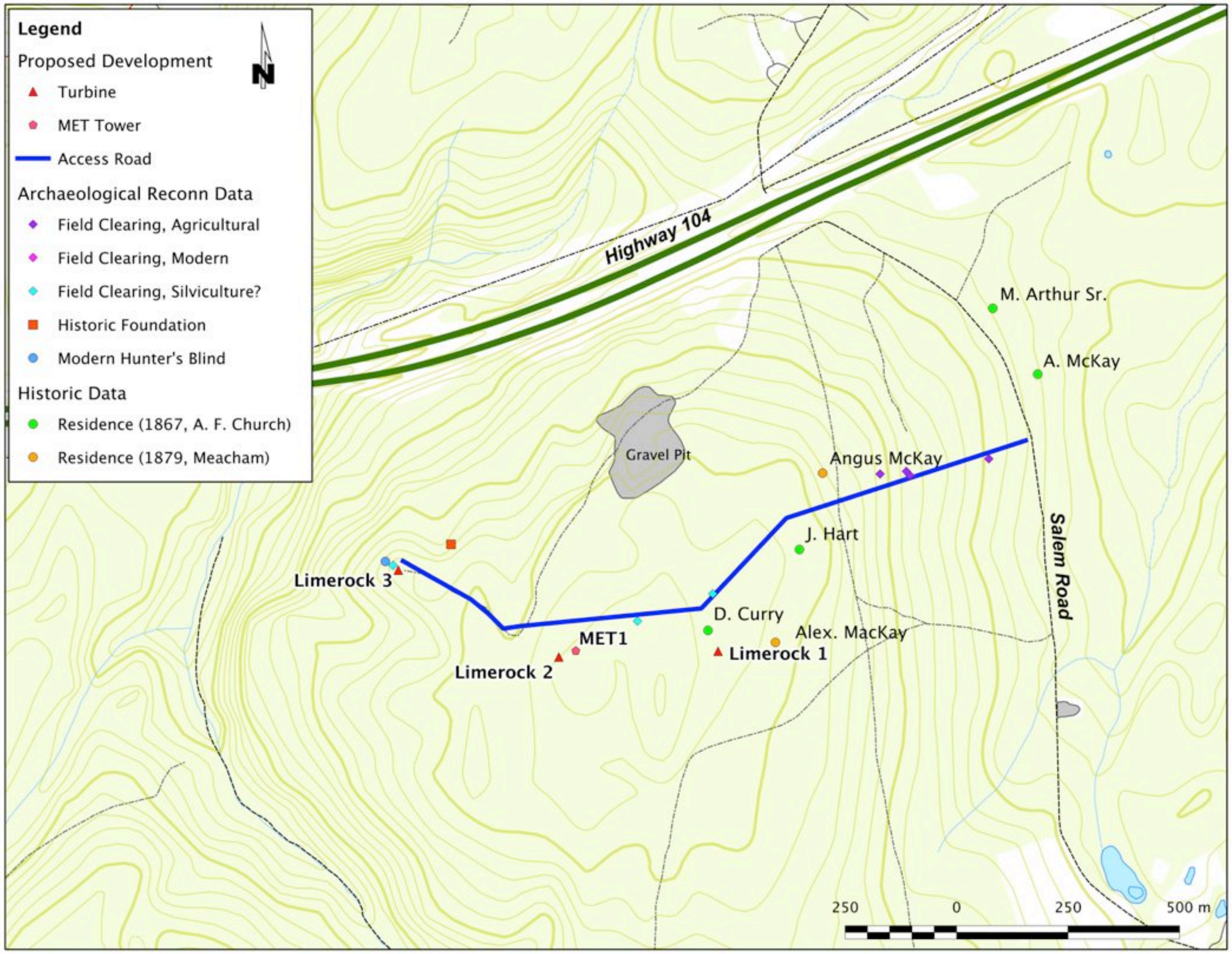

Figure 3.3-2: Map of the study area showing the proposed development and the locations of cultural features in relation to documented historic homesteads.

skidder trails can be seen criss-crossing the study area here. No associated formal features such as a foundation or outbuildings could be located and it is possible that such features, if they existed, were destroyed or obscured by clear cutting.

Table 3.3-1: GPS Coordinates of areas of cultural activity encountered during the archaeological reconnaissance.

Site Name	Type	Coordinates (NAD83)
Stone pile 1	Agricultural	20 T 514786 5043219
Stone pile 2	Agricultural	20 T 514778 5043229
Stone pile 3	Agricultural	20 T 514719 5043223
Stone pile 4	Silviculture (?)	20 T 514344 5042954
Stone pile 5	Silviculture (?)	20 T 514175 5042893
Stone pile 5	Modern, unknown	20 T 513627 5043017
Stone pile 6	Agricultural	20 T 514963 5043257
Hunter's Blind	Modern	20 T 513610 5043026
Historic Foundation	Pioneer (?)	20 T 513757 5043065

Four hundred and fifty meters west of Salem Road, the proposed access road crossed over an old unnamed road that is currently used for ATV traffic, though the road dates back at least to the third quarter of the 19th century as it appears on both Church's (1867) and Meacham's (1879) maps. Much of the land on the west side of this old road, including the site of turbine #1, has been clear cut in the last 30 to 40 years (Plate 3). Portions of the land appear to have been used for silviculture (possibly a Christmas tree nursery) that has since been abandoned. The forest is a mixed-wood environment of spruce, birch, and young maple with an understory of blackberry bushes, ferns, and moss.

There is an area of blow down, likely a result of Hurricane Juan in 2003, between turbines #1 and #2 (Plate 4). There are two field clearing stone piles along the access road to the north and northwest of turbine #1 (Figure 3.3-1: *Stone piles 4 and 5*) (Plate 5). The nature of the stone piles and the surrounding land do not suggest that this field clearing was related to agricultural clearing of the land. Rather, it is likely associated with silviculture. There were no associated features encountered nearby that would suggest historic land use.

Turbine #2 is located at the west edge of a recent clearing (Plate 6). A swath of land approximately 100 m by 100 m was cleared for the construction of a meteorological (or MET) tower which stands approximately 45 meters to the east northeast of the proposed turbine site (Plate 7). Investigation of the exposed soils in the area of the MET tower indicated very rocky soil with exposed till. No heritage resources were noted in the disturbed soils. The land surrounding the MET tower and the proposed turbine site is a young forest of birch, spruce and maple about 15 years old with evidence of clear cutting. A dirt road runs northwest and northeast to the north of this area. The northeast branch of the road leads to an active or recently-abandoned gravel pit while the proposed access road roughly follows the northwest branch.

Near the north westernmost end of the access road, a secondary road leads east northeast down an incline. The land on the south side of the road is relatively flat and a *Historic Foundation* (Figure 3.3-1) was reported to the archaeologists in this area. The foundation is located 95 meters down the secondary road, and 40 meters east southeast of it. The foundation appears more or less as a mounded depression in which a few foundations stones can be seen on the west wall inside what is likely a small root cellar (Plate 8). The cellar measures approximately 3 meters north-south by 3.5 meters east-west and 1.3 meters in depth. Around the perimeter of the cellar, the earth that was dug out of the cellar appears to have been mounded and subsequently leveled. No footing stones for a foundation can be seen along the mounding. A very large pine tree, about 150 years old, is growing out of the south wall of the mounding. No associated features or surficial artifacts were encountered. The surrounding forest is predominantly young birch with moss-covered cut stumps indicating clear cutting 20 to 30 years ago. The site is located 85 meters off the access road and is not expected to be impacted by construction.

Turbine #3 is also located in an area that was clear cut, though there are a number of very old (100 to 120 years) pine trees in the area (Plate 9). The proposed turbine site is located on a low ridge adjacent to the road. The ridge appears to be natural rather than a result of bulldozing for the road. A survey of the surrounding area indicated a small field clearing stone pile approximately 15 meters north northwest of the proposed turbine (Figure 3.3-1: *Stone Pile 6*) (Plate 10). The stone pile is comprised of angular rock rather than the typical field stones that are seen in stone piles related to agricultural clearing. The soil and rock beneath a nearby tree fall indicates that the bedrock in this area fractures into angular blocks. It appears that someone has been piling the fractured bedrock into the stone pile relatively recently.

Leading down the low ridge on which the turbine site is located and past the stone pile is a well-worn footpath. The path leads to a large pine tree which is used as a *Hunter's Blind* (Figure 3.3-1). There are couch cushions next to the tree and a bungee cord that descends from the tree for access. Again, this is related to recent activity.

There were no sources of freshwater encountered during the reconnaissance and, although First Nations peoples may have taken advantage of the area for hunting and/or gathering, there is little reason for them to have settled here. Hunting and gathering activities would have left little or no evidence of their presence.

4.0 Results and Discussion

There is evidence of cultural activity in the study area, though no significant archaeological features were located directly in the impact area. At the east end of the access road, off Salem Road, are several field clearing stone piles which are indicative of past agricultural activities. However, this area has also been impacted by clear cutting in the last 35 to 40 years which may have impacted on more significant archaeological features such as a house foundation and associated outbuildings, well and privy. The field clearing may have been associated with the Angus McKay homestead that appears on Meacham's 1879 map on the west side of the old unnamed road and 70 meters north of the access road.

Additional field clearing likely associated with 20th century silviculture further along the access road has also been encountered but is not considered to be archaeologically significant. Nor is the field clearing near turbine #3 as it, too, is believed to be related to relatively recent activity.

The foundation on the east side of the access road at its westernmost end is considered to be archaeologically significant. The nature of the construction, along with the age of the tree growing on top of the feature, suggests that this may have been a pioneer homestead. Historic foundations with small root cellars in one end of the house can be found all over Pictou County and are most often related to early 19th century Scottish immigrants. It is postulated that this type of housing relates to a period of rebuilding in which the rudimentary log cabins built on sills or directly on the ground by pioneers immediately upon landing were replaced after a winter or two with more substantial, permanent dwellings with formal foundations. No associated features such as a well, privy, or midden were encountered during the reconnaissance. The site is located approximately 115 meters east of the proposed access road and, therefore, is not expected to be impacted by construction.

The potential for First Nations resources within the study area is low. Although they may have made short term forays into the area for hunting and/or gathering, such activity is unlikely to leave an archaeological footprint.

5.0 Conclusions and Recommendations

Avoidance is the preferred method of mitigation in all instances where archaeological resources are present. The only archaeologically significant resource encountered during the reconnaissance was the *Historic Foundation* at the far west end of the access road. The proposed width of the access road is 50 meters and the site lies approximately 115 meters east of the center of the road. Therefore, it is not anticipated that the site will be impacted by construction. The nearest proposed turbine site is located 130 meters to the west southwest. Based on the current development plan, no further active mitigation is recommended for this area.

The stone pile (*Stone Pile 6*) and hunter's blind near turbine #3 represent modern activity and are not considered to be archaeologically significant. No further mitigation is recommended for this area.

The stone piles along the access road between turbines #1 and #2 (*Stone piles 4 and 5*) are not considered to be archaeologically significant and, therefore, no further mitigation is recommended.

The field clearing stone piles at the east end of the access road (*Stone piles 1, 2 3, and 7*) appear to be related to agricultural land clearing which suggests that a homestead was located nearby. However, no evidence of such could be found during the reconnaissance and the land clearing may be related to a homestead located outside the study area or the remains of such may have been impacted by late 20th century clear cutting. No further mitigation is recommended for the stone piles. However, in the event that additional archaeological features are encountered during ground disturbing activities, it is required that all activity cease and the Coordinator of Special Places (902-424-6475) be contacted immediately regarding a suitable method of mitigation.

Finally, should development plans change so that areas not previously assessed by archaeologists are to be impacted, it is recommended that those areas be subjected to an archaeological assessment by a qualified archaeologist. Likewise, if it is anticipated that those resources of archaeological significance are expected to be impacted, it is recommended that a strategy for their mitigation be developed prior to ground disturbance.

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PLATES

Plate 1: Stone pile 2, looking west.

Plate 2: Stone pile 1, looking northwest.

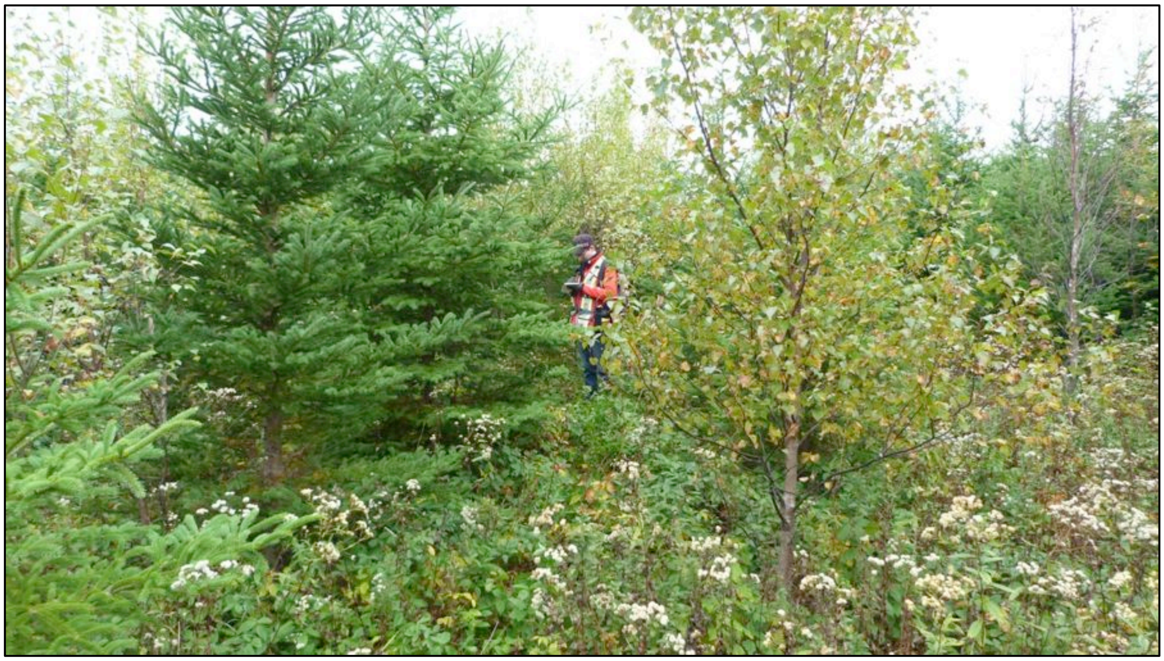

Plate 3: Proposed site of turbine #1, looking northwest.

Plate 4: Hurricane blow down along the south side of the access road between turbines #1 and #2. Looking northwest from the south side of the access road.

Plate 5: Stone pile 4, looking northwest.

Plate 6: Proposed site of turbine #2, looking west.

Plate 7: Meteorological tower, looking west.

Plate 8: Steve standing in the root cellar of the Historic Foundation near the far northwest end of the study area. There are visible stones to Steve's right. Note the large pine tree in the right (southeast) of the frame. Looking north.

Plate 9: Proposed site of turbine #3, looking west.

Plate 10: Stone pile 6 to northwest of proposed turbine #3, looking southeast.

APPENDIX A:
Heritage Research Permit

NOVA SCOTIA

Heritage Research Permit (Archaeology)

Special Places Protection Act **1989**

(Original becomes Permit when approved by Communities, Culture and Heritage)

Office Use Only
Permit Number:

A2013NS087

Greyed out fields will be made publically available. Please choose your project name accordingly

Surname MacIntyre	First Name April
Project Name Limerock Wind Farm	
Name of Organization Davis MacIntyre & Associates Limited	
Representing (if applicable)	
Permit Start Date 02 October 2013	Permit End Date 31 December 2013
General Location: 2.5 kms east southeast of Limerock, Pictou County	

Specific Location: *(cite Borden numbers and UTM designations where appropriate and as described separately in accordance with the attached Project Description. Please refer to the appropriate Archaeological Heritage Research Permit Guidelines for the appropriate Project Description format)*

20 T 513639 E 513639 N (Turbine #1)

Permit Category:
Please choose one

- [ ] Category A – Archaeological Reconnaissance
- [ ] Category B – Archaeological Research
- [x] Category C – Archaeological Resource Impact Assessment
- [x] I certify that I am familiar with the provisions of the *Special Places Protection Act* of Nova Scotia and that I have read, understand and will abide by the terms and conditions listed in the Heritage Research Permit Guidelines for the above noted category.

Signature of applicant April MacIntyre	Date 18 September 2013
Approved by Executive Director [signature]	Date Sept 23-13

Appendix I

Dalhousie Mountain 2008 Bat Population Study

& Kemptown 2013 Bat Study

Characterization of the magnitude of bat activity at the proposed Kemptown Wind Energy Project, Colchester County, NS

Final Report Prepared for:
RMS Energy
1383 Mt. Thom Rd.
Salt Springs, Nova Scotia

Attn: Lisa Fulton
Environmental Lead and Project Coordinator

Prepared By:
Lynne Burns, M.Sc.
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Department of Biology
Saint Mary's University
Halifax, Nova Scotia
B3H 3C3

November 2013

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Context

Project Background

Affinity Renewables (LLC), with oversight from RMS Energy, is proposing to install three GE 1.6 megawatt (MW) wind turbines near the community of Kemptown, Colchester County, Nova Scotia. The project is in an early phase with wind monitoring onsite at a meteorological tower.

Commercial scale wind energy production is one of the fastest growing sectors of the global energy industry as the demand for renewable energy sources for electricity generation continues to increase (Nelson 2009). This demand, combined with recent advances in wind turbine technology that have improved the cost-competitiveness of wind energy, has led to a global increase in the number of wind energy installations. In Canada, energy production and regulation falls under provincial jurisdiction and thus most renewable energy targets are set at the provincial level. In the province's Renewable Electricity Plan , the Provincial Government of Nova Scotia has set an aggressive target of 40% of the province's electricity needs to be met by renewable energy by the year 2020 (Nova Scotia Department of Energy 2010). Of this amount, 25% has been set as coming from made-in-Nova Scotia sources by 2015, and the wind energy sector is anticipated to be the largest contributor in meeting these goals. The Kemptown project is part of the Community Feed-In Tariff program (COMFIT) of the Renewable Electricity Plan which facilitates small-scale, local renewable projects that involve community groups.

Despite the many environmental benefits of electrical generation via wind energy, the rapid global growth of the wind energy sector has raised concerns regarding the impacts of these developments on both resident and migratory populations of wildlife (Arnett et al. 2008b). The documentation of large numbers of bat fatalities at wind energy facilities is a relatively recent development (Johnson 2005a), although is gaining considerable global attention. As a result, fatalities of bats have become a primary environmental concern associated with wind energy development.

Efforts to minimize conflicts between wildlife and wind energy have focused mainly on two areas: risk avoidance and impact mitigation (Weller and Baldwin 2012). Impact mitigation refers to those efforts focused on developing methods to reduce wildlife fatalities at operational wind facilities and does not apply to this project at this time. Risk avoidance involves conducting surveys prior to construction to avoid sites, or areas within sites, with high levels of usage by wildlife. The assumption of this approach is that low indices of activity prior to construction should result in low fatality rates post-construction since there should be fewer animals 'available' to be killed assuming that bats are not attracted to the infrastructure once built (Baerwald and Barclay 2009). As the planning phase proceeds for the development of the project, surveys of the wildlife at the proposed site are being undertaken to address any potential wildlife issues related to the development of the site. This document provides a summary of the echolocation survey undertaken for bats at the Kemptown Wind Energy Project in 2013.

Regulatory Context

The following legislation and policy were considered in relation to the proposed survey at the Kemptown Wind Energy Project:

- Federal Species at Risk Act (http://laws-lois.justice.gc.ca/eng/acts/S-15.3/page-1.html)
- Nova Scotia *Wildlife Act* (http://nslegislature.ca/legc/statutes/wildlife.pdf)
- Nova Scotia *Endangered Species Act* (http://www.novascotia.ca/legislature/legc/statutes/endspec.htm)

Additional resources that are relevant to the proposed surveys used include:

- Atlantic Canada Conservation Data Centre (http://www.accdc.com/)
- Wild Species The General Status of Species in Canada (http://www.wildspecies.ca/home.cfm?lang=e)
- Global Species Rankings (http://www.natureserve.org/explorer/)

Study Objectives

The objectives of this project were to:

(1) Provide information on the occurrence and relative magnitude of bat activity in the proposed development area, based on analysis of acoustic survey results;

(2) Provide relevant information on the resource requirements of local bat species that may be useful for the decision-making process on the proposed development; and

(3) Make relevant recommendations based on the results of this project and recent developments in the field of bats and wind energy.

Review of Key Issues

Background

Currently in Nova Scotia there are >150 wind turbines in operation (CanWEA 2013) and, as of yet, we are not aware of any incidents of major mortality, though bats have been killed. For context and qualification, most of these turbines have been in operation for only a short period of time (months to 7 years or less) and it is not known how thoroughly all existing operational turbines have been surveyed for bat fatalities or how well documented and reported the findings are. In the following sections we discuss the various means by which bats may be impacted by wind energy developments, including direct mortality, changes to habitat availability, and disruption of movement patterns (e.g., foraging, mating, migrations, or abandonment of sites).

Direct Mortality

Proximate causes of bat fatalities at wind energy developments may be due to direct strike by rotating turbine blades, collision with turbine towers, barotrauma or any combination of the three. Barotrauma involves tissue damage to the lungs due to rapid or excessive air-pressure reduction near moving turbines blades (Baerwald et al. 2008, Cryan and Barclay 2009) and the discussion of the relative role of barotrauma in the death of bats at wind energy developments remains on-going (Grodsky et al. 2011, Capparella et al. 2012, Rollins et al. 2012). In North America, significant bat fatality events at wind energy developments occur primarily in the late summer and early fall, peaking during the period that coincides with fall migration (Johnson 2005b, Cryan and Brown 2007, Arnett et al. 2008a). These trends have led researchers to believe that migration plays a key role in the susceptibility of certain bat species to wind turbine fatalities (Cryan and Barclay 2009). Although some fatality has also been documented during the spring (Brown and Hamilton 2006, Arnett et al. 2008a), numbers are much lower, thought to be a result of more scattered migratory behaviour, or possibly the use of different routes compared to fall migration.

The species that have the largest number of kills at wind farms are the long-distance migratory bats, including the hoary bat (*Lasiurus cinereus*), the eastern red bat (*L. borealis*), and the silver-haired bat (*Lasionycteris noctivagans*). In North America, these species make up about 75-80% of the documented fatalities at wind energy developments, with the hoary bat alone comprising almost half (Kunz et al. 2007, Arnett et al. 2008a). The cumulative impacts of current mortality rates as a result of wind turbines on these affected species could have long-term population effects (Kunz et al. 2007). Bat fatalities have also been reported for resident hibernating bat species, including the big brown bat (*Eptesicus fuscus*), the little brown bat (*Myotis lucifugus*), the northern long-eared bat (*M. septentrionalis*), and the tri-colored bat (*Perimyotis subflavus*) (Nicholson 2003, Johnson 2005b, Jain et al. 2007, Arnett et al. 2008a). At some sites in the eastern United States high numbers of fatalities of these resident, hibernating species have been reported (Kunz et al. 2007).

Various explanations for the high incidence of bat fatalities at wind energy developments have been proposed (Johnson 2005b, Kunz et al. 2007, Arnett et al. 2008a, Cryan and Barclay 2009). Estimates of the number of bat fatalities vary widely from less than 3 bats/turbine/year (Johnson et al. 2003, Johnson et al. 2004) to upwards of 50 bats/turbine/year (Nicholson 2003, Kerns et al. 2005, Jain et al. 2007). Given the considerable variability in species composition and rates of bat fatalities among wind energy facilities, it is likely that location-specific qualities of individual facilities are important (e.g., located along migration routes or other flight corridors). It has also been proposed that the use of turbines with increasing height has extended developments further into the flight space used by migrating bats (Barclay et al. 2007). However, behavioural observations of bats displaying flight patterns typical of foraging activity prior to collisions with turbines (Horn et al. 2008) may suggest that bats are actively foraging which may mean that foraging while migrating may take place for some individuals. Others have hypothesized that collisions may result from bats being attracted to turbines out of curiosity, misperception (failure to avoid a detected obstacle or interference with perception of an obstacle), or as potential feeding, roosting, and mating opportunities (reviewed in Cryan and Barclay 2009). To date, the cause(s) of bat fatalities at turbines remains unclear and is an active area of research.

As mortalities may be the result of site-specific and design-specific characteristics and conditions, it is important to conduct site-specific monitoring studies to make reliable inferences on the potential impacts of a wind energy development on local bat populations (American Society of Mammalogists 2008).

Habitat Availability

In forested landscapes, habitat availability for bats may be impacted by the alteration or removal of vegetation to accommodate roads and wind turbine installations. This may include the direct loss of resources (e.g., roost trees), fragmentation of habitat components (e.g., foraging and roosting areas), or other disturbance that may cause bats to vacate certain areas, likely acting to degrade the local environment for bat colonies/populations that reside in the area during the summer. This negative impact of new wind energy developments is likely to occur, and will contribute to the cumulative effect of habitat loss that is occurring throughout the range of most bat species.

At the site level, small-scale clearings in forested landscapes have been shown to attract certain bat species, which use these areas for foraging (Grindal and Brigham 1998, Hayes and Loeb 2007). Removal of vegetation can create edges and small clearings which can act to concentrate prey for bats. The extent to which this loss of vegetation can be perceived to be beneficial to bats is not known and will vary from site to site, as there must be a balance between the availability of suitable roosting resources with the availability of suitable foraging areas within commuting distance to provide conditions that favour the occupancy of resident bat species (Henderson and Broders 2008).

Movement Patterns

From the perspective of bat movement, resident bats may be affected by wind energy developments through alterations to foraging areas and possible disruption of commuting movements between roosting and foraging areas. There is some genetic evidence to suggest that bat movements can be impeded by fragmentation of habitat, which can scale up to population or distributional level effects (Kerth and Petit 2005, Meyer et al. 2009). However, this is not well understood for most species.

Little is known about the dynamics of movement (e.g., altitude, travel routes, frequency of visitation) of resident, hibernating bats to and from hibernation sites. Anecdotal evidence suggests that bats likely use ridges and other linear landscape elements (e.g., riparian corridors) as travel routes, depending on the landscape (Arnett 2005, Lausen 2007, Furmankiewicz and Kucharska 2009). In the late summer and early autumn large numbers of bats congregate at the entrances to underground hibernacula in an activity referred to as ‘swarming’ (Davis and Hitchcock 1965, Fenton 1969, Thomas and Fenton 1979, Glover and Altringham 2008). During the swarming period bats do not roost in hibernacula; research being conducted in Nova Scotia indicates that resident bats are ‘on the move’, roosting transiently on the landscape (Lowe 2012), though we do not have a full understanding of the dynamics of these behaviours. Swarming may serve several functions, including courtship, copulation, and orienting young-of-the-year to over-wintering sites (Fenton 1969, Thomas and Fenton 1979).

Movement data from Ontario and Manitoba suggests that resident bats may move up to at least 120 km between hibernacula within a year, and up to at least 500 km between years (Fenton 1969, Norquay et al. 2013). In New England, there are records of bats moving 214 km between hibernacula within one year, with one female moving 128 km in only three nights during spring emergence from hibernation (Davis and Hitchcock 1965). Obviously these resident hibernating species are at least capable of large scale migratory movements on the order of hundreds of kilometers. It is not known whether flight behaviour (e.g., height, routes, etc.) during this time differs from when resident species are in their summering area; the paucity of information on this aspect of their biology would appear to be one of the largest impediments in accurately predicting the impact of wind energy developments on local bat populations (Weller et al. 2009).

Bats in Nova Scotia

Nova Scotia Bat species

In Nova Scotia there are occurrence records for seven species of bats (Table 1; van Zyll de Jong 1985, Broders et al. 2003, Segers et al. 2013), and each have been documented to have experienced fatalities at wind turbine sites (Arnett et al. 2008a). There are three species of long-distance migratory bats recorded in the province, the hoary bat, the eastern red bat, and the silver-haired bat. These three species have extensive distributional ranges throughout North America, with Nova Scotia at or near their northern range limit (van Zyll de Jong 1985). Low numbers of echolocation recordings of the long-distance migratory species in Nova Scotia by Broders (2003) and other unpublished work suggests that there are no significant populations or large scale migratory movements of these species in the province, but they do occur regularly and are often associated with coastal or off-shore occurrences (Cryan and Brown 2007, Czenze et al. 2011, Segers et al. 2013). Two species of bats in the genus Myotis, the little brown bat and the northern long-eared bat, are the only abundant and widely distributed bats in Nova Scotia (Broders et al. 2003, Henderson et al. 2009). These 5–8g insectivorous bats are sympatric over much of their range (Fenton and Barclay 1980, van Zyll de Jong 1985, Caceres and Barclay 2000). A third species, the tri-coloured bat, has a significant population in the province, however they are likely restricted to southwest Nova Scotia (Broders et al. 2003, Rockwell 2005, Farrow and Broders 2011). These three species are gregarious species that over-winter in caves and abandoned mines in the region (Moseley 2007, Randall 2011). There is only one unconfirmed observation of the big brown bat, also a gregarious species, hibernating at a cave in central mainland Nova Scotia (Taylor 1997).

Ecology of Resident Species

Northern long-eared and little brown bats are expected to be the most likely species to occupy the proposed development area. The life history of both of these species is typical for temperate, insectivorous bats. Their annual cycle consists of a period of activity (reproduction) in the summer, and a hibernation period in the winter. Females of the two species bear the full cost of reproduction in the summer, from pregnancy to providing sole parental care to juveniles (Barclay 1991, Hamilton and Barclay 1994, Broders 2003).

The northern long-eared bat is a forest interior species that primarily roosts and forages in the interior of forests (Broders 2003, Jung et al. 2004, Henderson and Broders 2008). Females form maternity colonies, roosting in coniferous or deciduous trees, depending on availability (Foster and Kurta 1999, Broders et al. 2006, Garroway and Broders 2008). Males typically roost solitarily in either deciduous or coniferous trees (Lacki and Schwierjohann 2001, Jung et al. 2004, Ford et al. 2006). The little brown bat is a generalist species that is associated with forests, as well as human-dominated environments (Barclay 1982, Jung et al. 1999). This species has been found to forage over water and in forests (Anthony and Kunz 1977, Fenton and Barclay 1980), and both males and females (i.e., maternity colonies) have been documented roosting in both buildings and trees (Crampton and Barclay 1998, Broders and Forbes 2004). During the summer, it appears that most of the commuting and foraging activity of northern long-eared and little brown bats occurs close to the ground (Broders 2003). Nonetheless, our ability to survey bat activity at high altitudes is extremely limited, and therefore our ability to make inference on the vertical distribution of bats is also limited.

A third species that occurs in significant numbers in Nova Scotia, the tri-colored bat, is not likely to occur in the proposed development area (Farrow and Broders 2011). In Nova Scotia, work that we have done in Kejimkujik National Park suggests that this species roost in Usnea lichen species and forages over waterways (Poissant et al. 2010).

White Nose Syndrome

In 2012, three species of bats found in Nova Scotia were listed by COSEWIC as Endangered, and in 2013 were listed as Endangered by the Province of Nova Scotia. This is primarily due to the spread of an emerging infectious disease known as White Nose Syndrome (WNS) that is responsible for unprecedented mortality in hibernating bats through much of eastern North America (Blehert et al. 2009, United States Fish & Wildlife Service 2012). The condition is caused by *Pseudogymnoascus destructans* (formerly *Geomyces destructans)*, a cold-loving fungus that thrives in cave conditions and as such, impacts bat population directly during the winter hibernation period (Lorch et al. 2011, Blehert 2012, Minnis and Lindner 2013). It is thought to disrupt patterns of torpor which results in death by starvation or dehydration (Cryan et al. 2010, Reeder et al. 2012, Warnecke et al. 2013). First documented in New York State in 2006 (Blehert et al. 2009), WNS spread rapidly to 19 states and four Canadian provinces by 2011 and is thought to be responsible for the death of more than 5.5 million bats (United States Fish & Wildlife Service 2012). White Nose Syndrome has been confirmed among populations of seven species of bats; the little brown bat, the most abundant species in the region currently affected by WNS, has experienced the most dramatic population declines (Frick et al. 2010). Some hibernacula have seen mortality rates of 90 to 100 percent of resident hibernating bats as a result of infection with WNS (United States Fish & Wildlife Service 2012), leading researchers to believe that WNS could lead to local extinctions of the little brown bat, as well as other species (Frick et al. 2010).

White Nose Syndrome was first documented in Nova Scotia in April 2011 and declines of 80% to 99% have since been recorded in winter populations (Broders and Burns, unpublished data). Therefore it would be prudent to protect any surviving animals that may be genetically predisposed to surviving the infection. Even prior to WNS, bats were increasingly recognized as a conservation priority in North America. Now, in consideration of the sharp declines and rapid spread of WNS, serious concerns have been raised about the impact of WNS on the population viability of affected bat species, consequently impacting the conservation status of bat species at the local, national and global level (Table 1). Given that hibernacula represent one of the more critical resources for bats, as they allow successful over-wintering, they are important to protect.

Potential for Hibernacula

The Nova Scotia Proponent's Guide to Wind Power Projects (Nova Scotia Environment 2012) states that wind farm sites within 25 km of a known bat hibernacula have a 'very high' site sensitivity. There are no major hibernacula within 25 km of the Kemptown Wind Energy Project area (Moseley 2007). Abandoned mine adits at New Lairg, Pictou County, are within 25 km although no overwintering count data exists for these (Moseley 2007) and recent acoustic surveys in 2010 by Randall suggest they are not significant autumn swarming sites (Randall 2011). In other ultrasonic monitoring by Randall in 2010, at two other sites in the vicinity of the proposed development area, McLellan's Brook Cave, Pictou County and at Natural Bridge Cave, Colchester County she concluded that neither of these exhibited strong evidence of fall swarming activity by bats although there were captures of bats at Natural Bridge Cave on one sampling night. The nearest known major bat hibernaculum to the Kemptown project is Hayes Cave, the largest known hibernaculum in NS, which is located in Maple Grove approximately 40 km from the proposed development area. At approximately 42 km away is Lear Shaft, located in Londonderry in an area with extensive underground mine workings and a number of mine openings. There are no underground records of hibernating bats from this site (owing to the structure of the site, a now-gated vertical shaft). In sampling on 7 nights in the autumns of 2009 and 2010, bat captures using harp traps resulted in an average of 8 bats captured per sampling hour indicating this is a fall swarming site (Burns unpublished data). Overwinter surveys for white-nose syndrome monitoring in 2012 yielded the collection of bat carcasses around the mine opening in winter demonstrating this site is a hibernaculum.

According to the Nova Scotia Abandoned Mine Openings Database (Fisher and Hennick 2009), there are 33 underground abandoned mine opening records in the vicinity of the Kemptown project (within 25km). Of these, the records suggest that 25 of the records have original depths of 30 m or less and/or were filled in or are flooded suggesting they would be unsuitable as hibernacula. Of the remaining 8 sites, 4 have been filled in (KPT-1-025, EMM-1-001, LCU-1-003,SPB-1-006) and 1 is one of the New Lairg sites investigated by Randall in 2010 (LCU-1-004; 2011) was not found to have high autumn bat activity levels. This leaves three openings to be potentially explored for bat activity.

Table 1. Over-wintering strategy and conservation status of bat species recorded in Nova Scotia

Species	Overwintering Strategy	Global Ranking[1]	COSEWIC Status	ACCDC status[3]	NSESA[4]
Little brown bat	Resident hibernator	G5	Endangered[2]	S1	Endangered
Northern long-eared bat	Resident hibernator	G4	Endangered[2]	S1	Endangered
Tri-coloured bat	Resident hibernator	G5	Endangered[2]	S1	Endangered
Big brown bat	Resident hibernator	G5	Not assessed	N/A	Not listed
Hoary bat	Migratory	G5	Not assessed	S1	Not listed
Silver-haired bat	Migratory	G5	Not assessed	S1	Not listed
Eastern red bat	Migratory	G5	Not assessed	S1	Not listed

[1] Global Ranking based on the NatureServe Explorer: G1 = Critically Imperiled, G2 = Imperiled, G3 = Vulnerable, G4 = Apparently Secure, G5 = Secure. All the above species were reassessed in July 2012.
[2] Assessed by COSEWIC and designated in an emergency assessment on February 3, 2012.
[3] Atlantic Canada Conservation Data Centre ranking, based on occurrence records from NB and NS: S1 = Extremely rare: May be especially vulnerable to extirpation (typically five or fewer occurrences or very few individuals).
[4] Listing status under the Nova Scotia Endangered Species Act: Endangered = a species facing imminent extirpation or extinction; species were reassessed in July 2013.

Methods

Study Area

The project area is located near the community of Kemptown, Colchester County which is situated approximately 16 km from the town of Truro which has a population of 12,500 people. This area is within the Rolling Upland District of the Carboniferous Lowlands Theme Region (Davis and Browne 1996) and the Nova Scotia Highlands Ecoregion and St. Mary's Block Ecodistrict (Webb and Marshall 1999). This area contains upland slopes ranging from 100 to 300 m in elevation. Softwood forests dominate the area with scattered sugar maple, beech and yellow birch occurring on low ridges and spruces, balsam fir, red maple and eastern hemlock common on well-drained mid-slopes. Forestry is the dominant land use activity in the area with some small mixed farming.

Ultrasonic Surveys

We used two automated bat detectors (model Song Meter SM2Bat+, Wildlife Acoustics, Concord, MA) to sample at two locations within the proposed development area (Table 2). One detector was deployed adjacent to a meteorological tower with two microphones: one microphone recorded at 2 m off the ground and another microphone recorded at approximately 40 m above ground (high microphone). The second detector was deployed along a trail in a regenerating forest and used one microphone that was placed at about 3 m above ground. Microphones were oriented parallel to the ground, or slightly down to shed rain. The seasonal timing of sampling likely corresponded to the end of the summer residency period, movement of resident species to local hibernacula, and to fall migration by migratory species.

Three other bat detectors (Anabat, Titley Electronics, Ballina, NSW, Australia) were placed in the vicinity of the identified abandoned mine openings (AMO) from the Nova Scotia Abandoned Mine Openings Database (Brookfield, BRF-1-002; Smithfield, SPB-1-003; Kemptown, KPT-1-007: Table 2). These openings are approximately 22.1, 10.5 and 3.8 km away from the proposed wind energy development, respectively.

Identification of many bat species is possible because of the distinctive nature of their echolocation calls (Fenton and Bell 1981, O'Farrell et al. 1999). Species were qualitatively identified from recorded echolocation call sequences by comparison with known echolocation sequences recorded in this and other geographic regions. All recorded bat call sequences from SM2Bat units were converted to zero-crossing file formats using Kaleidoscope™ software (Wildlife Acoustics) and were imported into AnalookW software (Titley Electronics, vs3.8v) for identification and analysis. Calls from Anabat units were directly used in AnalookW. In the case of species in the genus Myotis (northern long-eared and little brown bat), we did not identify sequences to the species level as their calls are too similar to be reliably separated. Call sequences that were clearly bat generated ultrasound, but could not be confidently classified due to poor quality of the recordings were classified as 'unknown'. As the unit of bat activity, we used the number of recorded echolocation files, which approximate an echolocation call sequence, defined as a continuous series of greater than two calls (Johnson et al. 2004). Because an individual bat may be recorded making multiple passes, the data presented represent a measure of bat activity, and cannot be used as a direct measure of the number of bats within or passing through an area.

Differences in bat call sequence detections, call quality and ultimately species identifications are known among different models of bat detectors. Recent comparisons have shown that Wildlife Acoustics SM2Bat units record more bat call sequence files then Anabat units (Allen et al. 2011, Adams et al. 2012) and these differences must be incorporated into the interpretations and inferences of data when using both detectors.

Table 2. Locations of ultrasonic survey sites for the 2013 survey of bat activity at the proposed Kemptown Wind Energy Project area, Colchester county, Nova Scotia. Coordinates are NAD83 UTM Zone 20T.

Site	**Location**	**Site type**	**Coordinates**		**Deployed**	**Retrieved**
1	Kemptown forest	Project Area	491314 E	5032843 N	30 Jul 2013	11 Oct 2013
2	Kemptown tower	Project Area	490786 E	5032690 N	30 Jul 2013	11 Oct 2013
3	Brookfield AMO	Mine opening	481526 E	5013245 N	30 Jul 2013	21 Sep 2013
4	Smithfield AMO	Mine opening	494061 E	5012824 N	30 Jul 2013	21 Sep 2013
5	Kemptown AMO	Mine opening	494234 E	5034854 N	28 Aug 2013	09 Nov 2013

Table 3. Site descriptions for ultrasonic survey sites for the 2013 survey of bat activity at the proposed Kemptown Wind Energy Project area, Colchester County, Nova Scotia.

Site	Description
1	The detector was placed along a trail through a regenerating coniferous forest.
2	The site was within a regenerating coniferous forest and the immediate vicinity of the tower had a gravel base with road access for the meteorological tower.
3	The exact location of the mine opening could not be located and was possibly filled in or collapsed. Regardless there was evidence of mine workings and a detector was deployed along a forest edge at the expected location of the opening and among the mine workings.
4	The exact location of the candidate mine opening could not be located but there were a number of locations where there was evidence of mine workings within 40 m of the GPS location which straddled a narrow patch of forest bounded by a road and a large field. The detector was deployed at the edge of the forest and the microphone was pointed into the field.
5	The exact location of the candidate mine opening could not be located and it is possible the opening was filled in. Detector was deployed in a small gap in a patch of forest approximately 20 m from the adjacent road.

Results

At site 1, the bat detector recorded from July 30 to October 3, 2013. Upon retrieval of this unit it was discovered that the unit had been vandalized with the power supply cut on October 4 such that no data was recorded for the remaining 7 nights before the unit was retrieved. Site 2 recorded data from July 30 to October 11, 2013 continuously. Detectors at the Smithfield and Brookfield abandoned mine openings were deployed and recorded continuously from July 30 to September 21 and the Kemptown abandoned mine opening recorded from August 28 to November 10, 2013.

Within the proposed wind energy development area there were 59 acoustic files recorded on the 3 microphones (2 detectors) with 14 classified as bat-generated ultrasound files and the remaining classified as extraneous noise (Table 4). Of these, 2 were recorded along the trail through the regenerating forest (site 1), 6 were recorded at the base of the meteorological tower (site 2) and 6 bat call sequence files were recorded on the high microphone on the meteorological tower. The majority of call sequences (10/14; 71.4 %) were classified as Myotis species (i.e., includes northern long-eared and little brown bats); as stated above no attempt was made to identify these call sequences to the species level given the difficulty in achieving such identifications. There were 4 call sequences attributed to hoary bats that were recorded on 3 nights during the fall migration period. Two hoary bat call sequences were recorded on August 17 where a single call was recorded on each of the low and high microphones at the same time and thus likely represent the same individual flying in the area. The other single hoary call sequences were recorded on each of August 27 and September 24th and are also suggestive that an individual bat was present each night and made the calls.

The bat detector at the Brookfield AMO recorded 46 acoustic files with 21 classified as bat-generated ultrasound files (Table 5). Sixty-six percent (n= 14) of the bat call sequences were classified as Myotis species, 28.6 % (n=6) were classified as hoary bat and there was one call sequence that was classified as unknown (4.7%). The hoary bat sequences were recorded on three nights with one sequence on the evening of Aug 21, two sequences on September 1st within 18 minutes of each other and three sequences on Sept 2nd within 28 minutes of each other. This suggests an individual bat on each night made the calls. The unknown sequence recorded was short in duration (5.14 milliseconds) consisting of 8 calls which lacked the distinctive frequency modulated sweep typical of bat calls and thus encompassed a maximum and minimum frequency of 39.54 and 38.54 kHz, respectively. These characteristics fall within known parameters for Myotis species or potentially a red bat however the missing shape parameters precluded a positive identification to a particular species group although do represent discrete bat call pulses. The bat detector at the Smithfield AMO recorded 210 acoustic files with 87 classified as bat-generated ultrasound files (Table 5). Myotis species again dominated the call sequences at 97.7% followed by 2.3% attributable to hoary bat call sequences. The hoary bat sequences at Smithfield were recorded on 2 separate nights with a single call sequence recorded on each of August 27 and September 8th. At the Kemptown AMO there was 1204 acoustic files recorded with10 classified as bat-generated ultrasound files. Myotis species comprised 60% of the call sequences and the remaining 40% were attributable to hoary bat call sequences. The hoary bat sequences were recorded on three nights with one sequence on the evening of Aug 28, two sequences on September 2 and one sequence on September 3rd. This is suggestive of an individual bat on each night.

The average number of recorded bat call sequences per night in the proposed development area (average for the two sites) was 0.19 (SD =0.52) during the sampling period. To place the relative magnitude of activity recorded in the study area into context, in 129 nights of monitoring along five forested edges in the Greater Fundy National Park Ecosystem from June to August 1999, the average number of sequences per night was 27 (SD = 44; Broders unpublished data). In 650 nights of monitoring at river sites in forested landscapes in southwest Nova Scotia from June to August of 2005-2006, the average number of sequences per night was 128 (SD = 232; Farrow unpublished data), though note that rivers act to concentrate bat activity, as they are used as foraging and commuting corridors (Laval et al.

1977, Fenton and Barclay 1980, Fujita and Kunz 1984, Krusic et al. 1996, Zimmerman and Glanz 2000, Lacki et al. 2007). Both of these previous comparisons were conducted prior to the emergence of white nose syndrome and therefore may not be directly comparable. In a forested landscape in Colchester Count, Nova Scotia, we detected an approximate 99% decrease in bat echolocation activity from 2012 to 2013 at forested and riparian sites that were monitored for bat activity following the confirmation of mortality from white nose syndrome in Nova Scotia (Segers and Broders, unpublished data).

The average number of recorded bat call sequences per night for the Brookfield, Smithfield and Kemptown abandoned mine openings were 0.40 (SD = 0.91), 1.64 (SD = 2.72), 0.14 (SD = 0.42), respectively. The Smithfield AMO had the highest level of bat activity of the four study areas and although bat activity was low, there was a trend of bat activity increasing towards the end of August and early September (Figure 1) as predicted for swarming sites.

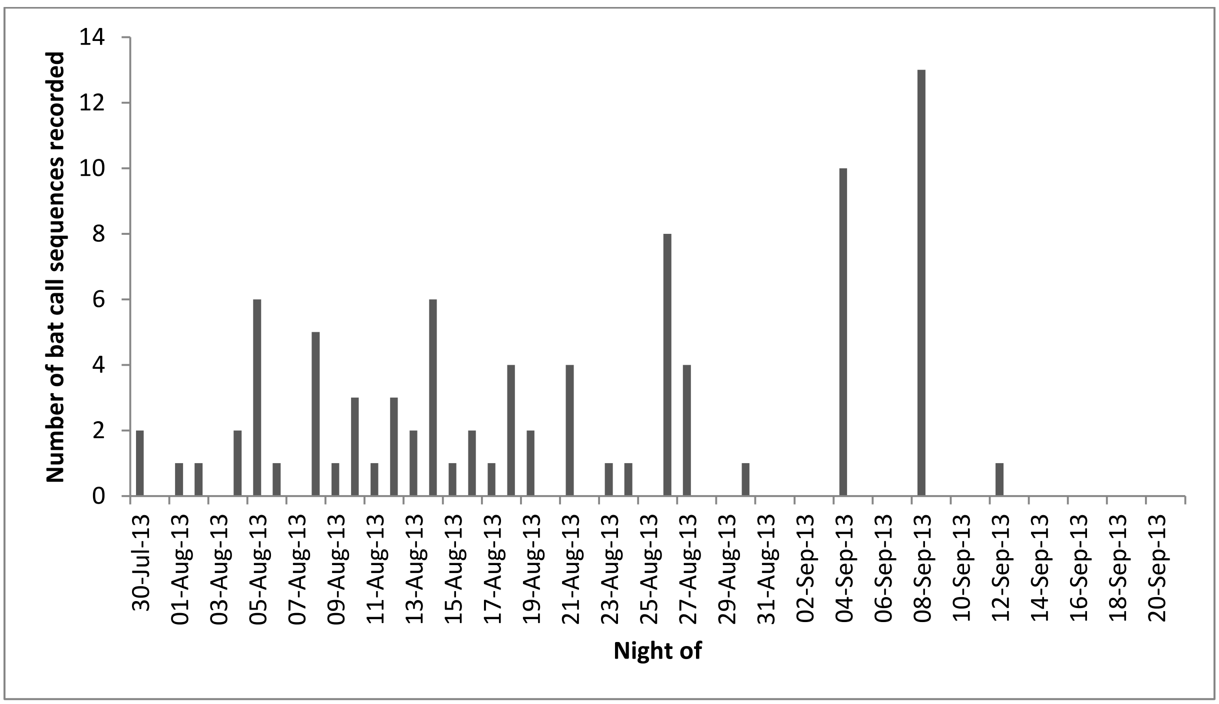

Figure 1. Number of bat call sequences recorded, by night, at the Smithfield abandoned mine opening, July 30 to September 20, 2013.

Table 4. Number of echolocation bat call sequence files recorded per night for the 2013 survey of bat activity at the proposed Kemptown Wind Energy Project area, Colchester County, Nova Scotia. MYO = Myotis species, LACI = *Lasiurus cinereus.*

	Site 1	Site 2 (low mic)		Site 2 (high mic)		Nightly total
Night of	**MYO**	**MYO**	**LACI**	**MYO**	**LACI**	**all sites**
30-Jul-13	0	0	0	0	0	0
31-Jul-13	2	1	0	0	0	3
01-Aug-13	0	0	0	0	0	0
02-Aug-13	0	0	0	0	0	0
03-Aug-13	0	0	0	0	0	0
04-Aug-13	0	0	0	0	0	0
05-Aug-13	0	0	0	0	0	0
06-Aug-13	0	0	0	1	0	1
07-Aug-13	0	0	0	0	0	0
08-Aug-13	0	0	0	0	0	0
09-Aug-13	0	0	0	0	0	0
10-Aug-13	0	0	0	0	0	0
11-Aug-13	0	0	0	1	0	1
12-Aug-13	0	0	0	0	0	0
13-Aug-13	0	0	0	0	0	0
14-Aug-13	0	0	0	0	0	0
15-Aug-13	0	1	0	0	0	1
16-Aug-13	0	0	0	0	0	0
17-Aug-13	0	0	1	0	1	2
18-Aug-13	0	0	0	0	0	0
19-Aug-13	0	0	0	1	0	1
20-Aug-13	0	0	0	0	0	0
21-Aug-13	0	0	0	0	0	0
22-Aug-13	0	0	0	1	0	1
23-Aug-13	0	0	0	0	0	0
24-Aug-13	0	0	0	0	0	0
25-Aug-13	0	0	0	0	0	0
26-Aug-13	0	0	0	0	0	0
27-Aug-13	0	0	1	0	0	1
28-Aug-13	0	0	0	0	0	0
29-Aug-13	0	0	0	0	0	0
30-Aug-13	0	0	0	0	0	0
31-Aug-13	0	0	0	0	0	0
01-Sep-13	0	0	0	0	0	0
02-Sep-13	0	0	0	1	0	1
03-Sep-13	0	0	0	0	0	0

Continued on next page

Night of	Site 1 MYO	Site 2 (low mic) MYO	Site 2 (low mic) LACI	Site 2 (high mic) MYO	Site 2 (high mic) LACI	Nightly total all sites
04-Sep-13	0	0	0	0	0	0
05-Sep-13	0	0	0	0	0	0
06-Sep-13	0	0	0	0	0	0
07-Sep-13	0	0	0	0	0	0
08-Sep-13	0	0	0	0	0	0
09-Sep-13	0	1	0	0	0	1
10-Sep-13	0	0	0	0	0	0
11-Sep-13	0	0	0	0	0	0
12-Sep-13	0	0	0	0	0	0
13-Sep-13	0	0	0	0	0	0
14-Sep-13	0	0	0	0	0	0
15-Sep-13	0	0	0	0	0	0
16-Sep-13	0	0	0	0	0	0
17-Sep-13	0	0	0	0	0	0
18-Sep-13	0	0	0	0	0	0
19-Sep-13	0	0	0	0	0	0
20-Sep-13	0	0	0	0	0	0
21-Sep-13	0	0	0	0	0	0
22-Sep-13	0	0	0	0	0	0
23-Sep-13	0	0	0	0	0	0
24-Sep-13	0	0	1	0	0	1
25-Sep-13	0	0	0	0	0	0
26-Sep-13	0	0	0	0	0	0
27-Sep-13	0	0	0	0	0	0
28-Sep-13	0	0	0	0	0	0
29-Sep-13	0	0	0	0	0	0
30-Sep-13	0	0	0	0	0	0
01-Oct-13	0	0	0	0	0	0
02-Oct-13	0	0	0	0	0	0
03-Oct-13	0	0	0	0	0	0
04-Oct-13	-	0	0	0	0	0
05-Oct-13	-	0	0	0	0	0
06-Oct-13	-	0	0	0	0	0
07-Oct-13	-	0	0	0	0	0
08-Oct-13	-	0	0	0	0	0
09-Oct-13	-	0	0	0	0	0
10-Oct-13	-	0	0	0	0	0
Totals	2	3	3	5	1	14
Site average						0.19
Num nights	66		73		73	

Table 5. Number of echolocation bat call sequence files recorded per night for the 2013 survey of bat activity at abandoned mine openings (AMO) near the proposed Kemptown Wind Energy Project area, Colchester County, Nova Scotia. MYO = Myotis species, LACI = *Lasiurus cinereus*, UNKN = unknown species of bat.

	Brookfield AMO				Smithfield AMO			Kemptown AMO		
Night of	MYO	LACI	UNKN	Nightly Total	MYO	LACI	Nightly Total	MYO	LACI	Nightly Total
30-Jul-13	1	0	0	1	2	0	2	-	-	-
31-Jul-13	0	0	0	0	0	0	0	-	-	-
01-Aug-13	1	0	0	1	1	0	1	-	-	-
02-Aug-13	0	0	0	0	1	0	1	-	-	-
03-Aug-13	0	0	0	0	0	0	0	-	-	-
04-Aug-13	2	0	0	2	2	0	2	-	-	-
05-Aug-13	0	0	0	0	6	0	6	-	-	-
06-Aug-13	0	0	0	0	1	0	1	-	-	-
07-Aug-13	0	0	1	1	0	0	0	-	-	-
08-Aug-13	3	0	0	3	5	0	5	-	-	-
09-Aug-13	0	0	0	0	1	0	1	-	-	-
10-Aug-13	0	0	0	0	3	0	3	-	-	-
11-Aug-13	0	0	0	0	1	0	1	-	-	-
12-Aug-13	0	0	0	0	3	0	3	-	-	-
13-Aug-13	0	0	0	0	2	0	2	-	-	-
14-Aug-13	0	0	0	0	6	0	6	-	-	-
15-Aug-13	0	0	0	0	1	0	1	-	-	-
16-Aug-13	0	0	0	0	2	0	2	-	-	-
17-Aug-13	0	0	0	0	1	0	1	-	-	-
18-Aug-13	0	0	0	0	4	0	4	-	-	-
19-Aug-13	0	0	0	0	2	0	2	-	-	-
20-Aug-13	0	0	0	0	0	0	0	-	-	-
21-Aug-13	0	1	0	1	4	0	4	-	-	-
22-Aug-13	0	0	0	0	0	0	0	-	-	-

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Night of	Brookfield AMO				Smithfield AMO			Kemptown AMO		
	MYO	LACI	UNKN	Nightly total	MYO	LACI	Nightly total	MYO	LACI	Nightly total
23-Aug-13	1	0	0	1	1	0	1	-	-	-
24-Aug-13	0	0	0	0	1	0	1	-	-	-
25-Aug-13	0	0	0	0	0	0	0	-	-	-
26-Aug-13	0	0	0	0	8	0	8	-	-	-
27-Aug-13	1	0	0	1	3	1	4	-	-	-
28-Aug-13	0	0	0	0	0	0	0	1	1	2
29-Aug-13	0	0	0	0	0	0	0	0	0	0
30-Aug-13	1	0	0	1	1	0	1	1	0	1
31-Aug-13	0	0	0	0	0	0	0	0	0	0
01-Sep-13	0	2	0	2	0	0	0	1	0	1
02-Sep-13	0	3	0	3	0	0	0	0	2	2
03-Sep-13	0	0	0	0	0	0	0	0	1	1
04-Sep-13	0	0	0	0	10	0	10	0	0	0
05-Sep-13	0	0	0	0	0	0	0	0	0	0
06-Sep-13	0	0	0	0	0	0	0	0	0	0
07-Sep-13	0	0	0	0	0	0	0	0	0	0
08-Sep-13	0	0	0	0	12	1	13	0	0	0
09-Sep-13	0	0	0	0	0	0	0	1	0	1
10-Sep-13	0	0	0	0	0	0	0	0	0	0
11-Sep-13	0	0	0	0	0	0	0	0	0	0
12-Sep-13	1	0	0	1	1	0	1	0	0	0
13-Sep-13	2	0	0	2	0	0	0	0	0	0
14-Sep-13	0	0	0	0	0	0	0	0	0	0
15-Sep-13	0	0	0	0	0	0	0	0	0	0
16-Sep-13	0	0	0	0	0	0	0	0	0	0
17-Sep-13	0	0	0	0	0	0	0	0	0	0
18-Sep-13	0	0	0	0	0	0	0	0	0	0

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	Brookfield AMO				Smithfield AMO			Kemptown AMO		
Night of	**MYO**	**LACI**	**UNKN**	**Nightly total**	**MYO**	**LACI**	**Nightly total**	**MYO**	**LACI**	**Nightly total**
19-Sep-13	1	0	0	1	0	0	0	0	0	0
20-Sep-13	0	0	0	0	-	-	-	0	0	0
21-Sep-13	-	-	-	-	-	-	-	0	0	0
22-Sep-13	-	-	-	-	-	-	-	1	0	1
23-Sep-13	-	-	-	-	-	-	-	0	0	0
24-Sep-13	-	-	-	-	-	-	-	0	0	0
25-Sep-13	-	-	-	-	-	-	-	1	0	1
*									Data not shown*	
Site total	14	6	1	21	85	2	87	6	4	10
Site average				0.40			1.64			0.14
Num nights				53			53			73

*Kemptown AMO was sampled further from 26-Sep-13 until 8-Nov-13 although no further bat call sequences were recorded

Discussion

Interpretation of these data are problematic for assessing relative risk to bats at the proposed development given our knowledge of the devastating impacts that white nose syndrome has had, and is having, on local bat populations. Elsewhere, white nose syndrome reduced the summer bat activity by >75% (Dzal et al. 2011). This past winter (2012-2013), there were hundreds of fatalities recorded at several known hibernacula in the province and annual monitoring counts of bats at such hibernacula down, on average, by 94% (Broders and Burns, unpublished data). The disease is now confirmed in seven counties in central Nova Scotia, including the proposed development area. These observations are suggestive of a major mortality event in the area, potentially decreasing the magnitude of bat activity in the area in the summer of 2013. This is supported by other work we are conducting in the region during summer suggesting a 99% reduction in the magnitude of echolocation activity in 2013, relative to 2012 (Segers and Broders, unpublished), and decimation of a number of maternity colonies in the region. For these reasons this dataset must be interpreted with caution.

Despite the above, there was no acoustic evidence of a significant movement or concentration of bats through the area investigated during this pre-construction survey of bat activity. The magnitude of activity was low compared to baseline levels (collected prior to 2007) expected in a forested ecosystem in the region. Although we cannot rule out the possibility that mortality events associated with this development will occur, we have found no evidence to suggest that the proposed project will directly cause a large number of bat mortalities. That being said, in light of white nose syndrome and the recent listing of the species as endangered, the significance of any mortality is greater than just a couple of years ago.

The majority of the identified echolocation sequences recorded for this project were attributable to the two species of Myotis bats known to occur in Nova Scotia, the little brown bat and the northern long-eared bat. This was expected as they are the only abundant and widely-distributed species in the province, and are two of only three species with significant populations in the province (Broders et al. 2003). Although we did not distinguish the calls of Myotis species, the majority of the recorded sequences likely represent the little brown bat, as this species is known to forage in open areas and over water. The northern long-eared bat is a recognized forest interior species (Jung et al. 1999, Henderson and Broders 2008), and is less likely to use open areas for foraging and commuting (Henderson and Broders 2008). Additionally, the northern long-eared bat has lower intensity echolocation calls and is thus not recorded as well as the little brown bat (Miller and Treat 1993, Broders et al. 2004). There were no echolocation sequences that were attributable to the tri-colored bat, which was expected as this species is only locally abundant in southwest Nova Scotia and the proposed development is outside of the known provincial distribution for this species (Farrow and Broders 2011).

Myotis bats are relatively new to the list of species among fatalities at wind turbines sites. This may be due to the fact that the first large scale wind developments were located primarily in western North America, typically in agricultural and open prairie landscapes (reviewed in Johnson 2005b). Fatalities of these resident, non-migratory species were largely absent from these sites, likely due to the association of these species with forested landscapes. More recently, evidence of Myotis fatalities resulting from collisions with wind turbines have been noted at sites in eastern North America (reviewed in Johnson 2005b, Jain et al. 2007, Arnett et al. 2008a). Although there are fewer documented fatalities of Myotis bats compared to long-distance migratory species, there is still a risk of direct mortality.

Other than direct bat mortality as a result of collisions with turbines, there is also the potential that disruption of the forest structure (e.g., removal of trees and fragmentation of forest stands for roads and clearings) will degrade the local environment for colonies/populations of Myotis bats that reside in the area during the summer. This can occur by the elimination of existing roost trees, the isolation of trees left standing, as well as the elimination or degradation of foraging areas for bats. These negative impacts will almost certainly occur and will add to the cumulative impact of habitat loss that is occurring throughout the ranges of these species. Additionally, these resident bat species make what are generally considered to be short distance migrations, in comparison to long-distance migratory behaviour by other bats species, from their summering areas to underground sites where they hibernate. Little is known about the flight behaviour and dynamics of these movements (i.e., height of travel, and routes); therefore, it is difficult to predict the specific effects that wind developments will have on the movements of local populations of bats.

The low number of call sequences attributed to the hoary bat, a long-distance migratory bat species, suggests that there are no large populations or migratory movements of these species at the study area. This fits with our current knowledge of their status in the province, but they do occur regularly but in low frequency although are especially vulnerable to wind facilities. This species is a solitary, tree-roosting species with an extensive distributional range throughout North American (van Zyll de Jong 1985). This species, in addition to red and silver-haired bats, have received the greatest attention with regards to wind energy developments because they make up the large majority of documented fatalities at existing wind energy developments in North America. Any mortality of this species would be significant to Nova Scotia given there low numbers in the region. Significant bat fatality events at wind energy developments occur primarily in the late summer and early fall, peaking during the period that coincides with the long-distance fall migration of these species (Johnson 2005b, Cryan and Brown 2007, Arnett et al. 2008a), leading researchers to believe that migration plays a key role in the susceptibility of certain bat species to wind turbine fatalities (Cryan and Barclay 2009). It has been proposed that this may be because these species travel at a height that puts them at increased risk of collisions with rotating turbine blades (Barclay et al. 2007, Arnett et al. 2008a).

The low number of bat call sequences recorded at the abandoned mine openings suggest they are not major hibernacula. However, given the impacts of WNS such low levels of activity are not unsurprising, even if the sites were important hibernacula. Although this activity is generally low and would not qualify for the criteria set out by Randall (2011) for designating swarming sites, this current work was carried out post-white nose syndrome which almost certainly reduced the overall magnitude of bat activity recorded. Further, Randall's work was carried out directly at the entrances of underground sites where activity is highest as the animals interact, whereas the detector at Smithfield was placed on a forest edge near presumed entrances and therefore activity may be lower since it is not directly at the swarming site entrance. Despite this, the activity at the Brookfield and Kemptown AMO's suggest that they are not currently major autumn swarming sites for bats. The Smithfield AMO had the highest level of bat activity recorded of all three study areas sampled in this study and the seasonal trend of increasing activity fits the pattern of increased activity at swarming sites in the period of the end of August and early September that begins to decrease around the middle of September (Burns unpublished data; Tutty 2006). These data are more suggestive of the site being a swarming site and may also potentially be a hibernaculum. Alternatively, this site may not represent a swarming site but may be situated along a migration corridor for bats to other travel among swarming sites which may explain the trend in bat activity following the patterns known for the autumn swarming season. Further work would be required to assess the importance of this site as an autumn swarming site, migration corridor or over-wintering site (hibernaculum).

Recommendations

1. *Post-construction monitoring* – A rigorous post-construction monitoring program, appropriately designed to account for searcher efficiency and scavenger rates, needs to be established to quantify bat fatality rates. These surveys should be conducted over an entire season (April to October), but especially during the fall migration period (mid-August to late-September) for at least two years. Should fatalities occur, they should be investigated with respect to their spatial distribution relative to wind turbines, turbine lighting, weather conditions, and other site specific factors, and should trends be identified, operations should be adjusted in an adaptive management framework. In this manner, mitigation can be focused on any identified high risk areas/infrastructure to minimize future fatalities. These data are essential for assessing potential risks at future developments in the region; therefore it is critical that the results of these surveys be appropriately reported.

2. *Retain key bat habitat* – Key bat habitat should be identified and retained in the project area to continue to support existing summer colonies/populations of bats. Retention of these bat habitat resources should be in a spatial manner that provides connectivity in the project area and with the larger landscape to ensure foraging and roosting areas remain well connected. Consideration of the potential for fragmentation of bat habitat resources should also be taken with regards to the development of road networks and transmission lines in the project area.

3. *Minimize project footprint* – To the extent possible, minimize the direct loss of bat habitat resources (e.g., wetlands, riparian areas, mature deciduous-dominated forest stands), and minimize the extent of bat habitat impacted by the development.

4. *Return to pre-project state upon decommissioning* – The project area should be returned to the state that existed prior to the development of the site once the project is decommissioned. This should include planning to ensure the continuity of forest stand succession to provide and maintain appropriate roosting areas well into the future as existing roost trees die off. Retention of forest stands of a range of ages will provide mature trees for bat roosting resources in the future.

5. *Develop an operations fatality mitigation plan* – Recent experimental case studies in Alberta and the United States have demonstrated dramatic reductions in bat fatalities at operational wind energy facilities can be made by changing operational parameters during the peak fatality period (Baerwald et al. 2009, Arnett et al. 2010). These include changes to when turbine rotors begin turning in low winds via alterations to wind-speed triggers and blade angles to lower rotor speed. These studies have found decreases in bat mortalities ranging from 44% to as high as 93% reductions on a nightly basis at relatively low cost to annual power production loss, at approximately ≤ 1%. This plan should be adaptive as operations continue through time and be in place prior to operations commencing such that if any bat mortalities be observed at the site once operational, the plan can be implemented immediately.

6. *Remain up to date with current research* –There is presently an abundance of on-going research aimed at determining the impacts of wind energy developments on populations of bats. Other studies are focusing on investigating the efficacy of potential mitigation measures, including the effects of weather on bat activity patterns and collisions with wind turbines, and possible bat deterrents (including acoustic and radar emissions). As these are active areas of research, it is essential that the most current studies and guidelines are used to guide management decisions and development plans for wind energy projects.

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Bat Species Composition and Activity at the Proposed Dalhousie Mountain Wind Development Site, Nova Scotia

Final Report

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Introduction and Background

Wind generated energy is a relatively new addition to the commercial energy market that is displaying phenomenal growth on a global scale. During the last decade, global wind energy capacity has doubled every three years, about a 30% increase annually (CanWEA 2006). Contrary to past perceptions of the industry, wind power is now modeled as a stable, cost-competitive sector that can substantially contribute to future power generation portfolios. This new stability has come from technological advancements, making the industry more economically competitive, and also from the continuing global demand for renewable energy sources (Andersen & Jensen 2000; Menz & Vachon 2006). In Canada the trend continues with expectations of 10,000 megawatts of wind capacity to be installed by 2010 (CanWEA 2001).

The Atlantic Provinces are poised to substantially contribute to the growth of wind energy in Canada. Objectives for installed capacity in the region are to reach 1,130 megawatts by 2015 (Hornung 2006). In Nova Scotia, wind energy will take a leading role in achieving the requirement for new renewable energy sources to comprise 5% of electricity by 2010 (Hornung 2006). Clearly as wind energy expands in the province, the role of identifying and selecting wind power sites which meet criteria set by government, industry and the public will become increasingly important.

Wind power is commonly cited as a model of an ‘environmentally friendly’ renewable resource because it does not contribute direct atmospheric emissions, has minimal economic expenditure following decommission and uses limited land area for operation (Andersen & Jensen 2000). Despite these environmental advantages, bird and bat mortalities have been documented for several wind generation facilities across the globe (Ahlén 2003; Johnson et al. 2003b; Johnson et al. 2004; Kerns & Kerlinger 2004; Osborn et al. 2000; Young et al. 2003). In comparison to avian fatalities, the documentation and analysis of bat fatalities at wind facilities is relatively recent and is gaining considerable attention.

Bat mortality as a result of collisions with man-made structures is not unique to wind turbines, with reports of bats colliding with such structures as lighthouses, communication towers and buildings dating as far back as 1930 (Johnson et al. 2004). Bat collision mortality from wind turbines first made its way into the media in North America following a large bat kill at a West Virginia wind farm in 2003 (Williams 2003 in Johnson et al. 2004). Since that time there has been many documented bat fatalities at wind development sites. Estimates of bat fatalities are highly variable ranging from less than 3 bats/turbine/year (Johnson et al. 2003a; Johnson et al. 2004) to 20-50 bats/turbine/year (Jain et al. 2007; Kerns et al. 2005; Nicholson 2003). Species composition of collision fatalities is typically comprised of hoary bats (*Lasiurus cinereus*), silver-haired bats (*Lasionycteris noctivagans*), eastern red bats (*Lasiurus borealis*), and big brown bats (*Eptesicus fuscus*), with smaller numbers of eastern pipistrelles (*Perimyotis subflavus*), northern long-eared (*Myotis septentrionalis*) and little brown bats (*Myotis lucifugus*) predominantly in eastern North America.

Occurrence records exist for seven species of bats in Nova Scotia, the same seven species with documentations of fatalities at wind turbine sites listed above (Broders et al. 2003a; van Zyll de Jong 1985). Nova Scotia is close to the northern periphery of the current known range for each of these species, with the exceptions of the northern long-eared and the little brown bat (van Zyll de Jong 1985). These two species, as well as the eastern pipistrelle, are the only bat species with significant populations in Nova Scotia (Broders et al. 2003a; Farrow 2007).

The eastern pipistrelle is a non-migratory bat species found throughout the eastern forests of North America (Fujita & Kunz 1984; Veilleux et al. 2004). This species occurs in very low numbers in southern coastal New Brunswick (Broders et al. 2001) and in 2001, Broders (2003a) discovered the first concentration of eastern pipistrelles in Nova Scotia at Kejimkujik National Park. Subsequent ultrasonic monitoring throughout mainland Nova Scotia confirmed the presence of a significant population of this species in the province, yet indicated restriction of the population to southwest Nova Scotia in the summer (Farrow 2007; Rockwell 2005). The restriction of this population to southwest Nova Scotia suggests that the population of eastern pipistrelles is disjunct, at least during the summer (Broders et al. 2003b; Farrow 2007).

Only the northern long-eared and little brown bat are common in Nova Scotia (Broders et al. 2003a) and they both have distributional ranges that extend into Newfoundland (Grindal & Brigham 1999; van Zyll de Jong 1985). They are therefore likely ubiquitous throughout the province (Broders et al. 2003a). The northern long-eared bat is a forest interior species (Broders et al. 2003a; Henderson 2007; Jung et al. 2004), while the little brown bats is more of a generalist species, associated with forests, as well as human-dominated environments (Barclay 1982; Jung et al. 1999). Both species are year-round residents in the province with over-wintering documented at a number of hibernacula located throughout central Nova Scotia (Garroway 2004; Moseley 2007; Tutty 2006).

The hoary bat, silver-haired bat and eastern red bat, are all migratory species with extensive distributional ranges in North America (van Zyll de Jong 1985). Historically, there have been few occurrence records for these species in Nova Scotia, though several reports of these species flying ashore in Massachusetts and aboard ships off the coast of Nova Scotia in the fall, suggest the possibility of a migratory movement across the Gulf of Maine (Broders et al. 2003a). In 2001, Broders et al. (2003a) recorded greater than 30,000 echolocation sequences from May to September at Kejimkujik National Park and Brier Island, yet fewer than fifteen of these, all in September, were attributed to any of the migratory species. Therefore, it was suggested that there are no significant migratory movements of these species through Nova Scotia and the incidence of individuals of these species during the summer are low (Farrow 2007; Rockwell 2005; Garroway and Broders unpublished data)

Localized over-wintering and reproduction records have been recorded for big brown bats in New Brunswick in low numbers, where their presence was associated with buildings. McAlpine *et al*. (2002) subsequently suggested that the species may exist in that province in low numbers where it is closely associated with human occupied buildings. Taylor (1997) identified 3 big brown bats hibernating in a hibernaculum in Nova Scotia. These findings indicate that the conditions may exist for year round-residency of the species in the province. However, a general lack of evidence for their presence given the increased research effort since Taylor's work suggests that if the species is present in Nova Scotia they are very localized and in very low numbers.

Echolocation is the primary sensory means by which all of these microchiropteran bat species orient themselves and hunt for prey (Fenton 1997; Fenton & Griffin 1997), where they emit vocalizations and analyze the returning echoes created when these sounds encounter objects (Fenton 2003). Instruments sensitive to these frequencies are referred to as bat detectors and allow investigators to record, hear, and even visualize the otherwise inaudible echolocation calls of bats (O'Farrell et al. 1999). Detectors permit identification of many bat species by their calls (Fenton & Bell 1981; O'Farrell et al. 1999; Thomas et al. 1987), assessment of activity patterns, and studies of behavior and habitat relationships of many species of echolocating bats (Fenton 1997). Bat detectors often permit investigators to sample a much larger area than conventional capture techniques and generally yield a more complete inventory of bat species than captures alone (O'Farrell & Gannon 1999).

Project Objective

It is likely that local resident bats will be impacted by the clearing of land to make room for turbines via the loss of roosting and foraging areas. However, it seems likely that if there will be significant direct mortality of bats associated with this project it will occur during the fall migration period (from mid-August until late September/early October); this project was designed to assess this. Therefore, the goal of this study was to provide local data that could be used to make inference on the potential for a wind development at Dalhousie Mountain to cause unacceptable levels of bat mortality. Specifically the objectives were to:

1) Document species composition

2) Determine whether there are abnormally high levels of bat activity at the site. It there is abnormally high bat activity it might indicate that the area represents a migration corridor and warrants further investigation.

Study Area

The proposed Dalhousie turbine site is approximately 340 m in elevation located near the community of Brookland, Pictou County, Nova Scotia. Dalhousie Mountain is situated in the Cobequid Hills ecodistrict theme region and the upland forest cover is primarily composed of sugar maple, yellow birch and American beech and can be intermixed with balsam fir, red spruce and black spruce (Davis & Browne 1996).

Methods

We used Anabat II detection systems to sample the echolocation calls of bats. Each system was deployed at ground level and consisted of an ultrasonic Anabat II detector interfaced to a CF Storage ZCAIM (Titley Electronics Ltd., NSW Australia). The seasonal timing of the sampling period likely corresponded to fall migration activity by migratory species and movement by resident species to local hibernacula. Activity was monitored at three locations (Location 1, 504290 E 5043190 N, Location 2, 503946 E 5049736 N and Location 3, 503810 E 5042461 N; UTM NAD83 Zone 20 format). Detectors were placed along forest edges or forested trails to maximize recordings of bats commuting or foraging in the area. Monitoring began on the evening of 08 August 2007 and was completed on the morning of 7 September 2007 (Location 1: 8 to 16 August; Location 2: 17 to 29 August; Location 3: 31 August to 7 September).

Identification of many bat species is possible because of the distinctive nature of their echolocation calls (Fenton & Bell 1981; O'Farrell et al. 1999). Species were qualitatively identified from echolocation sequences by comparison with known echolocation sequences recorded in this and other geographic regions. In the case of species in the genus Myotis (northern long-eared and little brown bat), we did not identify sequences to the species level, as their calls are too similar to be separated. The calls of silver-haired bats and big brown bats are also very similar and therefore we also grouped these two species together. Identifications were accomplished using frequency-time graphs in ANALOOK software (C. Corben, www.hoarybat.com). An anabat echolocation file that approximates a call sequence, defined as a continuous series of greater than two calls (Johnson et al. 2004), was used as the unit of activity.

Results

A total of 461 bat echolocation call sequences were recorded over thirty detector nights at the three sample locations (Table 1). All of the recorded sequences except for one were attributable to *Myotis* species, with a single recorded call sequence that was consistent with characteristics of a big brown bat or silver-haired bat (recorded at 02:17 AM at location 2 on the evening beginning on 17th August). Only 12 of the *Myotis* call sequences were recorded at location 3 and 80 of the call sequences were recorded at location 1. The remaining 368 Myotis echolocation sequences and the single big brown sequence were recorded at location 2. The average number of sequences per night at Dalhousie Mountain (all locations) was 16 (SD = 20) during the sampling period. For context, in 129 nights of monitoring along 5 forested edges from June-August 1999 in the

Greater Fundy National Park Ecosystem the average number of sequences per night was 27 (SD = 44) (Broders unpublished data). The level of activity found at Dalhousie Mountain was less than the average nightly activity level found during the summer in southern New Brunswick.

Although we did not distinguish the calls of Myotis species, the majority of the Myotis sequences recorded at both locations likely represent the little brown bat for at least two reasons. First, the northern long-eared has low intensity calls and is thus not recorded as well as the little brown bat (Broders et al. 2004). Secondly, the northern long-eared bat is a recognized forest interior species (Broders et al. 2006; Jung et al. 1999; Lacki & Hutchinson 1999; Sasse & Pekins 1996) and is less likely to use open areas for foraging and commuting (Henderson 2007).

Discussion

The majority of the recorded echolocation sequences at the proposed Dalhousie Mountain wind development site were calls of the two Myotis species known to occur in Nova Scotia, the little brown bat and the northern long-eared bat. This was expected as these two species are the most common species in the province and are two of only three species of bats with significant populations in Nova Scotia (Broders *et al.* 2003b). We recorded only one call sequence of a species other than a Myotis (either a big brown bat or a silver-haired bat) both of which are rarely encountered in Nova Scotia (Broders et al. 2003a; Taylor 1997) and therefore, it was expected that these species would not be well represented in this survey. The majority of the Myotis calls are likely attributable to the little brown bat because it has calls that are more easily recorded (higher intensity;

Broders *et al.* 2004, Miller and Treat 1993) and is a generalist species that forages in a variety of habitats, including open areas and over water (Anthony & Kunz 1977; Lacki & Hutchinson 1999). Both species may be potentially impacted by the loss of roost sites (tree cavities) and foraging areas when sites are cleared of forest cover for developments if suitable roost trees were situated in the area.

Myotis bats are relatively new to the list of bat fatalities at wind turbine sites. The first large scale wind developments were located in western North America typically in agricultural and open prairie landscapes (reviewed in Johnson 2005). Fatalities of these non-migratory species were largely absent from these sites. It is likely that this reflects the location of these wind development sites in open non-forested landscapes. These species may be under represented in the Chiropteran fauna in these open areas due to an association with forested landscapes. More recently, evidence of Myotis fatalities from collisions with wind turbines have been noted at sites in forested areas in eastern North America (Jain et al. 2007; Johnson 2005; Kerns & Kerlinger 2004).

Another explanation for the paucity of Myotis species from fatalities is that they tend to fly close to the ground (Broders 2003), and thus are less impacted by the rotating blades. A study of bat activity at potential turbine sites prior to construction is currently in progress in the eastern United States where bat activity is being monitored at three heights, ground level (1.5 m), 22m and 44m (Arnett et al. 2006). Preliminary results from this study show that Myotis activity is greater at ground level compared with activity at heights of 22 and 44 m. These findings may lend support to the suggestion that Myotis bats tend to fly lower to the ground but do not account for the relatively high numbers of Myotis fatalities found at wind turbine sites on forested ridges.

To date, very little is known about the real implications of wind developments on populations of small, non-migratory bat species. Little is known about the flight behaviour and dynamics of movements (e.g., height agl of travel and travel routes) of bats to/from hibernacula sites during their regional migration in the fall and spring, and their behavior once they arrive at the hibernacula but before they begin to hibernate. Further, bats arrive at hibernacula 1-2 months before the onset of hibernation when courtship and copulation is believed to occur (Fenton 1969). Exploratory research in Nova Scotia in 2006 indicates that bats are moving significant distances in the fall during swarming (reproductive period) (Poissant and Broders, unpublished data). During this time the majority of bats present during swarming activity at night did not roost in the hibernacula during the day. Additionally, the incidence of recapture was exceptionally low (<1%) and 4 bats with radio transmitters could not be located after release suggesting they moved significant distances from the hibernacula where they were captured. Movement data in other areas of eastern North America indicate bats moved in excess of 200 km between hibernacula within a year and up to 500 km between years (Davis & Hitchcock 1965; Fenton 1969) which demonstrates large scale movements by resident hibernating species.

With data lacking on the activities and movements of regional hibernators like the little brown and northern long-eared bat, it is difficult to predict the specific effects that a wind development will have on local populations of these bats. The high number of fatalities of non-migratory bats at turbine locations on forested ridges in eastern North America suggests that it is an important issue requiring continued research attention and monitoring in the future.

No calls were recorded for the other migratory species (hoary or eastern red bats) at any of the detector sites. Location records for all of these migratory species in the province are patchy with off-shore accounts suggesting only occasional migratory movements through the province (Broders et al. 2003b; van Zyll de Jong 1985). Thus, the lack of recorded call sequences from migratory species was not unexpected. Although the survey did not take place over the entire migratory period, it was approximately 4-weeks long and it is therefore expected that if the area was an important migration corridor we should have detected it.

Recently it has been hypothesized that the size (height) of wind turbines plays a key role in bat fatalities. An on-going study by Arnett *et al.* (2006) that is assessing the height of recorded bat activity at sites prior to construction of turbines, has found that migratory bat species are flying at the highest sampled heights (44m and above). These heights put these species at the greatest risk of collision with rotor blades and may explain high mortality at certain sites. In another study, Barclay *et al.* (2007) compiled data from published and unpublished reports regarding bat (migratory and year-round resident species) and bird mortality at 33 wind energy sites in North America. They provided evidence that suggests that the increased size of new turbines at installations (i.e. height of turbines has increased) may be impacting the number of bat mortalities. Turbines with towers exceeding 60 m potentially resulted in a disproportionately high number of mortalities compared to towers shorter than 60 m. However, the authors noted that turbine height (and therefore size) alone does not explain all of the documented differences in the number and composition of bat species mortalities.

We only used ground based echolocation sampling which may have affected our ability to detect calls by high-flying species if they did move through the area. The range of detection of the systems is dependent on a number of factors, including the frequency and orientation of the call source. However, at its maximum range for an intense, low-frequency call it likely does not exceed 15 to 20 m. Some migratory bats may be flying at heights that exceed 100 m, outside of the range of our ability to detect them but within the area that puts them at risk of collisions. However, our expectation is that if there were any significant numbers of long distance migrants moving through the area we would detect a portion of them with our sampling design. Given the results of other research we have been doing in the region (which suggests few individuals of these species are present), and the fact that we recorded only one echolocation sequence with characteristics consistent with one of the long-distance migrants in this survey it is unlikely that there was any significant amount of activity of these species in the study area.

It is likely that many design and site-level differences determine fatality events as well as various aspects of bat behaviour and movements during the fall swarming and migration period although information on these phenomena are poorly understood (Holland 2007). For example, it is not known if bats actively echolocate when migrating (either locally or long-distance) and the role of landmarks (natural or artificial) as visual cues for swarming and/or migration are also not understood (Cryan & Brown 2007). It is also not known if certain bat species routinely and predictably migrate at certain heights and routes (specific to a region or site) nor is it known if there is large variation in the number of migrants passing through an area from year to year (Barclay et al. 2007;

Johnson et al. 2003a). Stochastic weather factors that vary spatially (regionally from topography) and temporally (in frequency) may also contribute to bat fatality events in an unpredictable manner. In particular, low barometric pressure, low relative humidity and low wind velocities (conditions associated with the passing of storm fronts in an area) have been shown to be associated with high bat mortality events (Erickson et al. 2003; Kerns et al. 2005). Therefore pre-construction activity surveys may be limited in their ability to detect and predict migrating bats moving through an area and thus unexpected mortalities may be found once turbines have been installed and are on-line.

Conclusions

Migratory species of bats have received the greatest attention because they make up the large majority of fatalities at existing wind turbine developments. Past evidence (Broders et al. 2003b), as well as the results of this survey, suggest that there is likely no significant movements of migratory bats species (hoary, red, silver-haired bats) and big brown bats through the region. Although we cannot rule out the possibility that there will be mortality events associated with this development, we have found no evidence with our study that the proposed structures will indeed cause significant direct mortality of long distance migrants, and this is supported by other research in the region that suggests that the abundance and distribution of these species in the province is small.

Bat activity recorded at the proposed site was dominated by Myotis species (little brown bat and northern long-eared), which typically forage at heights below the level of turbine blades. Because the proposed Dalhousie wind development is located in a forested area and bat mortalities have recently been noted at other forested wind developments in eastern North America, their may be a risk of mortality of Myotis bats at this site. Little is known, however, about how these bats interact with turbines and the impact of turbines on their populations may become of concern in the future.

There are a number of significant hibernacula in northeastern Nova Scotia where thousands of bats congregate for courtship and spend the winter months. We know little about the dynamics of the spatial and temporal movement patterns of bats from summering areas to hibernacula and among hibernacula (e.g. are they following specific corridors? Are spatio-temporal aspects of movements in response to particular weather patterns? etc.). Without this information it is difficult to be certain that the development will not impact bats during this time. With our study we have found no evidence to suggest that significant numbers of bats are moving through this area during the migratory period (i.e., no evidence that it is a migration corridor). Therefore, although we cannot rule out the possibility that there will be significant direct mortality associated with the development, we found no evidence to suggest there would be.

To date, there is no established link between pre-construction surveys and post-installation mortalities. Presently there are a number of studies aimed at determining the impacts of wind turbines on bats (e.g. Baerwald and Barclay in southern Alberta) and others are trying to link pre-construction activity with resulting bat mortalities following construction in order to predict relative risk of installation at sites as well as potential fatalities. In response to these concerns, we are making the following recommendations for this proposed project.

Recommendations

- Conduct post-construction fatality searches, ideally for an entire season (April to October), but especially during the fall migration season from mid-August to late-September to fully understand temporal patterns of fatalities. Standardized methods for these searches, including the necessary corrections for scavenging losses and searcher efficiency, can be found in the literature. These data are essential for assessing potential risks at future developments in the region.
- Remain up to date with current research on bats and wind energy developments. There is presently an abundance of research aimed at determining the impacts of wind energy developments on populations of bats. Studies focus on a number of potential mitigation methods, including the effects of weather on activity patterns and collisions, various mitigation treatments (such as turning off turbines when wind speeds are low) or possible deterrents (including acoustic and radar emissions).

Appendix A

Table 1. Number of echolocation call sequences by species group recorded per night at three locations at the proposed Dalhousie Mountain Wind Development Site, Pictou County, Nova Scotia.

	Myotis*				BBB/SHB**	Total for
Evening of	Loc. 1	Loc. 2	Loc. 3	Total	Loc. 2	all species
8-Aug-07	2	n/a	n/a	2	0	2
9-Aug-07	8	n/a	n/a	8	0	8
10-Aug-07	5	n/a	n/a	5	0	5
11-Aug-07	4	n/a	n/a	4	0	4
12-Aug-07	13	n/a	n/a	13	0	13
13-Aug-07	9	n/a	n/a	9	0	9
14-Aug-07	2	n/a	n/a	2	0	2
15-Aug-07	15	n/a	n/a	15	0	15
16-Aug-07	22	n/a	n/a	22	0	22
17-Aug-07	n/a	17	n/a	17	1	18
19-Aug-07	n/a	93	n/a	93	n/a	93
20-Aug-07	n/a	29	n/a	29	n/a	29
21-Aug-07	n/a	30	n/a	30	n/a	30
22-Aug-07	n/a	45	n/a	45	n/a	45
23-Aug-07	n/a	30	n/a	30	n/a	30
24-Aug-07	n/a	2	n/a	2	n/a	2
25-Aug-07	n/a	23	n/a	23	n/a	23
26-Aug-07	n/a	15	n/a	15	n/a	15
27-Aug-07	n/a	42	n/a	42	n/a	42
28-Aug-07	n/a	32	n/a	32	n/a	32
29-Aug-07	n/a	10	n/a	10	n/a	10
30-Aug-07	n/a	n/a	2	2	n/a	2
31-Aug-07	n/a	n/a	1	1	n/a	1
1-Sep-07	n/a	n/a	4	4	n/a	4
2-Sep-07	n/a	n/a	2	2	n/a	2
3-Sep-07	n/a	n/a	1	1	n/a	1
04-Sep-07	n/a	n/a	0	0	n/a	0
05-Sep-07	n/a	n/a	0	0	n/a	0
06-Sep-07	n/a	n/a	2	2	n/a	2
Total	80	368	12	460	1	461

* Includes the little brown bat (*Myotis lucifugus*) and the northern long-eared bat (*M. septentrionalis*).
**BBB/SHB is big brown bat (*Eptesicus fuscus*) or silver-haired bat (*Lasionycteris noctavigans*)
n/a are nights not monitored at a location for bat activity

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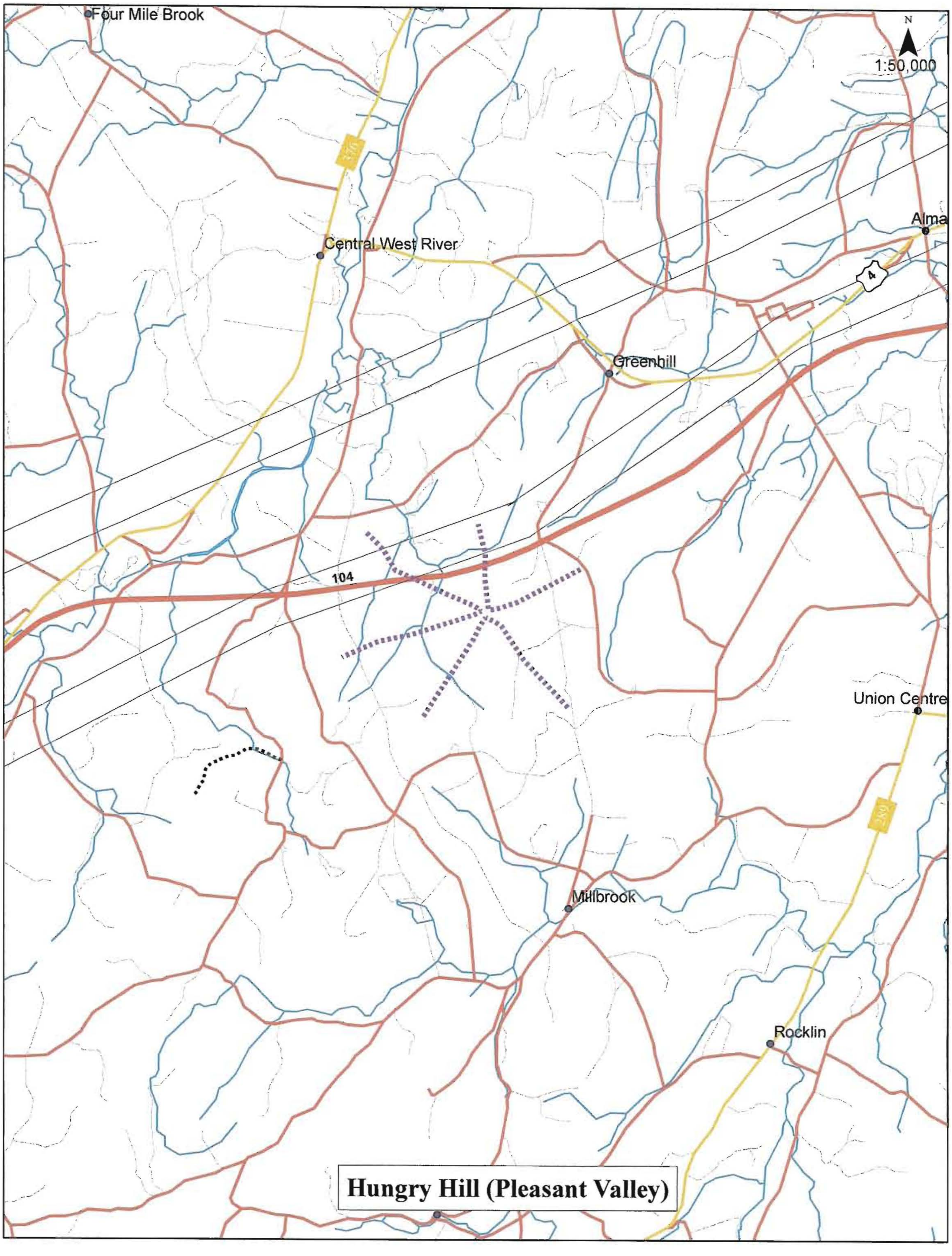
Appendix J

Mainland Moose PGI Study

Moose Pellet Survey
Proposed Wind Farm Hungry Hill, Pictou County

The following project was set up and conducted by Jody Hamper in the fall of 2011. These transects were set up using aerial photos and GIS maps showing the different stand and land types.

This areas' stands ranged from overmature down to 10-15 year old cutovers. There were many waterways crossed over. These transects all started on top of a hill and ran down the sides of the hill.


Four Mile Brook
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Union Centre
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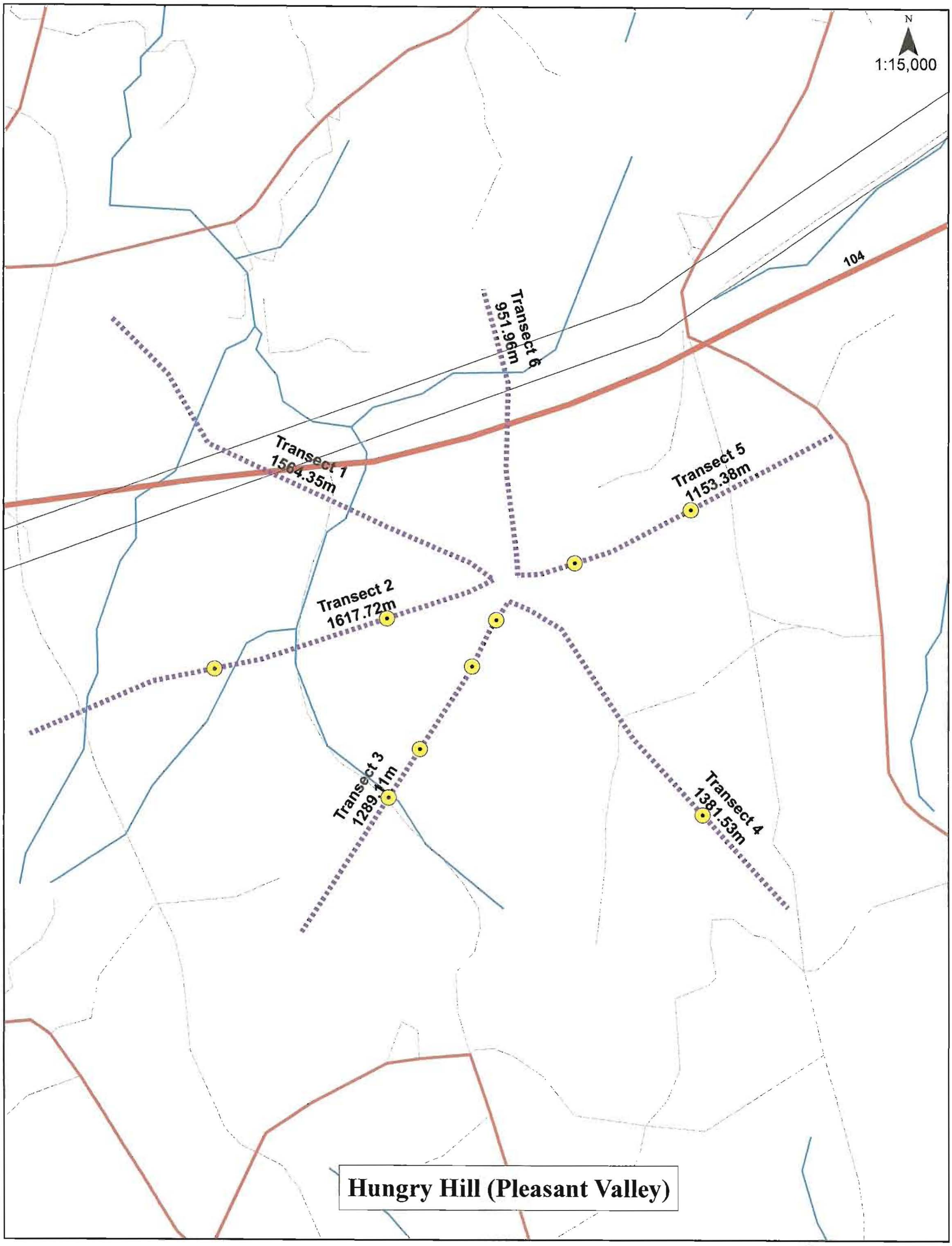
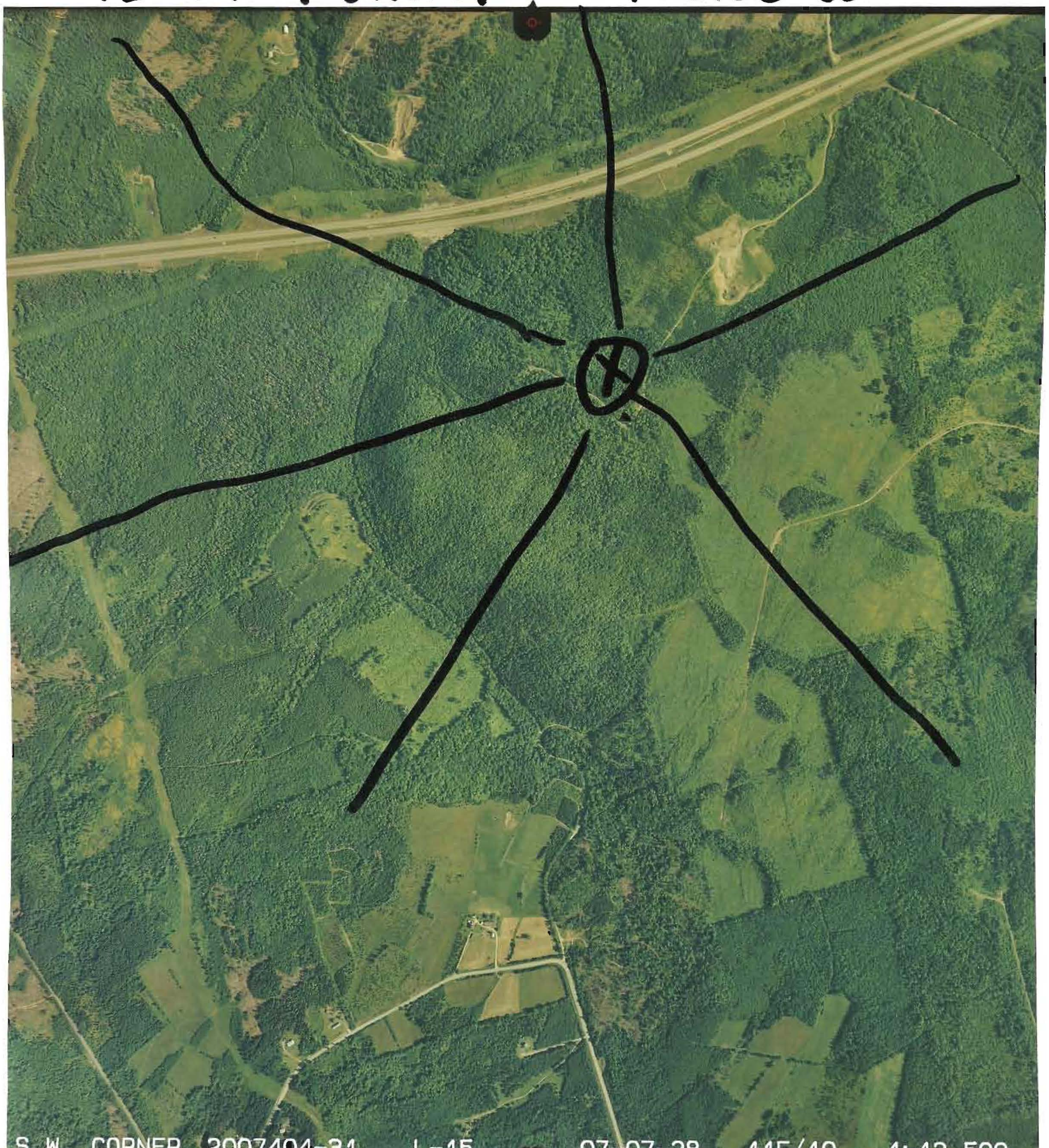
Millbrook
Rocklin
Hungry Hill (Pleasant Valley)



*all deer, NO moose

PLEASANT VALLEY PICTOU CO.



Appendix K

Pictou Municipal Wind Turbine Bylaw

Municipality of the County of Pictou
Land Use Bylaw

Adopted by Municipal Council on September 10, 2007

I acknowledge receipt of this Land Use Bylaw, dealing with Wind Energy Developments, adopted at a meeting of Municipal Council held on September 10, 2007.

I have reviewed the documents pursuant to Section 208 of the *Municipal Government Act* and have not determined that the documents fall within any of the categories requiring approval listed in subsection 208(3), therefore the documents are not subject to the approval of the Minister of Service Nova Scotia and Municipal Relations.

Dave Smith
Assistant Provincial Director of Planning

Dated: OCT 1 2007

MUNICIPALITY OF THE COUNTY OF PICTOU

Land Use Bylaw

Wind Energy Developments

August 2007

Table of Contents

Land Use By-law

1. TITLE AND PURPOSE

TITLE

1.1. This By-law shall be known and may be cited as the Land Use By-law for the Municipality of the County of Pictou.

PURPOSE

1.2. The purpose of this By-law is to carry out the purpose and intent of the Municipal Planning Strategy in accordance with the provisions of the Nova Scotia Municipal Government Act (Chapter 18, Acts of 1998) as amended, by regulating the development of wind turbines. This By-law shall apply to the Municipality of the County of Pictou shown on Schedule "A", Zoning Map.

1.3. This By-law does not exempt any person from complying with other by-laws or regulations in force within the Municipality of the County of Pictou or from obtaining any license, permission, permit, authority or approval required there under. Where any provisions of this By-law conflicts with those of any other Municipal, Provincial or Federal regulation, by-law or code, the more stringent requirement shall prevail.

2. ADMINISTRATION

DEVELOPMENT OFFICER

2.1. This By-law shall be administered by the Development Officer appointed by the Council of the Municipality of the County of Pictou, and the Development Officer shall issue Development Permits under this By-law.

ACTING DEVELOPMENT OFFICER

2.2. In the absence or incapacity of the Development Officer, the Acting Development Officer appointed by Council shall act in the Development Officer's stead.

REQUIREMENT FOR DEVELOPMENT PERMIT

2.3. No person shall undertake, or cause or permit to be undertaken, any wind turbine development in the area to which this Land-Use By-law applies unless a Development Permit has been obtained in relation to such development from the Development Officer or Acting Development Officer, as appointed by Council.

NO PERMIT REQUIRED

2.4. A Development Permit is not required for any development except for wind turbine development.

REQUIREMENT FOR APPLICATION

2.5. Every person wishing to obtain a Development Permit must submit an application for such Development Permit to the Development Officer in the form prescribed from time to time by Council.

CONTENTS OF APPLICATION

2.6. Every application for a Development Permit shall be accompanied by a plan drawn to an appropriate scale and showing:

2.6.1. the true shape and dimension of the lot to be used or upon which the development is proposed;

2.6.2. the proposed location, height and dimensions of any building or structure for which the permit is applied and the location information shall include measurements of the lot frontage and front, side and rear yards;

2.6.3. the location of every building or structure already constructed, or partly constructed, on such lot and the location of every building or structure existing upon abutting lots;

2.6.4. the location of any watercourse and location of any existing or proposed building or structure in relation to the watercourse; and

2.6.5. other such information as may be necessary to determine whether or not the proposed development conforms with the requirements of this By-law.

SURVEY OF LANDS

2.7. Where the Development Officer is unable to determine whether the proposed development conforms to this By-law, the Development Officer may require that the plans submitted under Section 2.6 be based upon an actual survey by a Nova Scotia Land Surveyor.

SIGNATURES

2.8. The application for a Development Permit shall be signed by the owner of the lot, or by his or her authorized agent, and shall set forth in detail the current and proposed use of the lot and each building or structure, or part thereof, together with all information necessary to determine whether or not the proposed development conforms to the requirements of this By-law.

ISSUANCE OF A DEVELOPMENT PERMIT

2.9. The Development Officer shall not issue a Development Permit unless:

2.9.1. the proposed development is in conformance with this By-law; or

2.9.2. the Development Officer has granted a variance from the terms of this By-law, pursuant to the Municipal Government Act and the time for appeal has elapsed or the appeal has been disposed of and the development is otherwise consistent with the requirements of this Land Use By-law.

DEVIATIONS

2.10. No person shall deviate, or allow deviations to be made, from the description of the proposed development that is contained in the Development Permit, unless the developer has obtained a new Development Permit from the Development Officer.

RIGHT OF ENTRY

2.11. Pursuant to the Municipal Government Act, the Development Officer, at all reasonable times, may enter into or upon any property within the area to which this Land Use By-law applies for the purposes of any inspection necessary in connection with the administration of this By-law.

LAPSE OF PERMITS

2.12. Every Development Permit issued under this By-law shall automatically lapse, and become null and void, if the development to which it relates has not commenced and three years has passed since its issuance.

REVOCATION OF DEVELOPMENT PERMIT

2.13. The Development Officer may revoke a Development Permit where the development permit was issued based upon false or mistaken information.

DECISION IN WRITING

2.14. Any decision of the Development Officer to refuse the issuance of a Development Permit shall be given by written notice served by ordinary mail, whereas any decision to revoke a Development Permit shall be given by written notice served by registered mail, and such revocation shall become effective on the third business day after it was sent.

VIOLATIONS

2.15. In the event of any alleged contravention of the provisions of this By-law, the Municipality of the County of Pictou may take action as outlined in the Municipal Government Act, as amended from time to time.

EFFECTIVE DATE

2.16. Pursuant to the Municipal Government Act, this By-law shall take effect on the date a notice is published in a newspaper, circulating in the Municipality, informing the public that the Planning Strategy and its implementing Land Use By-law are in effect.

COST OF NOTICE FOR A VARIANCE

2.17. Pursuant to the Municipal Government Act, where a variance from the requirements of this By-law has been granted or refused, the Development Officer shall give notice to the persons required and in the manner prescribed by the Municipal Government Act, such notice to be served by ordinary mail, and the Municipality shall recover from the applicant the cost of giving such notice.

3. INTERPRETATION

ZONES

3.1. For the purpose of this By-law, the whole of the Municipality of the County of Pictou shall be placed in the General Development Zone, the boundaries of which are shown on the attached Schedule "A". This zone is also referred to by the symbol "GD".

ZONING MAP

3.2. The attached Schedule "A" is titled "Zoning Map" and forms a part of this By-law.

INTERPRETATION OF CERTAIN WORDS

3.3. In this by-law, words used in the present tense include the future; words in the singular number include the plural; words in the plural include the singular number; the word "used" includes "arranged", "designed" or "intended to be used"; the word "shall" is mandatory and not permissive. All other words and phrases carry their customary meaning except for those defined in Part 5 of this By-law, entitled "Definitions".

STANDARDS OF MEASUREMENT

3.4. The Metric System of Measurement is used throughout this By-law and in all cases represents the required standard. Imperial measurements are approximate only, for convenience only, and are not to be regarded as precise.

VARIANCE FROM MINIMUM REQUIREMENTS

3.5. In accordance with the requirements of the Municipal Government Act, the Development Officer may not grant a variance for the size of yards (setback requirements) provided the

- variance violates the intent of this Land-Use By-law;
- difficulty experienced is general to properties in the area; or
- difficulty experienced results from an intentional disregard for the requirements of this Land-Use By-law.

4. GENERAL DEVELOPMENT (GD) ZONE

PERMITTED DEVELOPMENTS

4.1. All developments are permitted in the General Development (GD) Zone.

REQUIREMENTS

4.2. No requirements apply to any development except wind turbine development which is subject to the following:

Utility Scale Wind Turbines

- Minimum setback from residences, except residences located on the same lot as the wind turbine, shall be 600 metres (1968.5 feet). There is no setback requirement from residences located on the same lot.
- Minimum setback from all property lines shall be one times the height of the turbine.
- Minimum setback from the boundary of a public road shall be 300 metres (984.3 feet);

Domestic Wind Turbines

- Minimum setback from all adjacent lot boundaries shall be one times the height of the turbine.

EXPANSION OF WIND TURBINE DEVELOPMENT

4.3. Notwithstanding the setback requirement from a residence contained in Section 4.2, where a residence is constructed within the setback distance of utility scale wind turbine development erected after the effective date of this Strategy, the wind turbine development may expand. The setback requirement for any expansion shall be the distance from the wind turbine development established after the effective date of this By-law to any residence constructed subsequent to the wind turbine development.

SETBACK ON LAND LEASED FOR WIND TURBINE DEVELOPMENT

4.4. The setback requirement from a property line contained in Section 4.2 is waived where wind turbine development occurs on land where the adjacent property is subject to a lease for that purpose for a term of 19 years or greater. The setback requirement shall apply to any property which is not leased for wind turbine development.

5. DEFINITIONS

For the purposes of this By-law all words shall carry their customary meaning except for those words and phrases defined in this Part.

5.1. **Domestic Wind Turbine** means a wind turbine which has a rated capacity of not more than 200 Kilowatts (kW) and which is intended primarily to reduce on-site consumption of utility power;

5.2. **Height of Wind Turbine** means the distance from ground level to the height of a rotor blade in a vertical position;

5.3. **Public Road** means:

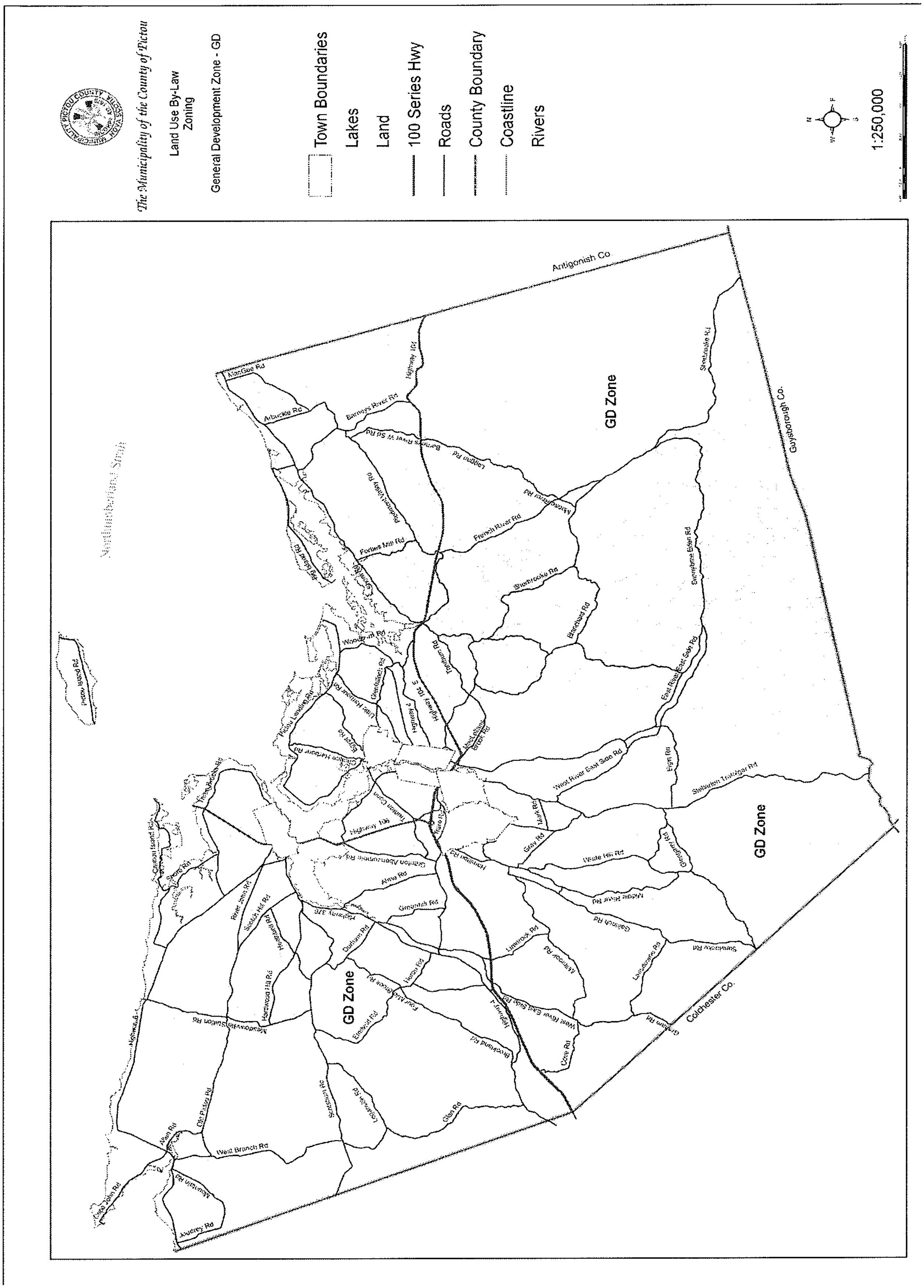
5.3.1. any road or highway owned and currently maintained by the Department of Transportation and Public Works excluding designated controlled access highways pursuant to Section 21 of the Public Highways Act, or

5.3.2. any road owned and currently maintained by the Municipality of the County of Pictou;

5.4. **Utility Scale Wind Turbine** means a device for converting wind power to produce electricity of at least 200 Kilowatts (Kw);

5.5. **Residence** means a structure used for human habitation, whether for seasonal or permanent occupancy, and is assessed for residential taxation purposes on the Municipality of the County of Pictou's annual assessment roll.

5.6. **Watercourse** means the bed and shore of every river, stream, lake, creek, pond, spring, lagoon or other natural body of water, and the water therein, whether it contains water or not.


The Municipality of the County of Pictou
Land Use By-Law
Zoning
General Development Zone - GD
Town Boundaries
Lakes
Land
100 Series Hwy
Roads
County Boundary
Coastline
Rivers
1:250,000
Antigonish Co.
Guysborough Co.
Colchester Co.
GD Zone
GD Zone
GD Zone

THIS IS TO CERTIFY that the foregoing is a true copy of a Bylaw duly adopted by the Municipal Council for the Municipality of the County of Pictou at a duly called meeting of the Council held on the 10^{th} day of September, 2007.

Brian Cullen

BRIAN CULLEN, MUNICIPAL CLERK

First Reading	August 7, 2007
Notice of Public Hearing	August 20, 2007 (The News)
	August 22, 2007 (Pictou Advocate)
	August 27, 2007 (The News)
	August 29, 2007 (Pictou Advocate)
Public Hearing	September 10, 2007
Second Reading	September 10, 2007

Appendix L

COMFIT Approval and Certification

NOVA SCOTIA
Energy
Office of the Minister

Suite 400, 5151 George Street, PO Box 2664, Halifax, Nova Scotia, Canada B3J 3P7 • Telephone 902 424-7793 Fax 902 424-3265 • www.gov.ns.ca/energy

April 13th 2012

Rueben Burge
Affinity Renewables (Nova Scotia SPCA)

Dear Affinity Renewables:

Re: Community Feed-In Tariff Approval

On behalf of the Nova Scotia Department of Energy, I am pleased to present you with your Community Feed-In Tariff (COMFIT) approval for your large wind facility near New Glasgow Nova Scotia (Project Number 184). Attached to this letter is a certificate indicating your approval.

In order to maintain your COMFIT approval, you must comply with:

(1) The specifications of the proposed project as outlined in your COMFIT application dated September 19, 2011; any alterations to your proposal (e.g., technology type, ownership structure, specifications, etc.) requires prior approval by the Department. Alterations must be submitted in writing for approval.

(2) The Electricity Act and the Renewable Electricity Regulations. Amongst other things, section 34 of the Renewable Energy Regulations requires you to submit a report to the Department of 30 days of your project's connection to the distribution grid. Failure to do so may result in revocation of your COMFIT approval.

As a condition of your approval, you must comply with any conditions set by Nova Scotia Power Incorporated.

As a further condition of approval, you must complete:

- An Environmental Assessment

- 25 Community Members: As per the *Renewable Electricity Act Regulations* S.20 (2) (e), your Not for Profit is required to have 25 community members. COMFIT directive 006 establishes a timeline of one year from approval to achieve this.

- Community Consultation: Two public information sessions must be held prior to the construction of the project. Results of the information sessions must be submitted to the Department of Energy, outlining any community concerns with the proposed project. If there are community concerns, additional consultation may be required.

- Project Time Line and Milestones: As per S. 30 of the *Renewable Electricity Act and Regulations,* a detailed project schedule including timelines and key milestones must be submitted to the Department of Energy within 60 days of approval. You will be required to report on the progress of the project, in accordance with your submission.

- Wind Energy Mapping: The Department of Energy and Department of Natural Resources are endeavoring to map wind development within the province. All approved projects are required to submit the appropriate geographic information system data, and work collaboratively to address any recommendations emerging from an assessment of the cumulative impact of wind energy in the province. More information is provided in the guidance note.

These conditions are not an exhaustive list of the permits and approvals needed for your project. COMFIT approval does not supersede any additional regulations, permits or approval required by other government (or agency) authorities as your project unfolds. Projects must still comply with all other conditions and milestones as set by government entities (or agencies) and Nova Scotia Power Inc. Failure to meet additional requirements may result in revocation of your COMFIT approval, even though they may not be an explicit condition at this time.

A COMFIT guidance note is attached with information pertaining to the implementation of your project. The guidance note is not a condition of approval, but information that may be useful to you as you implement your project. As per Directive 004: Annual Progress reports, the Department looks forward to receiving your annual reports on how COMFIT proceeds have assisted in meeting community sustainability goals.

If you have any questions about your approval, or if we can be of further assistance to you, please call COMFIT Clerk at (902) 424-5293 and a representative will be happy to assist you.

Yours Sincerely,

Charlie Parker

Charlie Parker
Minister

Enclosure

№. Project 184

Community Feed-In Tariff Approval

This certifies that *Affinity Renewables* has received Community Feed-In Tariff Approval by the Nova Scotia Department of Energy for a 6MW large wind project near New Glasgow, Nova Scotia. Approval may be revoked should a project not meet the requirements of the Community Feed-In Tariff program or deviate from details specified in its Community Feed-In Tariff application.

NOVA SCOTIA
Department of Energy

Charlie Parker
Minister

№. Project 184

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NOVA SCOTIA
Department of Energy

Charlie Parker
Minister