Appendix 4: BIRD REPORTING

Draft Protocol for the Baseline Spring Migration Bird Survey at the Atwoods Brook Wind Project

Andrew G. Horn

This document summarizes the planned baseline studies to assess spring bird migration at the site of two proposed wind turbines at Atwoods Brook, Nova Scotia.

Determining Site Sensitivity and Level of Concern

Background information

Background information is still being collected from the various sources suggested in EC 2007b. While little information is available for the immediate surroundings of the proposed turbine sites, much information is available from nearby areas, particularly:

- Cape Sable Island, which is covered intensively by birders year-round
- neighboring atlas squares to the east and west, each surveyed for > 20 hours
- environmental monitoring at the Pubnico Wind Farm (~13 km away on broadly the same landform)

These sources of information are still being searched, so this protocol is based mainly on the background knowledge of the author.

Site sensitivity

Following EC 2007b, the site is near to locations that would fit the criteria of a Very High level of sensitivity, because they have:

Species at Risk (notably Piping Plover (breeds on Cape Sable Island ~12 km away) and Roseate Tern (breeds on The Brothers islands ~7km away))

Large colonies or staging areas (Cape Sable Island has tern colonies and heronries, and is a significant staging area for several species, notably Brant)

Important Bird Areas (Cape Sable Island is recognized as an Important Bird Area)

Migration corridors (the nearby peninsulas and islands such as Cape Sable Island, Pubnico Point, Baccaro (17km) and the Blanche Peninsula (21km) are known to concentrate migrants)

A likely mitigating factor is that the turbine sites are set 2 km from the nearest coast, so that, at a local scale (kms), the sites are not on a peninsula. Also, many of the sensitive species at these nearby sites, such as Piping Plover, Roseate Tern, and Brant, are strongly associated with marine environments and unlikely to cross or use sites so far inland.

Nonetheless, at a landscape scale (tens of kms) the turbine sites are on the same landform as the peninsulas listed above. Also, birders concentrate their efforts on those peninsulas, so the use of more inland sites is less well known. Finally, there is habitat near the sites that may support several listed species reported in adjacent atlas squares (notably bogs for Olive-sided Flycatchers and Rusty Blackbirds).

Thus the precautionary approach is to consider the site as having Very High sensitivity, recognizing that baseline surveys might justify a lower level of sensitivity.

Level of Concern

The size category of the project (2 turbines) is Small, making the Level of Concern (from Table 3 of EC 2007b) Category 4.

Methods

This is a summary of the methods as planned based on the material now at hand. They will be adjusted once the field worker gains familiarity with the site and, if time permits, through consultation with CWS. Ronnie d'Entremont (of Pubnico) will perform the field work, and Andrew Horn (of Halifax) will write the report. Data will be georeferenced and eventually entered into the Wind Energy Bird & Bat Monitoring Database hosted by Bird Studies Canada (http://www.bsc-eoc.org/birdmon/wind/main.jsp).

Each site will be visited approximately 8 times, between dawn and four hours after sunrise, between 15 and May 31. Each visit will include line transects, point counts, and area searches. If vantage points overlooking the site can be found, passage migration counts will also be done (although preliminary fieldwork suggests no such vantage points are available).

Line transects will total at least 2.5 km in length, with their exact configuration to be determined after the initial site visits. Given the small size of the site, the difficulty of the terrain, and the patchiness of the habitat, the transects will likely be laid out in a regular, rather than random, configuration. While walking the transect at a roughly steady rate, the observer will note any species not registered during the point counts (see next paragraph), as well as any birds flying overhead whose flight pattern suggests they are migrants or otherwise making a long-range passage across the site.

Approximately every 250m along each transect, a 5 minute point count will be conducted (10 minutes is recommended in EC 2007a; the time is halved here because the transects are covering the same ground at the same time). Otherwise, the point counts will follow the methods in EC 2007a, including distance sampling; i.e., they will list the number of individuals of each species that are detected within 50m, 50-100m, and > 100m from the observer.

Line transects and point counts will be followed on some days by area searches, which will focus on searching for species or habitats that are suspected of being present but missed by the other methods. Although these searches will be informal, the number and behavior (e.g., breeding code) of all birds encountered will be recorded, as will the level of effort (start and stop times of search, etc.).

If possible, passage migration counts will be conducted on suitable days for migration, mainly between mid-morning and mid-afternoon, and will follow the methods in EC 2007a, including mapping of flight heights, positions, and directions relative to the proposed turbines, except that each count will last one half to two hours (rather than the six recommended in EC 2007a for sites where passage rates are already known to be high).

Anticipated methods for the breeding season surveys

Exact methods for the breeding season will based on experience gained from the spring migration surveys, but will at least include:

- point counts in representative habitats on at least two days separated by two weeks
- if warranted (e.g., by suitable habitat) area searches and/or playback for species of concern
- fieldwork totaling at least 20 hours (including the above), recording breeding evidence

References

Environment Canada, Canadian Wildlife Service (EC). 2007a. Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds.

Environment Canada, Canadian Wildlife Service (EC). 2007b. Wind Turbines and Birds, A Guidance Document for Environmental Assessment.

Draft Protocol for Pre-construction Breeding Bird Survey at Atwoods Brook Wind Project in Nova Scotia

Andrew G. Horn

This document summarizes the planned protocol for a pre-construction breeding bird survey at the proposed site for construction of two wind turbines near Atwoods Brook, Nova Scotia.

Much information on the breeding birds at the site has already been collected in the course of a spring migration survey at the site, which is now nearly complete. This survey consisted of eight visits spaced through the second half of May. These visits included point counts at 10 stations, transects and area searches meant to cover all habitats, and passage migration watches.

The results of the survey, as well as a desktop survey of available information on the site, are still being assembled. Based on discussion with the field worker, however, coverage of potential breeding habitat appeared to be adequate and evidence on abundance and breeding has already been obtained for well over half the expected breeding species. No risk factors for breeding birds (e.g., colonies, staging area) were detected, and no species at risk were detected at the proposed turbine sites. Near the site (within 1km), however, a family of Gray Jays (Yellow Listed in NS) was detected, and potential breeding habitat exists for Common Nighthawk and Olive-sided Flycatcher.

Therefore, despite the small size of project and apparent lack of risk factors for breeding birds, as a precaution, the site is being treated as having Very High Sensitivity and Category 4 Level of Concern (EC 2007b) until the lack of risk factors can be confirmed.

Goals

The goal of the breeding bird survey will be to predict the consequences of the turbines and associated activities (e.g., access roads) to species diversity at the site (EC 2007a). The survey might also provide a baseline for actually measuring these effects after construction, if the EA requires post-construction monitoring. The present survey design will probably not be adequate for this purpose, however, because habitat mapping is incomplete, and the eventual location of the turbines is uncertain. The project is small enough that finding measurable effects on local species diversity and abundance will require that sampling be more finely tuned in relation to habitat and turbine locations, which is not possible at this point. If further monitoring is required, however, sampling can be planned in relation to the final location of the turbines, as noted in EC 2007a.

Methods

These methods focus on determining the site's sensitivity to breeding birds, by estimating species diversity and abundance and by searching for species at risk.

CWS protocols (EC 2007a) recommend that a breeding bird survey last up to 4-10 days between late May and July. The present site is small, and so would fall at the low end of that range. Also, the site has already been visited throughout May using very similar methods to those given here, so the present document emphasizes the remaining visits.

These remaining visits will consist of two to three days, with two of them separated by at least two weeks, during June and July, with overall sampling effort (including time already spent in late May) totaling at least 20 hours. Each visit will begin with 10-minute, unlimited radius point count, completed within four hours of sunrise, from the 10 sampling stations used in the spring survey. These sampling stations were picked to include all the turbine sites, while allowing an efficient path through the site. The habitats sampled by the point count stations (two stations in conifer, with eight in mixed, of which three were predominated by conifer), included the main habitats at the site, at least at a coarse level (Figure 1). For each point count, distances to detected birds will be estimated as 0-50m, 50-100m, and >100m. Habitats will be classified as in the Maritimes Breeding Bird Atlas (http://www.mba-aom.ca/jsp/codes.jsp?lang=en&pg=habitat).

Point counts will be followed by searches for additional species in each patch of habitat within the project area. A particular effort will be made to seek species at risk with have potential breeding habitat in the project area, i.e., Common Nighthawk (which may require an evening visit) and Olive-sided Flycatcher. The searches will be informal, but the level of effort (start and stop times of search, and whether "pishing" or playback was used) will be recorded.

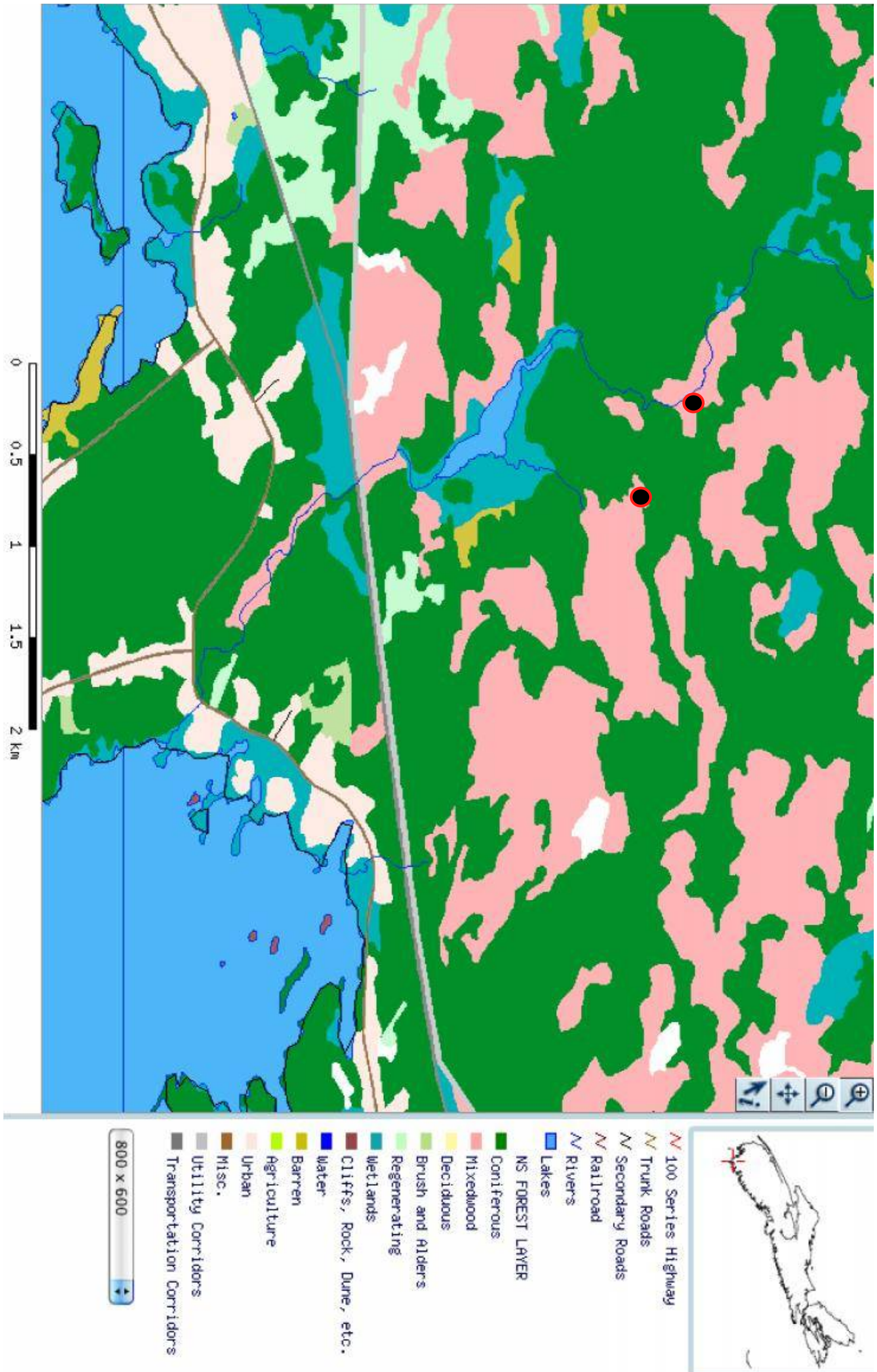
During both point counts and area searches, breeding status will be noted using standard breeding status codes (http://www.mba-aom.ca/jsp/codes.jsp?lang=en&pg=breeding). Particular care will be taken to note any birds on long, directed flights overhead, especially over the proposed turbine locations.

References

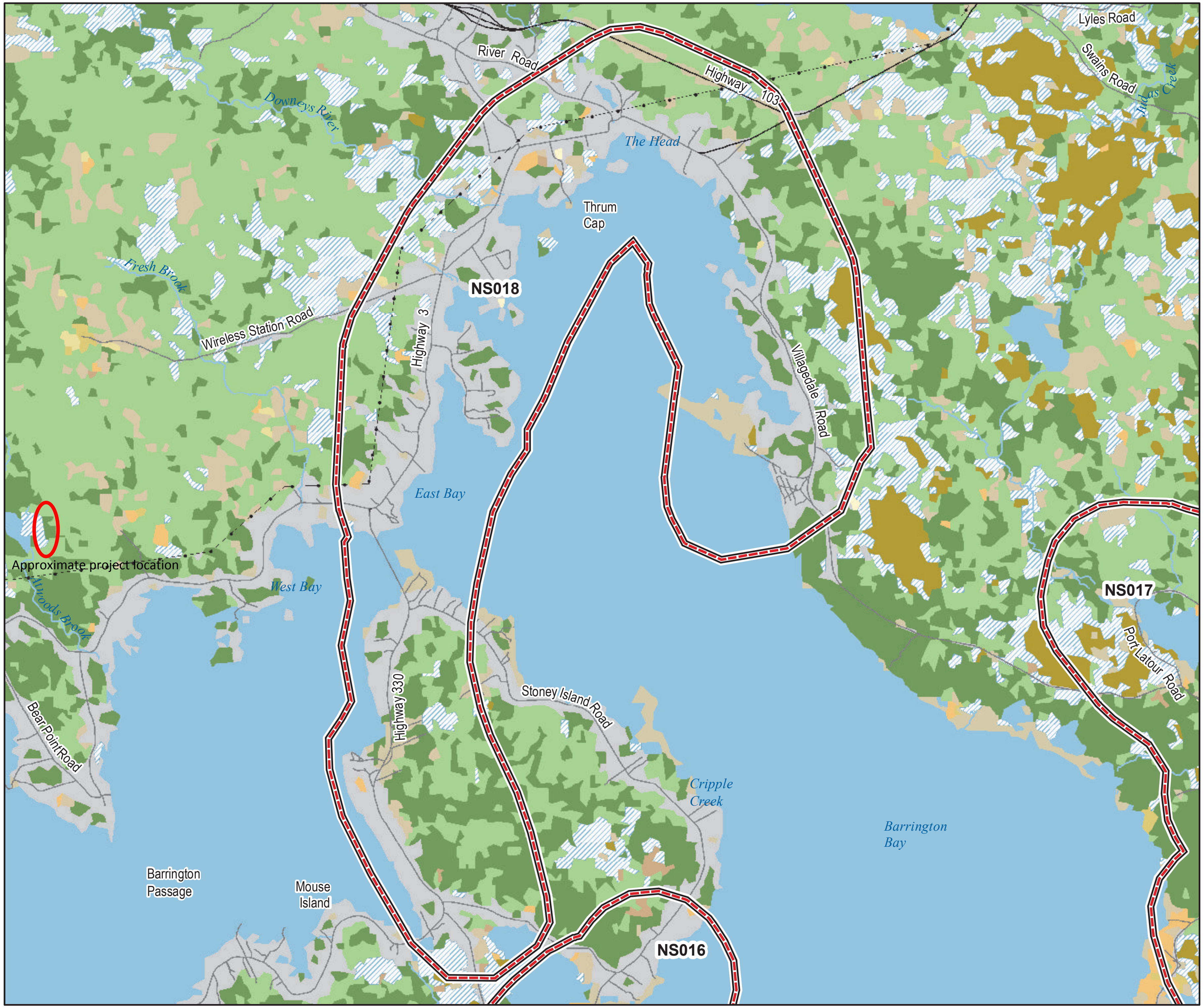
Environment Canada, Canadian Wildlife Service (EC). 2007a. Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds.

Environment Canada, Canadian Wildlife Service (EC). 2007b. Wind Turbines and Birds, A Guidance Document for Environmental Assessment.

Figure 1. Approximate proposed site of turbines on forest cover map of site (from https://ca.nfis.org/provinces/ns/index_eng.html).



Site: NS018 **South Shore (Barrington Bay Sector)** **Nova Scotia**



Important Bird Areas of Canada

Zones importantes pour la conservation des oiseaux du Canada

http://www.ibacanada.ca/site.jsp?siteID=NS018

Legend	Légende
Generalized IBA boundary	Limite générale de la ZICO
Expressway or highway	Autoroute ou route nationale
Regional or local road	Route régionale ou locale
Rail line	Chemin de fer
Utility corridor	Ligne de transport d'énergie
Contour line (m)	Courbe de niveau (m)
Watercourse	Rivière ou ruisseau
Deciduous forest (dense)	Forêt de feuillus (dense)
Deciduous forest (open)	Forêt de feuillus (ouvert)
Coniferous forest (dense)	Forêt de conifères (dense)
Coniferous forest (open)	Forêt de conifères (ouvert)
Mixedwood forest (dense)	Forêt mixte (dense)
Mixedwood forest (open)	Forêt mixte (ouvert)
Shrubland	Milieu arbustif
Wetland	Milieu humide
Other forest / woodland	Autre forêt
Grasses, sedges or herbs	Graminées, de carex, d'herbes
Barren or sparsely vegetated	Dénudé sec ou végétation clairsemée
Agriculture / open country	Milieu agricole
Developed area	Zone développée
Snow / ice	Neige / glace
Water	Eau
Unclassified	Non classifié

Topographic data / Données topographiques

Cartographic production by Bird Studies Canada - iba@birdscanada.org
Production cartographique par Études d'oiseaux Canada - iba@birdscanada.org

The IBA Program is an international conservation initiative coordinated by BirdLife International. The Canadian co-partners for the IBA Program are Bird Studies Canada and Nature Canada. Regional partners affiliated with the Program coordinate a wide variety of conservation activities at IBAs and play a key role in the establishment and maintenance of IBA Caretaker Networks.

Le programme des ZICO est une initiative de conservation internationale coordonnée par BirdLife International. Les co-partenaires canadiens du programme des ZICO sont Études d'Oiseaux Canada et Nature Canada. Les partenaires régionaux du programme coordonnent une vaste gamme d'activités liées à la conservation de la nature dans les ZICO et ils jouent un rôle primordial dans la mise en place et le maintien des Réseaux de gardiens des ZICO.

Bird Studies Canada and Nature Canada. 2004-2010. Important Bird Areas of Canada Database. Port Rowan, Ontario: Bird Studies Canada.To access the Canadian IBA directory: http://www.ibacanada.com

Études d'oiseaux Canada et Nature Canada. 2004-2010. Base de données des zones importantes pour la conservation des oiseaux au Canada. Port Rowan, Ontario : Études d'oiseaux Canada. Pour accéder le répertoire canadien des ZICO : http://www.ibacanada.com

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October 2010 / Octobre 2010

Pre-construction Baseline Fall Migration Bird Surveys at the Atwoods Brook Wind Development

Andrew G. Horn

Summary

This document summarizes the results of fall migration bird surveys at the proposed wind turbine project at Atwoods Brook, near Barrington, Nova Scotia. These surveys consisted of 10 3-h passage migration counts conducted between 6 September and 5 November 2012.

The overall passage rate was 8 birds/h. Some of these birds were likely migrants, but no large movements or species at risk were seen. These results show that there is some migration through the site, but using the criteria of EC 2007b, together with earlier results from spring and summer surveys, suggest that the Site Sensitivity is Low

Background information

Construction of 2 turbines (3.2 MW total) is planned for a site at Atwoods Brook, near Barrington, Nova Scotia. An initial evaluation of the required preconstruction bird surveys (in consultation with EC 2007a, b) applied a precautionary approach in estimating that the site might be one of Very High Sensitivity, mainly because, even though it is well set back (kms) from any known high-risk factors, at a landscape scale (tens of kms) it is on the same landform as locations having nesting species at risk, large colonies, Important Bird Areas, and migration corridors (details in Horn 2012).

The size category of the project (2 turbines) is Small, so the Level of Concern was initially judged to be at least Category 2. Given the uncertainties expressed above, the site was treated as Category 4, at least until spring and summer baseline surveys were completed. Those surveys revealed no obvious migrants, nor any breeding species that were species at risk. Nonetheless, a fall migration survey was undertaken for completeness.

Methods

All fieldwork and data compilation was done by Ron d'Entremont.

The site was visited ten times during the autumn migration period from September 6 to November 5, with an attempt to visit on days with suitable tail winds (Table 1). Each visit consisted of a three-hour passage migration count, starting between 0635 and 0740, from the vantage point at N 43 32'09 W 65 40'27 which, although it did not provide a direct view of the turbine site, allowed a view of a c. 400m^2 area as close as was possible to the turbine sites, given the dense cover in the area. The observer noted the species, number of individuals in each flock, flight heights, and directions (EC 2007a).

Results

Most birds seen were presumably local residents, but some presumed migrants (based on the fact that they were non-breeding species, mixed flocks, or birds passing through the entire site, especially in a N-S direction) were observed (Table 2). The largest daily totals of these were 12, 20, and 21 warblers (on 25 Sep, 13 Oct, and 2 Oct) and four flocks of 10-15 American Robins each (5 Nov). The largest flocks were 20 Mallards (13 Sep), 15 White-winged Crossbills (28 Oct) and the robin flocks just mentioned. No species at risk or particularly rare species were seen.

In total, 244 birds were seen in 30 hours, yielding a pooled passage rate of 8 birds/h.

Conclusions

The fall survey results show that the project area certainly has migrants passing through it, but do not show that it particularly concentrates migrants or serves as a main route for species at risk or otherwise rare species. The results, together with those of spring and summer surveys, suggest that the Site Sensitivity (EC 2007b) is Low.

References

Environment Canada, Canadian Wildlife Service (EC). 2007a. Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds.

Environment Canada, Canadian Wildlife Service (EC). 2007b. Wind Turbines and Birds, A Guidance Document for Environmental Assessment.

Horn, A.G. 2012. Pre-construction Baseline Spring Migration and Breeding Bird Surveys at the Atwoods Brook Wind Development. Report for Eon Wind, August 2012.

Table 1. Sampling effort. All watches were 3h long.

Date	Start time	Weather
September 6	6:38am	Overcast, wind 20km/h from the Southwest
September 13	6:54am	Overcast, Wind Light.
September 19	7:10am	Cloudy, Wind NE 30 km/h
September 25	7:22	Clear, Wind light
October 2	7:20am	Partly Cloudy, wind NW 20km/h
October 8	7:20am	Partly cloudy, wind light
October 13	7:22am	Clear, wind N 20-30 km/h
October 21	7:30am	Wind Southwest Breezy, Clearing
October 28	7:35am	Foggy, Wind Northeast 15km/h
November 5	6:40 am	Partly Cloudy, wind Northwest 20km/h.

Table 2. Species detected during passage counts.

Species	Flocks	Flock size	Median height (range)
Mallard	1	20	75
Duck sp.	1	1	50
Sharp-shinned Hawk	2	1	20
Red-tailed Hawk	1	1	20
American Kestrel	2	1	47.5 (20-75)
Double-crested Cormorant	1	1	50
Herring Gull	2	1	50 (25-75)
Belted Kingfisher	1	1	20
Northern Flicker	3	1-2	25 (10-50)
Eastern Wood-Pewee	1	1	10
Common Raven	3	1-2	25 (20-25)
American Crow	2	1-2	17.5 (10-25)
European Starling	1	8	50
Blue Jay	1	1	15
Cedar Waxwing	1	8	25
American Robin	6	5-15	25 (20-25)
Black-and-white Warbler	1	1	20
Palm Warbler	1	2	25 (25-25)
Yellow-rumped Warbler	3	1-3	20 (20-40)
Magnolia Warbler	2	1-2	22.5 (20-25)
Warbler sp.	36	1-6	50 (20-100)
Dark-eyed Junco	2	1-5	25 (20-30)
Sparrow sp.	1	1	20
Pine Siskin	2	5-7	20
American Goldfinch	4	2-5	27.5 (25-50)
White-winged Crossbill	1	15	15

Pre-construction Baseline Spring Migration and Breeding Bird Surveys at the Atwoods Brook Wind Development

Andrew G. Horn

Summary

This document summarizes the results of spring migration and breeding bird surveys at the proposed wind turbine project at Atwoods Brook, near Barrington, Nova Scotia. These surveys consisted of nine visits from 15 May to 9 July 2012, which each included point counts, transects, and area searches. As well, a passage migration count was conducted on 20 May and an area search of Bear Point Pond for species at risk was conducted on 12 July.

The surveys did not reveal any high sensitivity factors for migrating or breeding birds (e.g., colonies, staging area), nor any species at risk, and few migrants were seen. The results suggest that the Site Sensitivity (EC 2007b) is Low, pending results of autumn migration surveys.

Background information

Construction of 2 turbines (3.2 MW total) is planned for a site at Atwoods Brook, near Barrington, Nova Scotia. An initial evaluation of the required preconstruction bird surveys (in consultation with EC 2007a, b) applied a precautionary approach in estimating that the site might be one of Very High Sensitivity, mainly because, even though it is well set back (kms) from any known high-risk factors, at a landscape scale (tens of kms) it is on the same landform as locations having nesting species at risk, large colonies, Important Bird Areas, and migration corridors (details in Horn 2012).

The size category of the project (2 turbines) is Small, so the Level of Concern was initially judged to be at least Category 2. Given the uncertainties expressed above, the site was treated as Category 4, at least until spring and summer baseline surveys were completed.

Methods

All fieldwork and data compilation was done by Ron d'Entremont.

Spring migration

The site was visited seven times during the spring migration period from May 15 to May 31 (Table 1). Most visits included a line transect and point counts between dawn and four hours after sunrise (Table 1). The line transect (the shortest line connecting all the point count stations) was initially planned to follow the methods in EC 2007a, but was found to detect the same birds as in the point counts, so after the first few visits it was only used to detect any species not detected during the point counts. Point counts were conducted approximately every 250m along each transect. Each lasted 5 minutes (initial trials showed that extending the time to 10 minutes gained few additional individuals). All detections were estimated as occurring within 50, 100, or >100 m from the observer. The line transect and point counts were accompanied by less standardized area searches, focused on searching for species or habitats that are suspected of being present but missed by the other methods. On 20 May, a passage migration count was conducted from a vantage point overlooking the site, following the methods in EC 2007a, noting flight heights, positions, and directions relative to the proposed turbines.

Breeding season

CWS protocols (EC 2007a) recommend that a breeding bird survey last at least 4-10 days between late May and July. The present site is small, so it presumably falls at the low end of that range. Given that it had already been visited throughout May as part of the migration surveys, only three additional visits were made, spread across at least two weeks as recommended in EC 2007a (Table 1). Methods were as described above, except the point counts were 10 min long, no passage counts were done, and the third visit consisted only of an area search (including playback) of Bear Point Pond for species at risk (Olive-sided Flycatcher, Rusty Blackbird).

Disposition of data

All data were georeferenced and formatted to be compatible with the Wind Energy Bird & Bat Monitoring Database hosted on the website of Bird Studies Canada (http://www.bsc-eoc.org/birdmon/wind/main.jsp), for later uploading to that site.

Results

Spring migration

No obvious migrants (i.e., non-breeding species, mixed flocks, or birds passing through the entire site) were encountered during the spring transects and point counts. The passage count detected seven individuals of four species, none of which, based on species identity, flight height, or flight direction, appeared to be a migrant (Table 2).

Breeding bird survey

Birds breeding at the site were widespread species typical of the habitats they were found in, although they do include several species known to have flight displays (Table 3). No species at risk (birds with COSEWIC status or elevated provincial rank or status) were found, other than one Common Loon detected flying over the site. Habitat at nearby Bear Point Pond appeared suitable for two species at risk (Olive-sided Flycatcher, Rusty Blackbird), so that area was searched, using playback, for these species on 12 July, but neither species was found.

Conclusions

The spring survey results suggest that the project area does not concentrate migrants, and the breeding bird survey results did not reveal any particularly sensitive features within the project area. Overall, these results suggest that the Site Sensitivity (EC 2007b) is Low, pending results of autumn migration surveys.

References

Environment Canada, Canadian Wildlife Service (EC). 2007a. Recommended Protocols for Monitoring Impacts of Wind Turbines on Birds.

Environment Canada, Canadian Wildlife Service (EC). 2007b. Wind Turbines and Birds, A Guidance Document for Environmental Assessment.

Horn, A.G. 2012. Draft Protocol for the Baseline Spring Migration Bird Survey at the Atwoods Brook Wind Project. Unpublished document prepared for Eon WindElectric, May 2012.

Rosenberg, K. V., and T. P. Hodgman. 2000. Partners in Flight Bird Conservation Plan for Eastern Spruce-Hardwood Forest (Physiographic Area 28).

Table 1. Sampling effort. Each visit included area searches, point counts, transects, and passage counts, except as noted.

Date	Time	Methods
15-May	7:30	Point counts, transect, area search, passage migration
18-May	6:20	“
21-May	6:25	“
24-May	6:20	“
27-May	6:07	“
29-May	6:21	“
31-May	6:20	“
25-Jun	6:15	Point counts, transect, area search
9-Jul	6:10	“
12-Jul		Area search of Bear Point Pond for Species at Risk

Table 2. Species detected during passage count on 20 May (one individual of each species was seen, except as noted).

Species	**Approximate height**	**Direction of flight**
Herring Gull	15-30	NW
Northern Parula	0-15	W
Magnolia Warbler	0-15	W
Purple Finch (4 individuals)	0-15	W

Table 3. Breeding birds, with number per point count, breeding evidence, and Partners in Flight priority (Rosenberg and Hodgman 2000). Yellow-listed species in **bold**, species with flight display starred (*).

Species	n/count	Breeding code	PIF priority
Mourning Dove*	0.01	H	
Great Horned Owl	0.03	T	
Barred Owl	0.03	T	
Downy Woodpecker	0.02	T	
Hairy Woodpecker	0.10	T	
Northern Flicker	0.02	H	
Pileated Woodpecker	0.07	T	
Eastern Wood-Pewee	0.01	H	PIF II
Yellow-bellied Flycatcher	0.09	T	
Least Flycatcher	0.24	T	PIF II
Blue-headed Vireo	0.16	T	
Red-eyed Vireo	0.18	T	
Gray Jay	0.14	T	
Blue Jay	0.02	T	
American Crow	0.01	H	
Common Raven*	0.01	H	
Black-capped Chickadee	0.33	FY	
Red-breasted Nuthatch	0.22	T	
Winter Wren	0.93	FY	
Golden-crowned Kinglet	0.31	T	
Swainson's Thrush	0.19	T	
Hermit Thrush	1.03	CF	
Cedar Waxwing	0.04	H	
Northern Parula	0.21	T	PIF II
Yellow Warbler	0.01	T	
Magnolia Warbler	0.61	T	
Black-throated Blue Warbler	0.01	h	PIF II
Yellow-rumped Warbler	0.39	T	
Black-throated Green Warbler	1.33	T	PIF II
Palm Warbler	0.02	T	
Black-and-white Warbler	0.17	T	
American Redstart	0.21	T	
Ovenbird*	0.44	T	
Common Yellowthroat*	0.22	T	
White-throated Sparrow	0.11	T	
Slate-colored Junco	0.71	FY	
Purple Finch*	0.01	H	PIF II

Appendix 5: BAT REPORTING

Pre-construction survey to determine bat species composition and activity at the proposed Barrington Wind Energy Project, Shelburne County, Nova Scotia

Final Report Prepared For:

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December 2012

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FIGURES

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CONTEXT

Eon WindElectric, in association with Watts Wind Energy Inc., is proposing to install two electricity-generating wind turbines near the community of Barrington Passage, Shelburne County, Nova Scotia.

Industrial wind energy production is among the fastest growing sectors of the global energy industry, as the demand for renewable energy sources continues to increase (Nelson 2009). Advances in wind turbine technology have improved the cost-competitiveness of the wind energy sector, contributing to a significant increase in the number of wind energy installations around the globe during the last decade. In Canada, energy production and regulation falls under provincial jurisdiction, therefore most renewable energy targets are set at the provincial level. In the province's Renewable Electricity Plan, the Government of Nova Scotia sets an aggressive target of 40% of electricity needs 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 expected to be the largest contributor in meeting this goal (Nova Scotia Department of Energy 2010).

Despite the many environmental benefits of wind energy, the rapid growth of the wind energy sector around the globe has raised concerns regarding the impacts of these developments on both resident and migratory populations of wildlife (Arnett et al. 2008). Documentation of large numbers of bat fatalities at wind energy facilities has been a relatively recent development (Johnson 2005), gaining considerable 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 (Weller and Baldwin 2012). The assumption of this approach is that low indices of activity prior to construction should translate to low fatality rates post-construction (Baerwald and Barclay 2009). This report summarizes the methods and results of a pre-construction survey to assess the potential for the proposed Barrington Wind Energy Project to negatively impact local bat populations.

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 capture and acoustic surveys;

(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.

This project is part of a large scale and ongoing research program titled "Characterization of bat movement patterns to inform the decision-making process about the potential risks of local wind energy developments on bat populations" that is co-funded by multiple industrial partners and the Natural Sciences and Engineering Research Council (NSERC). This report does not report on the larger program as the results are still pending, but is an interim report on the results of the 2012 field season at the specific study site.

BACKGROUND

Currently in Nova Scotia there are >50 wind turbines in operation and, as of yet, we are not aware of any incidents of major mortality, though a number of 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 a few years) and it is not known how thoroughly existing operational turbines have been surveyed for bat fatalities and 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

The proximate cause of bat fatalities at wind energy developments may be due to direct strike by the rotating turbine blades, collision with turbine towers, or by barotrauma, which involves tissue damage to the lungs due to rapid or excessive air-pressure reduction near moving turbine blades (Baerwald et al. 2008; Cryan and Barclay 2009), although the discussion as to the relative role of barotrauma in the death of bats is on-going (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 (Arnett et al. 2008; Cryan and Brown 2007; Johnson 2005). 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 (Arnett et al. 2008; Brown and Hamilton 2006), 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 most affected 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 about half of all fatalities (Arnett et al. 2008; Kunz et al. 2007). 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 in smaller numbers 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*) (Arnett et al. 2008; Jain et al. 2007; Johnson 2005; Nicholson 2003). 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 (Arnett et al. 2008; Cryan and Barclay 2009; Johnson 2005; Kunz et al. 2007). 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 (Jain et al. 2007; Kerns et al. 2005; Nicholson 2003). 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 puts the migration hypothesis to question (Horn et al. 2008). Others have hypothesized that collisions may result from bats being attracted to turbines out of curiosity, misperception, 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 utilize these areas for foraging (Grindal and Brigham 1998; Hayes and Loeb 2007). Removal of vegetation can create edge habitat or 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). However, this is not well understood for most species.

Little is known about the dynamics of movement (e.g., altitude and travel routes) 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). 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; Glover and Altringham 2008; Thomas and Fenton 1979). 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, 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; Craig Willis, Pers. Comm.). 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. 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).

Nova Scotia Bats

In Nova Scotia there are occurrence records for seven species of bats (Table 1; Broders et al. 2003; van Zyll de Jong 1985), and each have been documented to have experienced fatalities at wind turbine sites (Arnett et al. 2008). 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 American, 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 migratory movements of these species in the province, but they do occur regularly. 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 (Caceres and Barclay 2000; Fenton and Barclay 1980; van Zyll de Jong 1985). 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; Farrow and Broders 2011; Rockwell 2005). 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 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; Broders 2003; Hamilton and Barclay 1994).

The northern long-eared bat is a forest interior species that primarily roosts and forages in the interior of forests (Broders 2003; Henderson and Broders 2008; Jung et al. 2004). Females form maternity colonies, roosting in coniferous or deciduous trees, depending on availability (Broders et al. 2006; Foster and Kurta 1999; Garroway and Broders 2008). Males typically roost solitarily in either deciduous or coniferous trees (Ford et al. 2006; Jung et al. 2004; Lacki and Schwierjohann 2001). 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 (Broders and Forbes 2004; Crampton and Barclay 1998). 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 spp. lichen 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, 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 *Geomyces destructans*, a cold-loving fungus that thrives in cave conditions and as such, impacts bat population directly during the winter hibernation period (Blehert 2012; Lorch et al. 2011). It is thought to disrupt patterns of torpor and possibly result in death by starvation or dehydration (Cryan et al. 2010; Reeder et al. 2012). 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. It is not known to what extent bats in the province will be impacted, though all three of the resident hibernating bat species found in the province (four if you include the big brown bat) have been affected by WNS elsewhere in their range. Therefore it would be prudent to protect any surviving animals which 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 known hibernacula within 25 km of the Barrington Wind Energy Project area, nor for most of southern mainland Nova Scotia (Moseley 2007; Randall 2011). According to the Nova Scotia Abandoned Mine Openings Database, there are also no known underground mine openings within 25 km of the project area (Fisher and Hennick 2009).

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

Species	**Over-wintering Strategy**	**Global Ranking**[1]	**COSEWIC Status**	**ACCDA Status**[2]	**GSRWSNS**[4]
Little brown bat	Resident hibernator (NS and NB)	G3	Endangered[3]	S1	Yellow
Northern long-eared bat	Resident hibernator (NS and NB)	G2	Endangered[3]	S1	Yellow
Tri-colored bat	Resident hibernator (NS and NB)	G3	Endangered[3]	S1	Yellow
Big brown bat	Resident hibernator (NB)	G5	Not assessed	N/A	Undetermined
Hoary bat	Migratory	G5	Not assessed	S1	Undetermined
Silver-haired bat	Migratory	G5	Not assessed	S1	Undetermined
Eastern red bat	Migratory	G5	Not assessed	S1	Undetermined

[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] 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).
[3] Assessed by COSEWIC and designated in an emergency assessment on February 3, 2012.
[4] General Status Ranks of Wild Species in Nova Scotia based on published scientific literature, wildlife atlasing projects, unpublished data, and expert opinion, providing an overall indication of a species` status in Nova Scotia. Yellow = Sensitive to human activities or natural events; Undetermined = Insufficient data exists to assess status.

METHODS

Study Area

The project area is located approximately 4 km west of the town of Barrington Passage, Shelburne County, Nova Scotia. This area is within the Quartzite Headlands District of the Atlantic Coast Region of Nova Scotia, which is characterized by barren headlands and coastal forests (Davis and Browne 1996). The Atlantic Ocean is the dominant influence on the region's climate, which is characterized by moderated seasonal and daily temperatures, high precipitation and humidity, strong winds, and fog (Davis and Browne 1996). Winters are relatively mild with long, cool springs, and short, cool summers. Because of frequent fog and the cooling influence of ocean waters, mean daily July temperatures typically stay below 15°C (Davis and Browne 1996). Cool, wet, acidic conditions favour the growth of conifers, with forest stands typically dominated by white spruce, black spruce, and balsam fir, though white birch, and red maple can be found in elevated, well-drained areas that are sheltered from coastal winds (Davis and Browne 1996).

Acoustic Surveys

We used two SM2BAT ultrasonic recorders (Wildlife Acoustics Inc., Concord, MA, USA) to passively record the echolocation calls of bats at two locations within the clearing where the meteorological tower for the proposed development is located, oriented parallel to the tree line (Table 2). The clearing is surrounded by forest dominated by balsam fir and spruce with a canopy height of approximately 6 m. 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.

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 using frequency-time graphs in ANALOOK software (C. Corben, www.hoarybat.com). 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. Similarly, the sequences of silver-haired bats and big brown bats are also very similar. Finally, for short sequences it is possible to confuse the identifications for tri-colored and eastern red bats, therefore we also grouped these species, especially considering the fact the both species are equally rare in the area. 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 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.

Table 2. Locations of acoustic sample sites for the 2012 pre-construction survey of bat activity at the proposed Barrington Wind Energy Project, Shelburne County, Nova Scotia. Coordinates are NAD83 UTM Zone 20T.

Site	Location	Coordinates		Direction	Deployed	Retrieved
1	On a granite boulder	284913 E	4821806 N	16°	August 2	September 15
2	On a tree stump 3 m above ground	399184 E	5038144 N	305°	August 2	September 15

Harp Trap Surveys

Two harp traps (Ausbat Research Equipment, Lower Plenty, Victoria, Australia) were used to capture bats on wooded trails within the study area. Species, body mass, and age were recorded for captures. Tissue samples were collected from the plagiopatagium of captured bats (4-6 mm diameter sample from each wing; Sullivan et al. 2006), and placed individually in 1.5 ml polypropylene microcentrifuge tubes. All capture and handling protocols in place during this research followed guidelines of the American Society of Mammalogists (Sikes et al. 2011), with the approval of the Saint Mary's University Animal Care Committee, and under authority of a permit from the Nova Scotia Department of Natural Resources.

RESULTS

Acoustic Surveys

Bat detectors were deployed from August 2 to September 15, 2012. After initial deployment, the unit at site 1 had a technical error with the equipment and stopped recording on August 12. The unit at site 2 also had a technical error and stopped recording on August 11. Both units were re-deployed on August 14 (Table 3).

In total there were 9940 acoustic files recorded, however only 6025 of these were bat-generated ultrasound, the remaining 3915 being classified as 'extraneous noise'. Of the bat-generated echolocation files, 6033 species classifications were made, as some files contained call sequences from more than one species. The majority of the calls (99.0%) were classified as Myotis spp. (i.e., includes northern long-eared and little brown bats); as stated, there was no attempt to identify the species of those call sequences classified as Myotis, given the similarity of their echolocation calls and the difficulty in achieving defensible identifications. Of the remaining identified call sequences, 19 were attributable to either the eastern red or the tri-colored bat, and another 4 were consistent with the call characteristics of a silver-haired or big brown bat. Approximately 0.6% (35) of the echolocation files were classified as 'unknown'.

Nightly activity levels at site 1 dropped off significantly after the first week of acoustic sampling, around August 11 (Figure 1). Activity levels at this site were low compared to site 2, which were, on average, more than 6 times greater. Activity levels at site 2 gradually decreased from around mid-August, except for a small peak in activity during the period of September 4 to 9. The average number of recorded sequences per night in the study area (average for the two sites) was 71.6 (SD = 60.4) during the sampling period. To place the relative magnitude of activity 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 (Fenton and Barclay 1980; Fujita and Kunz 1984; Krusic et al. 1996; Lacki et al. 2007; Laval et al. 1977; Zimmerman and Glanz 2000).

Table 3. Number of echolocation files recorded per night for the 2012 pre-construction survey of bat activity at the proposed Barrington Wind Energy Project, Shelburne County, Nova Scotia. MYOT = Myotis species, LB/PS = *Lasiurus borealis* or *Perimyotis subflavus*, LN/EF = *Lasionycteris noctivigans* or *Eptesicus fuscus.*

Evening of	Site 1			Site 2				Nightly Total
	LB/PS	MYOT	UNKN	LB/PS	LN/EF	MYOT	UNKN	
2-Aug-12	0	48	0	0	0	70	0	118
3-Aug-12	0	9	0	0	0	98	1	108
4-Aug-12	0	188	0	0	0	139	3	330
5-Aug-12	0	46	0	3	0	257	3	309
6-Aug-12	1	51	0	0	0	105	0	157
7-Aug-12	0	65	0	1	0	168	0	234
8-Aug-12	2	99	0	0	0	163	0	264
9-Aug-12	0	60	0	8	0	207	0	275
10-Aug-12	0	107	0	0	0	245	1	353
11-Aug-12	0	26	0	0	0	109	0	135
12-Aug-12	0	14	1	-	-	-	-	15
13-Aug-12	-	-	-	-	-	-	-	-
14-Aug-12	0	0	0	0	0	206	1	207
15-Aug-12	0	11	0	0	0	181	0	192
16-Aug-12	0	0	0	0	0	351	6	357
17-Aug-12	0	0	0	0	0	217	1	218
18-Aug-12	0	2	0	0	0	184	1	187
19-Aug-12	0	29	0	0	0	167	0	196
20-Aug-12	0	18	0	0	0	263	1	282
21-Aug-12	0	2	0	0	0	135	0	137
22-Aug-12	0	1	0	0	0	119	0	120
23-Aug-12	0	1	0	0	0	194	1	196
24-Aug-12	0	9	0	0	0	157	1	167
25-Aug-12	0	7	0	0	0	108	0	115
26-Aug-12	0	0	0	0	0	92	0	92
27-Aug-12	0	0	0	0	0	61	0	61
28-Aug-12	0	0	0	0	0	19	0	19
29-Aug-12	0	0	0	1	0	65	1	67
30-Aug-12	0	2	1	0	2	69	2	76
31-Aug-12	0	0	0	0	0	130	0	130
1-Sep-12	0	1	0	0	0	44	0	45
2-Sep-12	0	0	0	0	0	25	1	26
3-Sep-12	0	0	0	0	0	28	1	29
4-Sep-12	0	0	0	0	0	201	2	203
5-Sep-12	0	0	0	0	0	40	1	41

- Continued on next page -

Evening of	Site 1 LB/PS	Site 1 MYOT	Site 1 UNKN	Site 2 LB/PS	Site 2 LN/EF	Site 2 MYOT	Site 2 UNKN	Nightly Total
6-Sep-12	0	26	0	0	0	149	0	175
7-Sep-12	0	5	0	1	0	155	0	161
8-Sep-12	0	10	0	0	0	119	1	130
9-Sep-12	0	0	0	0	0	15	0	15
10-Sep-12	0	0	0	1	1	13	2	17
11-Sep-12	0	1	0	0	0	11	0	12
12-Sep-12	0	2	0	0	0	21	2	25
13-Sep-12	0	1	0	0	1	16	0	18
14-Sep-12	0	0	0	1	0	18	0	19
Total	**3**	**841**	**2**	**16**	**4**	**5134**	**33**	**6033**
/night (±SD)	**19.7 ± 37.3 sequences**			**123.5 ± 60.4 sequences**				

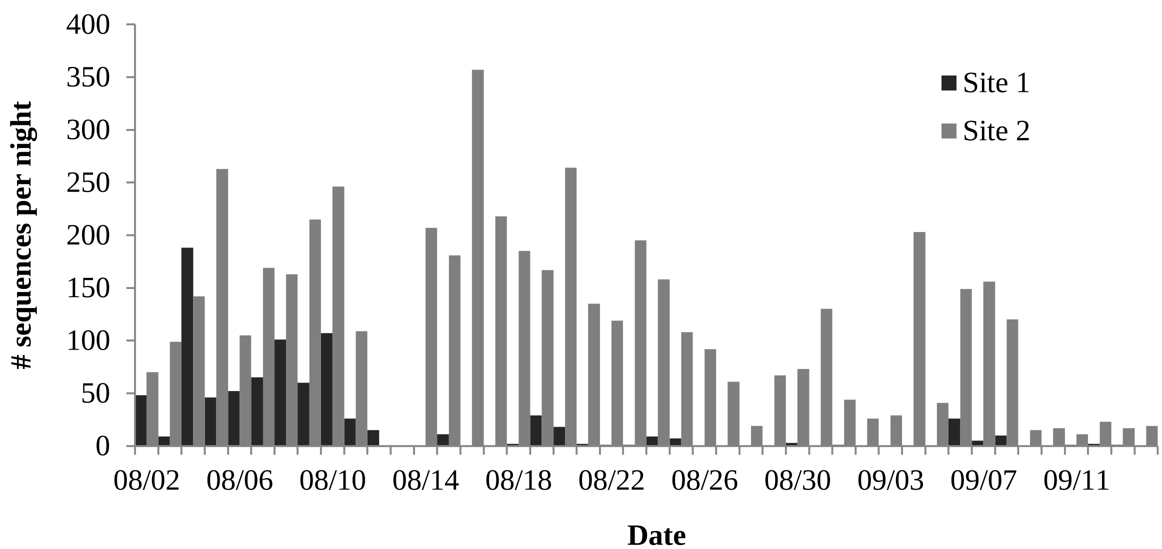

Figure 1. Number of echolocation sequences recorded per night at the two sites ultrasonically monitored for the 2012 pre-construction survey of bat activity at the proposed Barrington Wind Energy Project, Shelburne County, Nova Scotia.

Harp Trap Surveys

Harp trap surveys were conducted during the evenings of Aug 2 and 3, 2012 (Table 4). A total of 14 hours of trapping using two harp traps resulted in one capture of a juvenile female northern long-eared bat on the evening of August 3 at site 3.

Table 4. Harp trap survey effort for the 2012 pre-construction survey of bat activity at the proposed Barrington Wind Energy Project, Shelburne County, Nova Scotia. Coordinates are NAD83 UTM Zone 20T. MYSE = *Myotis septentrionalis.*

Site	Date	Conditions	Coordinates	Traps Up/Down	Captures
1	Aug 2	Cold, foggy	284915 E 4821887 N	20:30/23:30	None
2	Aug 2	Cold, foggy	285209 E 4821517 N	20:30/23:30	None
3	Aug 3	Cold, light fog	285121 E 4821844 N	20:00/00:00	MYSE
4	Aug 3	Cold, light fog	285139 E 4821837 N	20:00/00:00	None

DISCUSSION

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 comparable to baseline levels expected in a forested ecosystem in the region, and there was only one capture of a northern long-eared bat as a result of trapping effort for this project. Although we cannot rule out the possibility that mortality events associated with this development will occur, we have not found evidence to suggest that the proposed project will cause significant direct mortality of bats. However, the capture of a juvenile female northern long-eared bat on a forested trail in early August for this project suggests that there is likely a maternity colony of female bats located close by and that the study area may be important for reproductively active females. The northern long-eared bat is a forest interior species that roosts and forages primarily in the interior of forests (Broders 2003; Henderson and Broders 2008; Jung et al. 2004). Females of this species form maternity colonies during the summer and usually roost in deciduous trees, but are also known to roost in coniferous trees, depending on availability (Broders et al. 2006; Foster and Kurta 1999; Garroway and Broders 2008; Henderson and Broders 2008). Given that females bear the full costs associated with reproduction, population persistence is likely most limited by the ability of reproductively active colonies of females to locate suitable roosting areas within commuting distance of foraging areas.

Interestingly, the average nightly activity level at site 2 was more than 6 times greater than the comparable level of activity at site 1, despite the fact that these two sites were located at opposite sides of the same clearing only approximately 115 m apart. This demonstrates the importance of site selection and surveying at multiple locations and over multiple years. Site 2 was elevated by approximately 3 m, and was therefore surveying bat activity at a slightly greater height, possibly providing an explanation for some of the variability between the two sample locations. Therefore, it would be beneficial for projects of this nature to monitor bat activity at multiple heights to sample the calls of bats travelling and foraging at different heights above ground.

Alternatively, it may also be simply that the forest edge along which site 2 was located is a more commonly used commuting or foraging corridor for bats.

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 (Henderson and Broders 2008; Jung et al. 1999), 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 (Broders et al. 2004; Miller and Treat 1993).

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 2005). 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 Arnett et al. 2008; Jain et al. 2007; Johnson 2005). 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.

There were 4 recorded call sequences that were attributed to either the silver-haired or the big brown bat, and 19 sequences that were attributed to either the eastern red bat or the tri-colored bat. There is only one unconfirmed observation of the big brown bat hibernating at a cave in central Nova Scotia (Taylor 1997). There is a significant population of tri-coloured bats in Nova Scotia that is likely restricted to southwest Nova Scotia (Broders et al. 2003; Farrow and Broders 2011; Rockwell 2005). In the summers of 2005 and 2006, Farrow and Broders (2011) recorded high levels of activity of this species at some inland forested river sites, however they were generally absent from coastal areas of southwest Nova Scotia. Nonetheless, little is known about where this species over-winters in the province and the dynamics of their late-summer and fall movements to hibernacula; therefore this species may be present among the bat species that occur in the study area. Like the Myotis bats, tri-colored bats are relatively new to the list of species among fatalities at wind turbines sites, but fatalities have been reported at sites in the eastern United States.

Both the silver-haired and the eastern red bat are non-gregarious, tree-roosting bats with extensive distributional ranges throughout North American (van Zyll de Jong 1985). These species, in addition to the hoary bat, 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. 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 (Arnett et al. 2008; Cryan and Brown 2007; Johnson 2005), 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 (Arnett et al. 2008; Barclay et al. 2007). For this study, acoustic sampling took place at ground-level, which may have an affect on our ability to detect the calls of high-flying species. Therefore, it is possible that our sampling regime underestimated the activity of these species in the area.

Overall data suggests that large numbers of migratory species do not occur in the area or move through during migration, but they do occur regularly and are especially vulnerable to wind facilities. The northeast-southwest orientation of the province is expected to concentrate migratory bat movements through coastal areas and islands of southwest Nova Scotia in the fall. The study area is located in coastal southwest Nova Scotia and is therefore in an area with inherently greater risk for long-distance migratory bat species.

RECOMMENDATIONS

1. Additional pre-construction monitoring – If possible, monitoring should be done from meteorological towers to gauge the magnitude of activity of commuting and foraging bats at different heights, and in particular of long-distance migratory species, which are known to travel at greater heights above ground than we are able to sample at ground level.

2. 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.

3. 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.

4. 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.

5. 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.

6. Remain up to date with current research – In addition to the Industry-NSERC-SMU partnership project, 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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APPENDIX A – PHOTOGRAPHS

Figure 1. The clearing with the meteorological tower at center where two SM2BAT ultrasonic recorders were located to acoustically sample bat activity at the proposed Barrington Wind Energy Project area, Shelburne County, Nova Scotia.

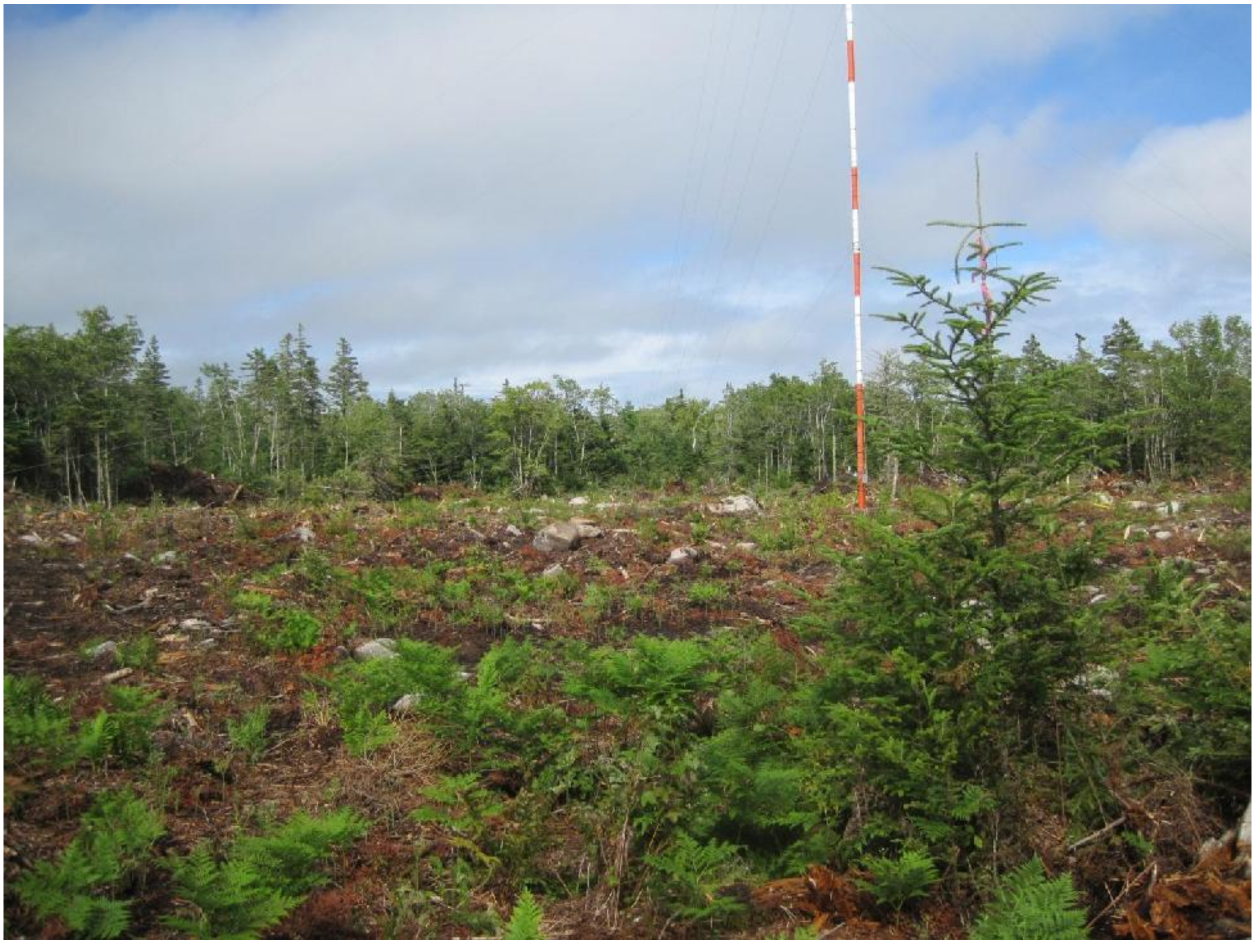

Figure 2. Acoustic sample site 1; the arrow indicates the location of the microphone for the SM2BAT ultrasonic recorder (located in the blue bin). The microphone was oriented parallel to the tree line to record bats as they commute and forage along the forest edge.

Figure 3. Acoustic sample site 2; the arrow indicates the location of the microphone of the SM2BAT ultrasonic recorder.

Appendix 6: ARCHAEOLOGICAL SCREENING

NOVA SCOTIA
Communities, Culture & Heritage
1747 Summer Street
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B3H 3A6
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Fax: (902) 424-0560

January 14, 2013

Mr. Stephen Garcin
Cultural Resource Management Group Ltd.
6040 Almon Street
Halifax, NS B3K 1T8

Dear Mr. Garcin:

RE: Heritage Research Permit Report
A2012NS0146- Barrington Wind

We have received and reviewed your report on work conducted under the terms of Heritage Research Permit A2012NS146 of an archaeological resource impact assessment of the proposed Barrington Wind Project, near Barrington Passage, Shelburne County.

The report details the archaeological screening and reconnaissance of the proposed Barrington Wind Farm Project by CRM Group Ltd. in October 2012. The screening and reconnaissance included background and historical research and field survey and inspection of the project area. Sub-surface testing was not undertaken. No archaeological features or artifacts were encountered during the archaeological assessment.

Based on the background study, including a review of the environmental setting, topography, Native land use, and property history, the vicinity of the study area is considered to exhibit low potential for encountering pre-contact or historic archaeological resources. No historic features or artifacts were observed during the field survey of the project area. Also, given the study are is set back from any significant water courses and occupies an uneven terrain, the area is considered to be of low overall potential for pre-contact and/or historic archaeological resources.

Based on the above the reporter recommends that the study area as defined in the report be cleared of any requirement for future archaeological investigation. In the unlikely event that archaeological deposits or human remains are encountered during activities associated with the Barrington Wind Farm Project, it is recommended that all work in the associated areas stop and the Coordinator of Special Places contacted.

Staff agree with the recommendations, and find the report acceptable as submitted. If you have any questions or concerns, please do not hesitate to contact me.

Sincerely,

Laura Bennett
Coordinator, Special Places

EON WINDELECTRIC

BARRINGTON WIND FARM PROJECT ARCHAEOLOGICAL SCREENING & RECONNAISSANCE SHELBURNE COUNTY, NOVA SCOTIA

2012 ARCHAEOLOGICAL
SCREENING AND RECONNAISSANCE REPORT

Submitted to:
Eon WindElectric
and the
Special Places Program

Prepared by:
Cultural Resource Management Group Limited
6040 Almon Street
Halifax, Nova Scotia
B3K 1T8

Consulting Archaeologist: Steve Garcin
Report Preparation: Steve Garcin

Heritage Research Permit Number: A2012NS146

CRM Group Project Number: 2012-0015-03

NOVEMBER 2012

CRM Group
Cultural Resource Management Group Ltd

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EON WINDELECTRIC
BARRINGTON WIND FARM PROJECT
ARCHAEOLOGICAL SCREENING & RECONNAISSANCE
SHELBURNE COUNTY, NOVA SCOTIA

1.0 INTRODUCTION

Eon WindElectric is proposing the development of its wind energy site near Barrington Passage (***Figure 1***). In order to investigate the potential for encountering archaeological resources during development of the facility, Cultural Resource Management (CRM) Group was retained by Eon WindElectric to undertake archaeological screening and reconnaissance of the proposed wind energy site.

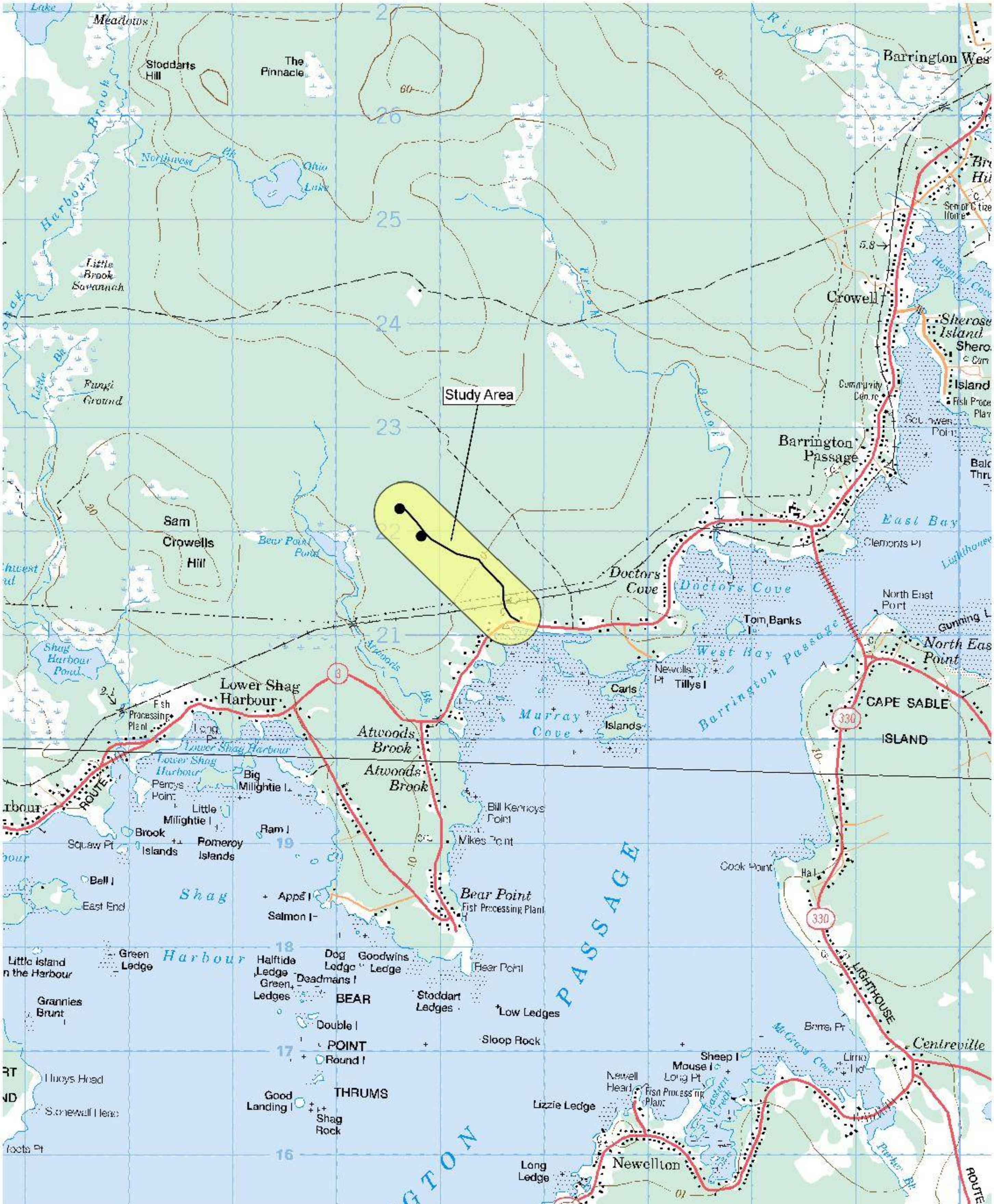
The archaeological screening and reconnaissance was directed by Staff Archaeologist, Steve Garcin with the assistance of archaeological technician Andrew Livingstone. Reconnaissance was conducted on October 23, 2012.

The archaeological investigation was conducted according to the terms of Heritage Research Permit A2012NS146 (Category 'C'), issued to Garcin by the Special Places Program. This report describes the archaeological screening and reconnaissance of the Barrington Wind Project study area, presents the results of these efforts and offers cultural resource management recommendations.

2.0 STUDY AREA

The Eon WindElectric wind energy site is located near the community of Barrington Passage, situated along Highway 3 within Shelburne County (***Figures 1&2***). The development will involve the construction of two wind turbines with an associated access road. Access to the study area can be gained off Highway 3, approximately 5 kilometres to the southwest of Barrington Passage.

PLATE 1. View east at turnoff to access road.



Study Area

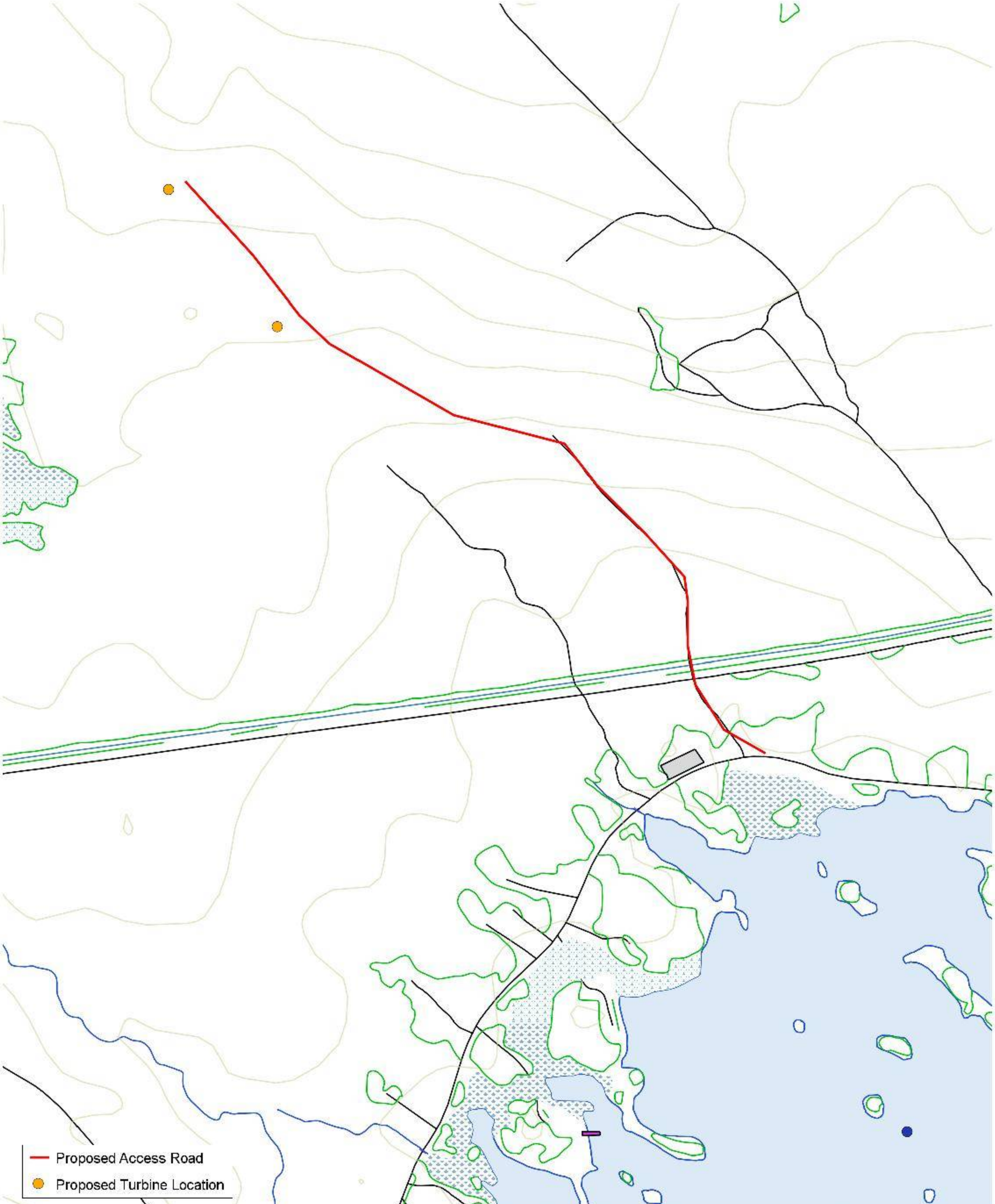
Figure 1

BARRINGTON WIND PROJECT
ARCHAEOLOGICAL SCREENING AND RECONNAISSANCE
LUNENBURG COUNTY

November 2012

Scale 1:50,000

CRM Group
Cultural Resource Management Group Ltd.



CRM Group
Cultural Resource Management Group Ltd.

Study Area

BARRINGTON WIND PROJECT
ARCHAEOLOGICAL SCREENING AND RECONNAISSANCE
SHELBURNE COUNTY

Figure 2

November 2012

Scale 1:10,000

3.0 METHODOLOGY

Eon WindElectric retained CRM Group to undertake archaeological screening and reconnaissance of the proposed Barrington Wind Project. The objective of the archaeological assessment was to evaluate archaeological potential within the area that will be impacted by development of the wind farm project. To address this objective, CRM Group developed a work plan consisting of the following components: a review of relevant site documentation to develop an archaeological potential model (screening); archaeological reconnaissance of the areas that may be impacted by development activities; and, a report summarizing the results of the background research and field survey, as well as providing cultural resource management recommendations.

3.1 Background Study

The archival research component of the archaeological screening and reconnaissance was designed to explore the land use history of the study area and provide information necessary to evaluate the area's archaeological potential. To achieve this goal, CRM Group utilized documentary resources available through various institutions including the Nova Scotia Archives, Nova Scotia Land Information Centre, the Department of Natural Resources and the Nova Scotia Museum.

The background study included a review of relevant historic documentation incorporating land grant records, legal survey and historic maps, as well as local and regional histories. Topographic maps and aerial photographs, both current and historic, were also used to evaluate the study area. This data facilitated the identification of environmental and topographic features that would have influenced human settlement and resource exploitation patterns. The historical and cultural information was integrated with the environmental and topographic data to identify potential areas of archaeological sensitivity.

3.2 Field Reconnaissance

The goals of the archaeological field reconnaissance were to conduct a visual inspection of the study area, document any areas of archaeological sensitivity or archaeological sites identified during the course of visual inspection, and design a strategy for testing areas of archaeological potential, as well as any archaeological resources identified within the study area. Although the ground search did not involve sub-surface testing, the researchers were watchful for topographic or vegetative anomalies that might indicate the presence of buried archaeological resources. The process and results of the field reconnaissance were documented in field notes and photographs.

A hand-held Global Positioning System (GPS) unit was used to record UTM coordinates for all survey areas, as well as any identified diagnostic artifacts, formal tools, isolated finds and site locations.

4.0 RESULTS

4.1 Background Study

The following discussion details the environmental and cultural setting of the study area. This background study provides a framework for the evaluation of archaeological potential and the initial interpretation of any resources encountered during the field component of the assessment.

4.1.1 Environmental Setting

A number of environmental factors such as water sources, physiographic features, soil types and vegetation have influenced settlement patterns and contribute to the archaeological potential of the area.

Water Sources

Proximity to water, for both drinking and transportation, is a key factor in identifying Precontact and historic Native, as well as early Euro-Canadian, archaeological potential. The study area is located along Murray Cove of Barrington Passage. The proposed wind turbines are situated approximately 1.5 kilometres inland from the coast. The closest source of freshwater are Bear Point Pond and Atwoods Brook, both located over 600 metres to the west and flow into Murray Cove.

Topography

The Barrington Wind Farm study area is located within the greater terrestrial region known as the Capes and Bays Unit within the quartzite Headlands district (Davis & Browne 1996: 203-204). The area is characterized by granite and greywacke bedrock with hummocky terrain with little relief (Davis & Browne 1996: 204).

Soils

The study area is covered by *Lydgate* series soils. *Lydgate* soils, developed from a granitic parent material, are stonier than those derived from schist or quartzite (MacDougall et al. 1961: 23). The soils consist of very dark brown sandy loam over dark yellowish brown sandy loam. *Lydgate* soil is excessively stony and generally unsuitable for agriculture (MacDougall et al. 1961: 23).

Vegetation

The forest growth within this ecological region consists of primarily white spruce and balsam fir with some maple, birch and poplar. Large areas of bog and barren are also common throughout the area with Labrador tea, blueberries and lambkill as the main vegetative cover in these areas (Davis & Browne 1996: 204).

Fauna

A range of coastal habitats provide a wide variety of environments for both shorebirds and waterfowl. This area is an important wintering area for many species. Nutrient-rich waters provide food for waterfowl and whales, while warm water conditions in the summer often attracts exotic tropical species (Davis & Browne 1996: 205).

4.1.2 Native Land Use

The land within the study area was once part of the greater Mi'kmaw territory known as *Kespukwitk*, meaning 'land ends'. A review of the Maritime Archaeological Resource Inventory (MARI), the provincial archaeological site database maintained by the Nova Scotia Museum, identified no registered Precontact sites in the immediate vicinity of the study area. The closest registered Precontact site is located approximately four kilometres to the east-southeast of the study area. Archaeological site AjDj-10 is situated on the northern end of Cape Sable Island and is classified as a possible Ceramic Period site (3,000 – 500 BP) consisting of isolated finds (three projectile points).

There are six additional Precontact sites registered within a 7 kilometre radius of the study area. Archaeological sites AjDj-02 through AjDj-06 and AjDk-01 are all possible Ceramic Period sites.

Based on its unfavourable environmental setting and limited potential of significant Native land use (its distance from any significant water source and known sites), the Barrington Wind Farm study area is ascribed diminished potential for encountering Precontact and/or early historic Native archaeological resources.

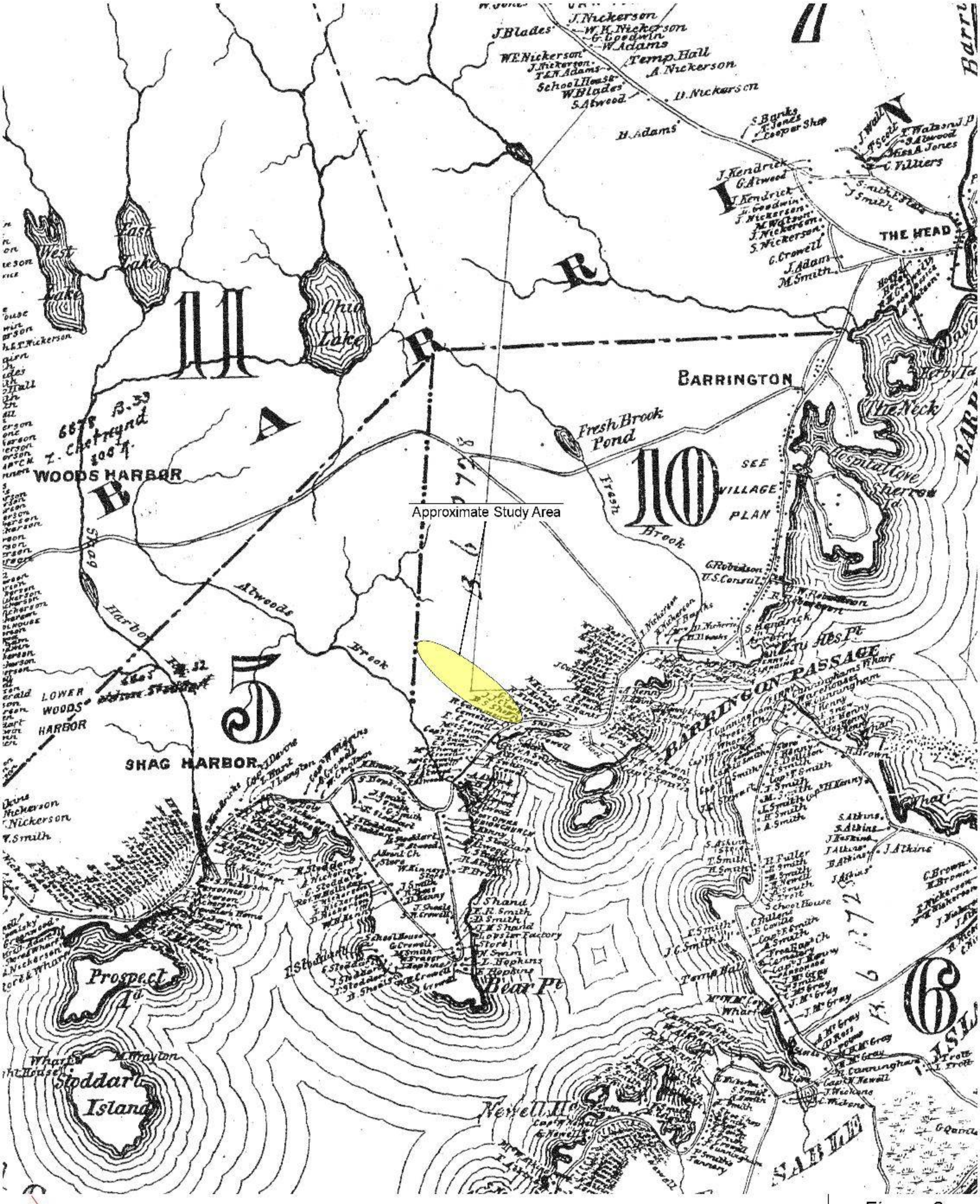
4.1.3 Property History

A review of historic land grant maps revealed that the study area is situated within a plot of 100,000 acres attributed to Barrington Township, with no indication as to whom the land was granted (Grant Sheet 011). Currently, the proposed development spans four separate properties.

A review of historic mapping for the area indicates no sign of any development or dwellings on or near the study area (Church's 1864 *Topographical Township Map of Shelburne County, Nova Scotia* - ***Figure 3***). At this time, settlement of the area was focused along the historic coastal road, which is currently Highway 3.

4.1.4 Archaeological Potential

Based on the various components of the background study, including environmental setting, Native land use and property history, the vicinity of the study area is considered to exhibit low potential for encountering Precontact and/or historic archaeological resources.



A.F. Chruch - 1864

Figure 3

CRM Group
Cultural Resource Management Group Ltd.

BARRINGTON WIND PROJECT
ARCHAEOLOGICAL SCREENING AND RECONNAISSANCE
SHELBURNE COUNTY

November 2012

4.2 Field Reconnaissance

The archaeological reconnaissance was undertaken on October 23, 2012 under clear conditions. The goal of the visit was to assess the area for archaeological potential and investigate any topographical and/or cultural features that had been identified as areas of elevated potential during the background research.

The proposed development will involve the construction of two wind turbine sites and associated access roads. An existing trail leads from Highway 3 through the study area to an existing meteorological tower (***Plates 2 & 3***). Much of the terrain leading into the study area is low and wet.

In general, the study area is characterized by gently sloping to undulating terrain (***Plate 4***). Numerous existing trails have been cut through the area possibly related to selective logging by local residents (***Plate 5***). Vegetation cover is comprised of a mixed forest of primarily spruce, fir and maple with blueberry, bunchberry, ferns and other shrubs as ground cover. Dense growth of young fir trees in many areas impeded visibility of the ground surface (***Plate 6***). Numerous areas of poorly drained, swampy terrain were also encountered throughout the study area (***Plate 7***).

No historic features or artifacts were observed during the field reconnaissance of the Barrington Wind Farm Project. Furthermore, given that the study area is set back from any significant water courses and occupies an uneven terrain, the area is considered to exhibit low overall potential for Precontact and/or historic archaeological resources.

PLATE 2. View northwest of existing trail leading from Highway 3.

PLATE 3. Poorly drained terrain in the vicinity of the meteorological tower; facing west.

PLATE 4. Typical terrain seen throughout the majority of the study area; facing east.

PLATE 5. Numerous existing trails have been cut through the study area; facing north.

PLATE 6. Dense growth impeded visibility in some areas; facing west.

PLATE 7. Low potential terrain within the study area; facing south.

5.0 CONCLUSIONS AND RECOMMENDATIONS

The 2012 archaeological screening and reconnaissance of the Barrington Wind Farm Project consisted of historical background research and a visual inspection of the study area. It did not involve sub-surface testing. The background research and field reconnaissance conducted by CRM Group determined the study area to exhibit low potential for encountering Precontact and/or early historic archaeological resources

Based on these results, CRM Group offers the following management recommendations for the study area:

1. It is recommended that the study area, as defined and depicted in this report, be cleared of any requirement for future archaeological investigation.

2. In the unlikely event that archaeological deposits or human remains are encountered during activities associated with the Barrington Wind Farm Project, all work in the associated area(s) should be halted and immediate contact made with the Coordinator of the Special Places Program (Laura Bennett: 902-424-6475).

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Appendix 7: BOTANY REPORTING

Wetland Survey
Eon WindElectric
Murray Cove, Shelburne County
Nova Scotia

2012

Prepared By:
Jim Jotcham, Marbicon Inc.
Dr. Nicholas Hill, Fern Hill Institute
December 8, 2012

INTRODUCTION

Marbicon Inc. has conducted a wetland survey at a property located by Murray Cove, Shelburne County, Nova Scotia (See Figure 1). The access road is located on Highway 3 between the communities of Atwood's Brook and Doctor's Cove. The subject property and surrounding area is forested. The approximate center of the site is at 43^{o} 31' 17" north and 65^{o} 39' 44" west, which is located on the 1:50,000 topographic map “Pubnico Nova Scotia” 20P/12. The nearest lake is Bear Point Pond, located about 0.8 km west of the site. The wetland boundaries depicted in this report represent a calculated estimation of the jurisdictional limits within the site, and are subject to modification following a detailed survey. Figure 1 shows an aerial view of the general area; Figures 2 and 3 are site photographs. The field work for this assessment was performed on July 5 (botanist Jim Jotcham), August 16 (botanist Dr. Nicholas Hill), and on November 6 (Dr. Nicholas Hill accompanied by Andrew Arbuckle) 2012.

The original mandate for this effort was to delineate the wetland areas along a proposed access road to two proposed wind turbine pads, identifying where culverts were likely necessary or where wetland crossings would trigger a requirement for wetland alteration approvals and hence more complete delineations. The resulting data identified start points and end points for wetlands along the proposed corridor. A botanical survey was also performed.

Existing Site Conditions

The subject site was composed of two parts: a proposed access road and the proposed turbine pad areas. Because of the imperfectly drained undulating topography common in the area, may portions of the proposed access road crossed wooded wetlands. The turbine areas were drier, and mostly upland sites (with a couple nearby wetlands). Turbine 1 was in an area of windfall with young fir regeneration. No wetlands were noted within the proposed pad, but some wetlands were north of the pad. Turbine 2 was in a moist softwood stand (balsam fir and white spruce). Although no wetlands were noted on the proposed pad, a wetland lay southwest.

Detailed observations about each wetland await a full wetland delineation, but generally speaking, the wetlands can be readily identified on site by deep black saturated soils, often with sphagnum moss under cinnamon fern (*Osmunda cinnamomea*), dominated by black spruce (*Picea mariana*). The uplands tended to be mixed woods. Common trees throughout were red maple (*Acer rubrum*), balsam fir (*Abies balsamea*), and black spruce (*Picea mariana*).

A list of wetlands observed along the proposed access road and the turbine pads is presented in Appendices 1 to 3 (July 5, August 16, and November 6 respectively) . Different GPS units on different days and readings by different people perhaps at slightly different points meant the way points may not be exactly duplicated when measuring the same feature.

The plant species inventory of the site and surrounding area (Appendix 4) did not reveal any rare plants or unusual habitat. The ACCDC list (dated April 20 2012) showed some species of interest that were recorded within 10 km of the site, shown in Table 1. Nova Scotia Agalinis (*Agalinis neoscotica*) was found on site. The DNR rank for this species has not yet been determined, but it is an S3 species. Eastern blue-eyed grass (*Sisyrinchium atlanticum* was also found on site, but it is considered secure by DNR (Green status). No protected species were identified.

Table 1. ACCDC partial list of species of concern (only those recorded within 10 km are shown)

Blue Felt Lichen	*Degelia plumbea*	S2	(4 km)
Olney's Bulrush	*Schoenoplectus americanus*	S3	(6 km)
Northern Adder's-tongue	*Ophioglossum pusillum*	S2S3	(7 km)
Ghost Antler Lichen	*Pseudevernia cladonia*	S2S3	(8 km)
Southern Mudwort	*Limosella australis*	S3	(8 km)
Shining Ladies'-Tresses	*Spiranthes lucida*	S2	(8 km)
Elliott's Goldenrod	*Solidago latissimifolia*	S3	(9 km)
Grass-leaved Rush	*Juncus marginatus*	*S3*	(9 km)
Nova Scotia Agalinis	*Agalinis neoscotica*	S3	(10 km)*
Greene's Rush	*Juncus greenei*	S1S2	(10 km)
Eastern Blue-Eyed-Grass	*Sisyrinchium atlanticum*	S3S4	(10 km)*
Long's Sedge	*Carex longii*	S1?	(10 km)
Knotted Pearlwort	*Sagina nodosa ssp. borealis*	S2S3	(10 km)

Little Curlygrass Fern	*Schizaea pusilla*	S3	(10 km)
Tubercled Orchid	*Platanthera flava var. flava*	S2	(10 km)
Eastern Cudweed	*Pseudognaphalium obtusifolium*	S3S4	(10 km)

No fish or shellfish were observed on site; signs of white-tailed deer and black bear were seen.

According to the *Soil Survey of Shelburne County Nova Scotia* (Report number 10, Nova Scotia Soil Survey 1961), the soil was a Gleyed Humic Podzol. Surface drainage is usually fairly rapid, but the high organic matter content of the surface layer retains moisture over long periods. Internal drainage is also restricted by the strong cementing in the B horizon. These soils are imperfectly drained (coded Lg/B-4 on the soil survey map). The topography is undulating.The wetlands found on site were not mapped in the soil survey.

The Pubnico 1:50,000 topographic map confirmed that the area is fairly level, with the site being between 10 and 20 metres elevation.

The soil survey also indicated a better-drained soil just to the north of the Lydgate series. This was the Port Herbert series, a Humic Podzol. The northern portion of the property may be a transition zone between the two soil series.

Figure 1. Site and Vicinity. (see Appendices for the wetland overlays). This 2010 image is taken from Google Earth 2012. The subject property is in the centre of this image. A powerline right-of-way can be seen across the bottom of the image, just north of, and parallel to, an abandoned railroad bed. A portion of Highway 3 is in the lower right corner.

Figure 2: Typical mixed forest, in this case with a strong balsam fir understory.

Figure 3. A stream following a woods road.

RESULTS

The GPS points for the wetlands identified on July 5 2012, from south to north, are presented in Appendix 1, and these are shown overlaid to a Google Earth image. Five streams (one intermittent) and associated wetlands, plus another eight wetlands (without a water channel) were identified walking from the southern access to the northern proposed turbine pad. That is, at least 13 wetland crossings were identified on the proposed road. The majority of the habitat in the wetlands were swamps. The GPS points from August 16 2012 are shown in Appendix 2, and add the wetlands identified on an established road used to access the met tower during construction. The data and wetland overlays from November 6 2012 is shown in Appendix 3.

A swamp is defined as "a wetland dominated by trees and shrubs, with generally over 30% cover in woody species, wood-rich peat or mineral soils and water tables typically at or below the surface. They may be seasonally or permanently flooded with as much as 30 cm of water. Swamps are generally not as wet as marshes, fens and the open bogs. They are common along the drier portions of floodplains and riparian areas of rivers and streams" (*Nova Scotia Wetland Policy, 2011*).

A complete list of species observed on site is presented in Appendix 4. The plants in the wetlands supported the definition of the site as a swamp. The plant species inventory of the site and surrounding area did not reveal any rare plants or unusual habitat. All native plants on site had an NSDNR Green status (or were undetermined).

Wetland hydrology indicators observed within the wetlands included surface pooling, and saturated soils in the upper 30 cm of soil profile. The wetlands generally drained west and south.

The soils in the swamps were organic (Histosol). These soils were determined to be hydric based on low chroma colors and the depth of the organic matter accumulation.

Full perimeter wetland delineations were not performed on all wetlands encountered in 2012. Wetland start and end points along a proposed corridor were identified. It is the proponent's responsibility to ensure that all regulatory requirements are met prior to further development or wetland alteration at this site.

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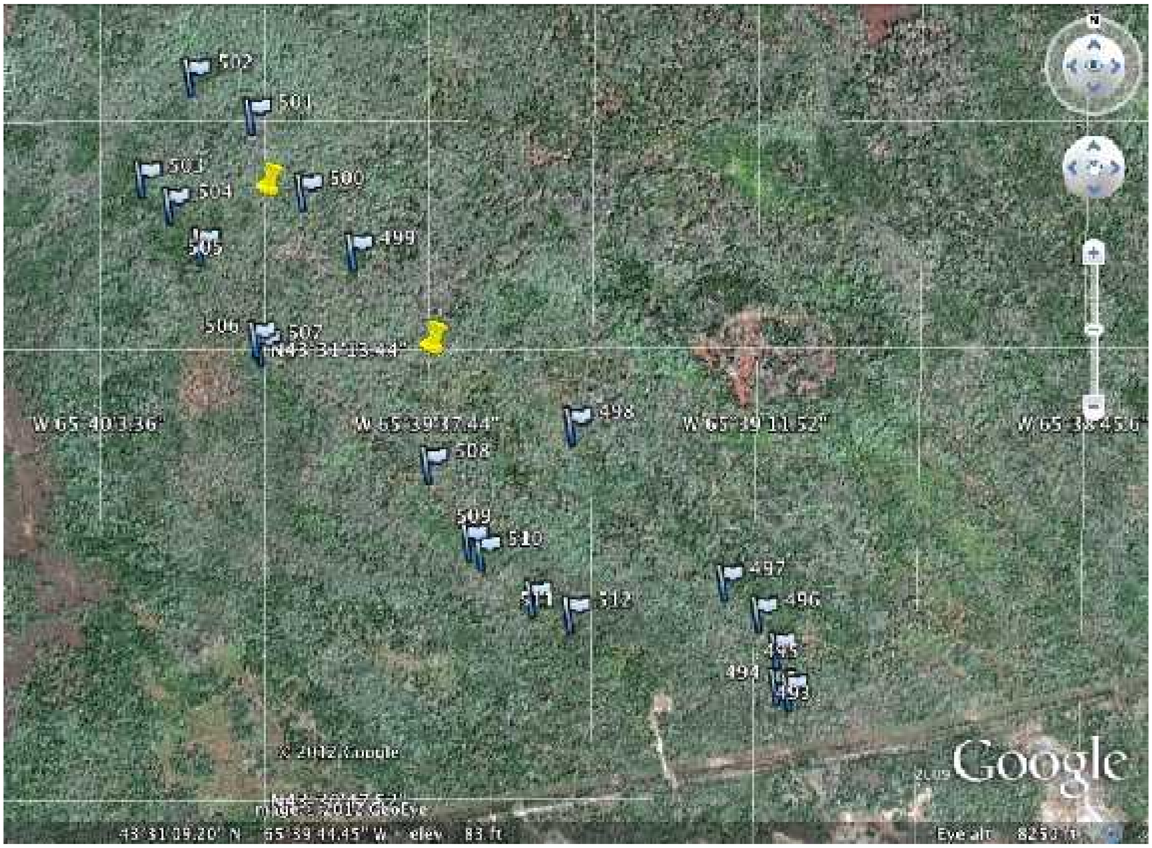
APPENDIX 1 - GPS points July 5, 2012 (see Google Earth overlay attached).

GPS POINT	Latitude	Longitude	Description
BAR STR 1	N43–30'46.63"	W065–39'05.62"	bridge over stream
327	N43–30'49.94"	W065–39'08.47"	wet area at ROW (start)
328	N43–30'50.83"	W065–39'08.80"	wet area at ROW (end)
329	N43–30'52.78"	W065–39'09.06"	before stream
BAR STR 2	N43–30'53.26"	W065–39'09.11"	stream
330	N43–30'53.60"	W065–39'09.08"	after stream
BAR LOWER WET	N43–30'54.97"	W065–39'09.25"	before wetland
347	N43–30'56.68"	W065–39'10.52"	?
BAR UPPER W-RD	N43–30'57.56"	W065–39'11.73"	after wetland / on trail
348	N43–30'57.97"	W065–39'10.42"	before wetland
349	N43–30'58.13"	W065–39'10.78"	after wetland
346	N43–30'58.26"	W065–39'12.73"	before stream
BAR STR 4	N43–30'58.82"	W065–39'13.62"	stream
345	N43–30'58.97"	W065–39'13.70"	after stream
BAR INT STRM	N43–30'59.69"	W065–39'13.63"	intermittent stream
331	N43–31'00.93"	W065–39'16.25"	before wetland
332	N43–31'01.63"	W065–39'17.51"	after wetland
333	N43–31'02.72"	W065–39'18.89"	before wetland
334	N43–31'03.63"	W065–39'19.90"	after wetland
344	N43–31'04.68"	W065–39'21.61"	before wetland
336	N43–31'04.56"	W065–39'22.45"	after wetland
337	N43–31'05.02"	W065–39'24.74"	before stream
BAR STR 3	N43–31'04.96"	W065–39'24.99"	stream
338	N43–31'04.94"	W065–39'25.05"	after stream
342	N43–31'10.88"	W065–39'32.46"	before wetland
341	N43–31'11.21"	W065–39'32.93"	after wetland
BAR T-2	N43–31'12.60"	W065–39'37.60"	South turbine
BAR WINDFALL	N43–31'12.71"	W065–39'37.54"	windfall
BAR T-1	N43–31'21.60"	W065–39'50.60"	North turbine
BAR OPEN MAPLE	N43–31'21.63"	W065–39'50.50"	open maple upland

APPENDIX 1 (cont.) - Google Earth image with July 5 2012 GPS points.

(See GPS point descriptions in Appendix 1 above)

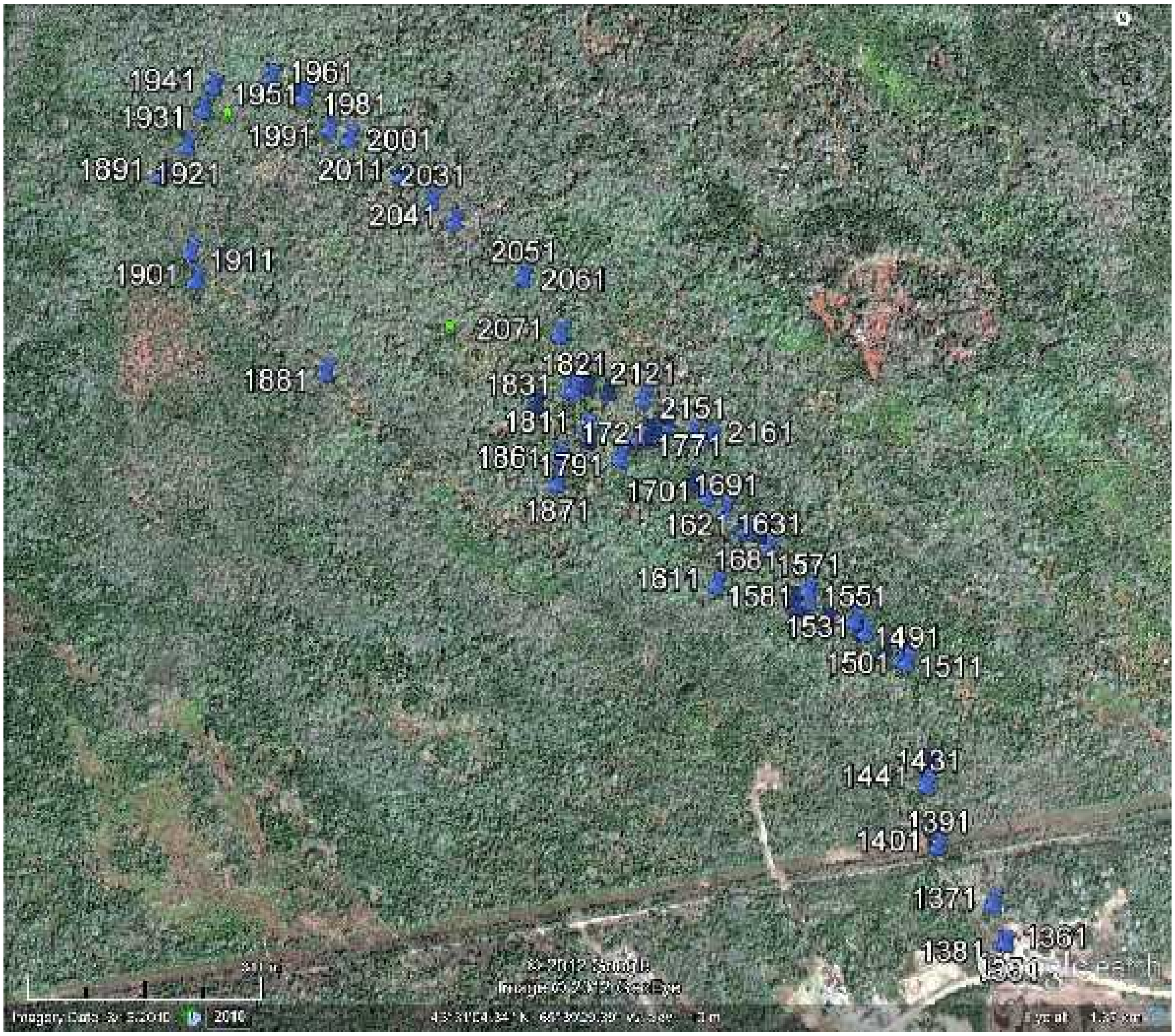
APPENDIX 2. Additional GPS points from Aug 16 2012 (Dr. N. Hill). Each point is a wetland.



<u>Wetland Waypoints August 16 2012</u>:

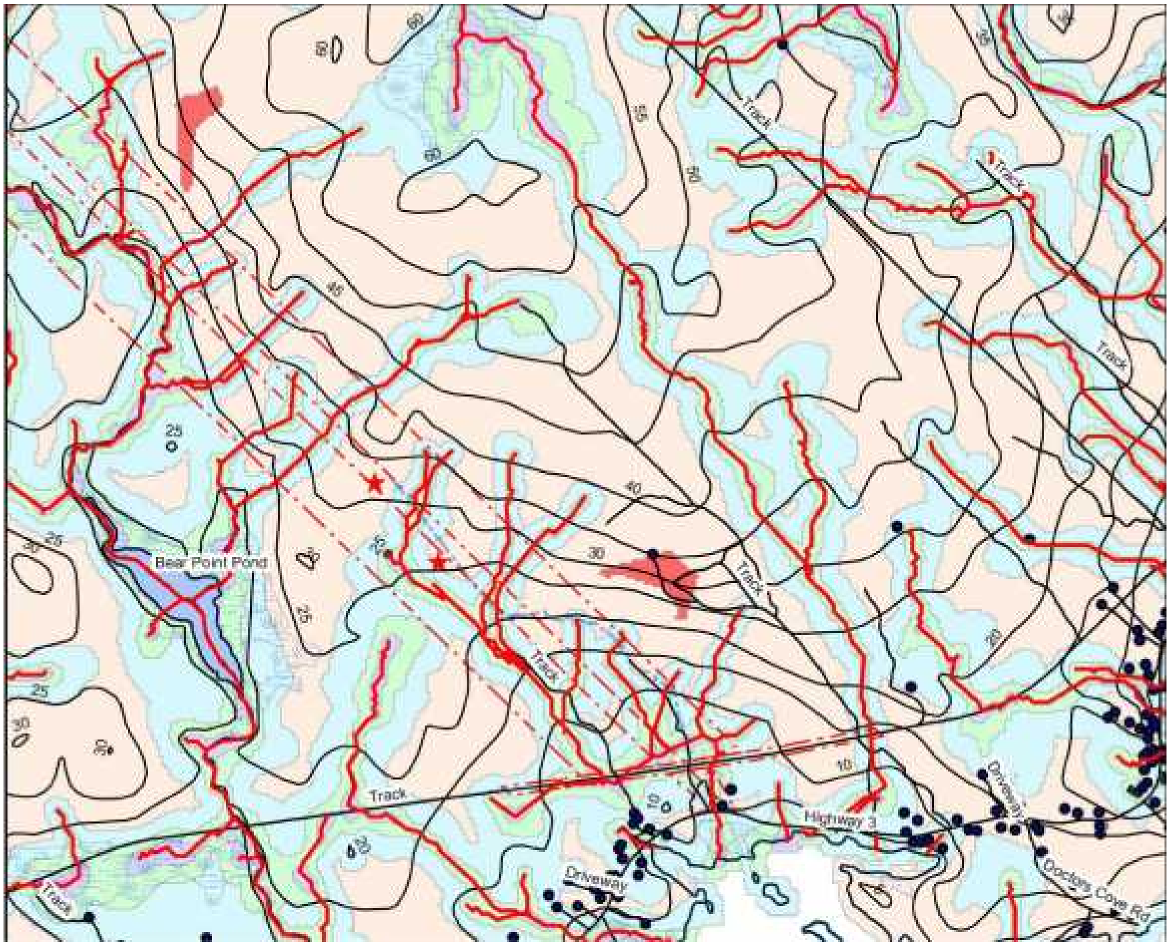
493	N 43.514575	W 065.652274
494	N 43.514662	W 065.652547
495	N 43.515248	W 065.652555
496	N 43.515830	W 065.652954
497	N 43.516337	W 065.653722
498	N 43.518845	W 065.657097 (area smaller than 100m^2)
499	N 43.521605	W 065.661915
502	N 43.524373	W 065.665473
504	N 43.522344	W 065.665926
505	N 43.521701	W 065.665276
508	N 43.518221	W 065.660264

APPENDIX 3. Additional GPS points from November 6 2012 (Dr. N. Hill and Andrew Arbuckle).
NOTE - Waypoints have an additional '1' shown, so that point 190 is shown as 1901, 191 is shown as 1911, etc.)



Narrative:

There was not adequate time on the November 6 to conduct a full inventory of potential wetland areas. WAM mapping (shown below, supplied by Eon WindElectric) shows considerable stream flow from NE to SW across the existing trackway (see attached figure). Avoiding all wetlands may be impractical without spur roads to service turbines from a roadway built further to east of the existing track.



WAM (Wetland Area Mapping) image of project site

Wetlands identified November 6:

1) East of the road at waypoint 136 straight line to 137, thence a line along a stream that is perpendicular to road.

136 N 43.512709 W 065.651204

137 N 43.513185 W 065.651419

West of the road wetland also forms a triangle to the same stream, see Track 16 and img. BARRWET1.

2) Powerline crossing (from 139 to 142 on west and 140 to 141 on east) is a 24 m crossing. Extensive wetland extends in both west and east directions (confirmed) and cannot be side stepped in this crossing area.

139 N 43.513873 W 065.652344
140 N 43.513879 W 065.652343
141 N 43.514069 W 065.652398
142 N 43.514081 W 065.652431

3) Track goes through wetland for 25 metres: on east side from 143 to 147 and on west of track from 144 to 148:

143 N 43.514614 W 065.652517
144 N 43.514661 W 065.652551
147 N 43.514881 W 065.652527
148 N 43.514880 W 065.652528

4) Flow mediation needed for following ABC cases (see below). A & B are underground streams that need culverts. C may need a bed of porous, incompressible material since the water is at the surface crossing the track and is about 5m wide and is underground.

A) 149 to 150 (underground stream; ca. 10 metres wide)

149 N 43.516106 W 065.652878
150 N 43.516110 W 065.652884

B) underground stream

152 N 43.516285 W 065.653241

C) 5 m wide stream crosses road

154 N 43.516473 W 065.653643

5) Pocket wetlands (<100m^2 in total area)

A) 155 N 43.516602 W 065.653756 (ca. 50m^2 area wetland)

B) 156 N 43.516607 W 065.654204 (< 50m^2 area)

6) Extensive wetland area west of track: Track 158 and 159. These tracks join and show a single wetland area here (See Figure below). It appears there may be a roadway to the east, however more work will be needed to establish that these east wetlands (Tracks164, 166) are separate from the large western side wetland. Also, tracking suggests the second eastern wetland is less than 100m^2, however, tracking integration function not accurate calls for metre tape method to get a reliable area measurement.

7) Wetland

169 N 43.517939 W 065.655906

8) Underground stream needing culvert (30 m2 total wetland area)

171 N 43.518271 W 065.656408

9) Large wetland.

172 N 43.518790 W 065.656922

10) Wetlands interspersed...need more work (waypoints 174 to 177)

174 N 43.518815 W 065.657031

175 N 43.518863 W 065.657094

176 N 43.518866 W 065.657220

177 N 43.518800 W 065.657339

11) Swamp in 20 m of roadway, wetland> 100m^2

180 N 43.518774 W 065.658144

181 N 43.518927 W 065.658196

12) Swamp, black spruce

182 N 43.519377 W 065.658400

183 N 43.519367 W 065.658493

13) Swamp

187 N 43.518258 W 065.658679

14) Blanket swamp (50 m span > 100m^2 wetland area)

193 N 43.522671 W 065.664451

194 N 43.522944 W 065.664272

NOTE - Waypoint 196 is upland; a dry high point.

196 N 43.523045 W 065.663329

RETURN leg from Turbine #1

There are numerous swampy spots but these would need to be described more carefully to see if they were large enough to cause problems. WAM for this local area shows several flows NE to SW.

The following waypoints were swampy spots on a pathway further to the east:

197-198

197 N 43.522860 W 065.662876

198 N 43.522827 W 065.662798)

199

199 N 43.522456 W 065.662375

Swamp on flat between 203-204

203 N 43.521600 W 065.660709

204 N 43.521359 W 065.660346

Wet spots

211 N 43.519350 W 065.657821

213 N 43.518957 W 065.657005

215 N 43.518855 W 065.656444

Noted dry sections included:

210 N 43.519425 W 065.658159

212 N 43.519264 W 065.657261

214 N 43.518996 W 065.656854

216 N 43.518798 W 065.656165

APPENDIX 4. Site vegetation inventory surveyed July 5 and August 16, 2012.

Scientific Name	Common Name	ACCDC S-rank	DNR Status
Abies balsamea	Balsam fir	S5	Green
Acer rubrum	Red maple	S5	Green
Agalinis (Gerardia) neoscotica	NS False foxglove	**S3**	undet.
Agrostis scabra	Rough bentgrass	S5	Green
Agrostis stolonifera	Spreading bentgrass	S5	Green
Alnus incana	Speckled alder	S5	Green
Amelanchier sp.	Serviceberries	n/a	n/a
Anaphalis margaritacea	Pearly everlasting	S5	Green
Aralia hispida	Bristly Aralia	S5	Green
Aralia nudicaulis	Wild sarsaparilla	S5	Green
Betula allegheniensis	Yellow birch	S5	Green
Betula papyrifera	Paper birch	S5	Green
Betula populifolia	Gray birch	S5	Green
Calamagrostis canadensis	Blue-joint reedgrass	S5	Green
Carex atlantica	Prickly bog sedge	S4	Green
Carex bullata	Button sedge	S4	Green
Carex crinita	Fringed sedge	S5	Green
Carex debilis	White-edge sedge	S5	Green
Carex echinata	Little prickly sedge	S5	Green
Carex exilis	Coast sedge	S4	Green
Carex folliculata	Long sedge	S5	Green
Carex nigra	Black sedge	S5	Green
Carex scoparia	Pointed broom sedge	S5	Green
Carex stricta	Tussock sedge	S5	Green
Carex trisperma	Three-seed sedge	S5	Green
Centaurea nigra	Black starthistle	SE	n/a
Clintonia borealis	Clinton lily	S5	Green
Coptis trifolia	Goldthread	S5	Green
Cornus canadensis	Dwarf dogwood	S5	Green
Crepis capillaris	Smooth hawksbeard	SE	n/a
Cypripedium acaule	Pink lady's slipper	S5	Green
Danthonia spicata	Poverty oat-grass	S5	Green
Daucus carota	Wild carrot	SE	n/a
Dennstaedtia punctilobula	Eastern hay-scented fern	S5	Green
Deschampsia flexuosa	Crinkled hairgrass	S5	Green
Dichanthelium acuminatum	Panic grass	S5	Green
Diervilla lonicera	Northern bush-honeysuckle	S5	Green

Doellingeria umbellata	Parasol white-top	S5	Green
Drosera rotundifolia	Roundleaf sundew	S5	Green
Dryopteris carthusiana	Spinulose shield fern	S5	Green
Dryopteris cristata	Crested shield-fern	S5	Green
Dryopteris intermedia	Evergreen woodfern	S5	Green
Eleocharis acicularis	Least spike-rush	S5	Green
Epigaea repens	Trailing arbutus	S5	Green
Epilobium ciliatum	Hairy willow-herb	S5	Green
Epilobium leptophyllum	Linear-leaved willow-herb	S5	Green
Eriophorum virginicum	Tawny cotton-grass	S5	Green
Eurybia radula	Rough-leaved aster	S5	Green
Festuca ovina	Hair fescue	SE	n/a
Fragaria virginiana	Virginia strawberry	S5	Green
Gaultheria hispidula	Creeping snowberry	S5	Green
Gaultheria procumbens	Teaberry	S5	Green
Gaylussacia baccata	Black huckleberry	S5	Green
Glyceria canadensis	Canada manna-grass	S5	Green
Glyceria striata	Fowl manna grass	S5	Green
Goodyera tesselata	Checkered Rattlesnake-plantain	S4	Green
Hieracium pilosella	Mouse-ear hawkweed	SE	n/a
Holcus lanatus	Common velvet grass	SE	n/a
Hypericum boreale	Northern St. John's-wort	S5	Green
Hypericum canadense	Canadian St. John's-wort	S5	Green
Ilex verticillata	Black holly	S5	Green
Iris versicolor	Blueflag	S5	Green
Juncus articulatus	Jointed rush	S5	Green
Juncus canadensis	Canada rush	S5	Green
Juncus effusus	Soft rush	S5	Green
Juncus pelocarpus	Brown-fruited rush	S5	Green
Kalmia angustifolia	Sheep-laurel	S5	Green
Larix laricina	American larch	S5	Green
Lathyrus pratensis	Yellow vetchling	SE	n/a
Ledum groenlandicum	Common Labrador tea	S5	Green
Leontodon autumnalis	Fall dandelion	SE	n/a
Leucanthemum vulgare	Oxeye daisy	SE	n/a
Linnaea borealis	Twinflower	S5	Green
Lysimachia terrestris	Swamp loosestrife	S5	Green
Maianthemum canadense	Wild lily-of-the-valley	S5	Green
Maianthemum trifolium	Three-leaf Solomon's plume	S5	Green
Malus pumila	Common apple	SE	n/a
Melampyrum lineare	American cow-wheat	S5	Green

Mitchella repens	Partridge-berry	S5	Green
Monotropa hypopithys	American pinesap	S4	Green
Myrica gale	Sweet bayberry	S5	Green
Myrica (Morella) pensylvanica	Northern bayberry	S5	Green
Nemopanthus mucronatus	Mountain holly	S5	Green
Oclemena acuminata	Whorled aster	S5	Green
Oclemena nemoralis	Bog aster	S5	Green
Oenothera biennis	Common evening primrose	S5	Green
Onoclea sensibilis	Sensitive fern	S5	Green
Orthilia secunda	One-sided wintergreen	S5	Green
Osmunda cinnamomea	Cinnamon fern	S5	Green
Osmunda claytoniana	Interrupted fern	S5	Green
Oxalis montana	White wood-sorrel	S5	Green
Phegopteris connectilis	Northern beech fern	S5	Green
Phleum pratense	Meadow timothy	SE	n/a
Photinia melanocarpa	Black chokeberry	S5	Green
Picea glauca	White spruce	S5	Green
Picea mariana	Black spruce	S5	Green
Picea rubens	Red spruce	S5	Green
Pinus strobus	White pine	S5	Green
Platanthera dilatata	Leafy white orchis	S4S5	Green
Poa pratensis	Kentucky bluegrass	S5	Green
Polygonum cilinode	Fringed black bindweed	S5	Green
Polygonum hydropiper	Marshpepper smartweed	SE	n/a
Polygonum sagittatum	Arrow-leaved tearthumb	S5	Green
Polypodium virginianum	Rock polypody	S5	Green
Populus tremuloides	Trembling aspen	S5	Green
Potentilla norvegica	Norway cinquefoil	SE	n/a
Potentilla simplex	Old-field cinquefoil	S5	Green
Prenanthes trifoliolata	Three-leaved rattlesnake-root	S5	Green
Prunella vulgaris	Self-heal	S5	Green
Prunus pensylvanica	Fire cherry	S5	Green
Prunus virginiana	Choke cherry	S5	Green
Pteridium aquilinum	Bracken fern	S5	Green
Ranunculus repens	Creeping buttercup	SE	n/a
Rhinanthus minor	Little yellow rattle	S5	Green
Rhododendron canadense	Rhodora	S5	Green
Rosa palustris	Swamp rose	**S3**	Green
Rosa virginiana	Virginia rose	S5	Green
Rubus allegheniensis	Allegheny Blackberry	S5	Green
Rubus hispidus	Bristly dewberry	S5	Green

Rubus idaeus	Red raspberry	S5	Green
Rubus recurvicaulis	A bramble	S?	Green
Salix bebbiana	Bebb's willow	S5	Green
Salix discolor	Pussy willow	S5	Green
Scirpus cyperinus	Woolly bulrush	S5	Green
Scirpus microcarpus	Small-fruit bulrush	S5	Green
Sisyrinchium atlanticum	Eastern blue-eyed grass	S3S4	Green
Sisyrinchium montanum	Strict blue-eyed grass	S5	Green
Solidago canadensis	Canada goldenrod	S5	Green
Solidago puberula	Downy goldenrod	S5	Green
Solidago rugosa	Rough goldenrod	S5	Green
Solidago uliginosa	Bog goldenrod	S5	Green
Sorbus americana	American mountain-ash	S5	Green
Spiraea alba	Narrow-leaved meadow-sweet	S5	Green
Spiraea tomentosa	Hardhack spiraea	S5	Green
Symphyotrichum lateriflorum	Farewell-summer	S5	Green
Symphyotrichum novi-belgii	New Belgium American aster	S5	Green
Symphyotrichum puniceum	Swamp aster	S5	Green
Taxus canadensis	Canadian Yew	S5	Green
Thalictrum pubescens	Tall meadow-rue	S5	Green
Thelypteris noveboracensis	New York fern	S5	Green
Trientalis borealis	Northern Starflower	S5	Green
Trifolium arvense	Rabbit-foot clover	SE	n/a
Trifolium hybridum	Alsike clover	SE	n/a
Trifolium pratense	Red clover	SE	n/a
Trifolium repens	Small white clover	SE	n/a
Typha latifolia	Broad-leaved cattail	S5	Green
Vaccinium angustifolium	Late lowbush blueberry	S5	Green
Vaccinium macrocarpon	Large cranberry	S5	Green
Vaccinium myrtilloides	Velvetleaf blueberry	S5	Green
Vaccinium vitis-idaea	Mountain cranberry	S5	Green
Veronica officinalis	Gypsy-weed	S5SE	Green
Viburnum nudum	Possum-haw viburnum	S5	Green
Viola cucullata	Marsh blue violet	S5	Green
Viola macloskeyi	Smooth white violet	S5	Green

(Rank definitions are on the following page)

Ranking:

S3 - Uncommon, or found only in a restricted range, even if abundant at some locations.
S4 - Usually widespread, fairly common, and apparently secure with many occurrences, but of longer-term concern.
S5 - Widespread, abundant, and secure, under present conditions.
SE - Exotic; an exotic, established in the province; may be native in nearby regions.
Green (Secure) **-** Species that are not believed to be at risk, or sensitive. This category includes some species that have declined in numbers but remain relatively widespread or abundant.

Appendix 8: ACCDC

DATA REPORT 4787: Atwoods Brook, NS

Prepared 20 April, 2012
by S.H. Gerriets

CONTENTS OF REPORT

1.0 PREFACE

The Atlantic Canada Conservation Data Centre (ACCDC) is part of a network of circa 85 NatureServe data centres and heritage programs in 50 states, 10 provinces and 1 territory, plus several Central and South American countries. The NatureServe network is more than 30 years old and shares a common conservation data methodology. The ACCDC was founded in 1997, and maintains data for the jurisdictions of New Brunswick, Nova Scotia, Prince Edward Island, Newfoundland and Labrador. Although a non-governmental agency, the ACCDC is supported by 6 federal agencies, plus 4 provincial governments, outside grants and data processing fees. URL: www.ACCDC.com.

Upon request and for a fee, the ACCDC reports known observations of rare and endangered flora and fauna, in and near a specified study area. As a supplement to that data, the ACCDC includes locations of managed areas with some level of protection, and also known sites of ecological interest. Data summarised in each report is attached as DBF files which may be opened from within data software (Excel, Access) or mapped in GIS (ArcView, MapInfo, AutoCAD).

1.1 RESTRICTIONS

The ACCDC makes a strong effort to verify the accuracy of all the data that it manages, but it shall not be held responsible for any inaccuracies in data that it provides. By receiving ACCDC data, recipients assent to the following limits of use:

a.) Data is restricted to use by trained personnel who are sensitive to its potential threat to rare and endangered taxa.
b.) Data is restricted to use by the specified Data User; any third party requiring data must make its own data request.
c.) The ACCDC requires Data Users to cease using and delete data 12 months after receipt.
d.) ACCDC data responses are restricted to that data in our Data System at the time of the data request.
e.) Data is qualified as to location (Precision) and time (SurveyDate); cf Data Dictionary for details.
f.) ACCDC data reports are not to be construed as exhaustive inventories of taxa in an area.
g.) The non-occurrence of a taxon cannot be inferred by its absence in an ACCDC data report.

1.2 ADDITIONAL INFORMATION

Please direct biological questions about ACCDC data to: Sean Blaney, ACCDC: (506) 364-2658, and technical data queries to: Stefen Gerriets, ACCDC: (506) 364-2657.
For provincial information on rare taxa and protected areas, or information on game animals, deer yards, old growth forest, archeological sites, fish habitat etc, please contact Sherman Boates, NSDNR: (902) 679-6146.

2.0 RARE AND ENDANGERED TAXA

A 100km buffer around the study area contains 3276 records of 303 taxa from 97 sources, a relatively low-to-moderate density of records (quintile 2): 0.10 rec/km2.

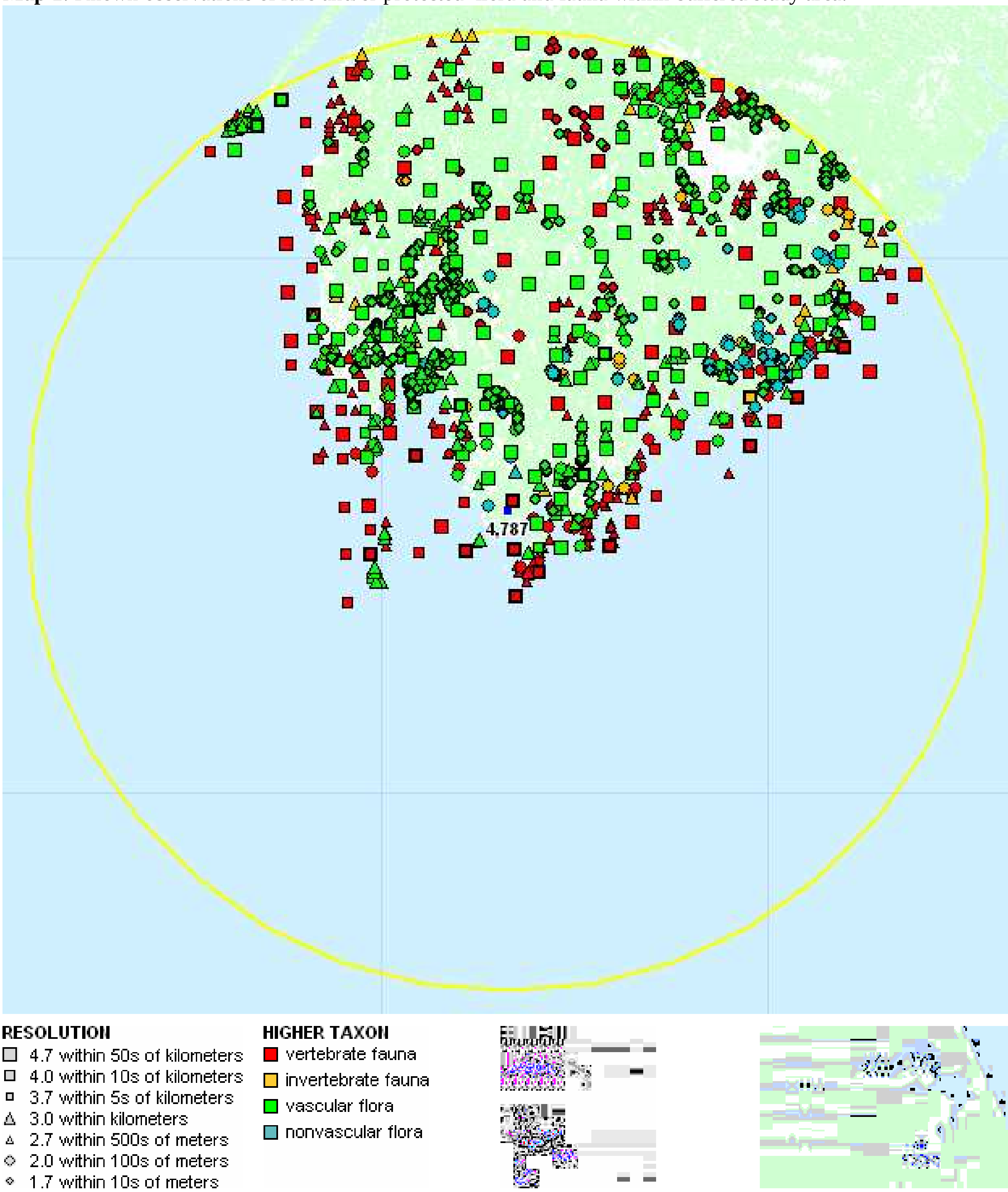
2.1 FLORA

A 100km buffer around the study area contains 1245 records of 156 vascular, 168 records of 20 nonvascular flora (see attached *ob.dbf).

2.2 FAUNA

A 100km buffer around the study area contains 1778 records of 96 vertebrate, 85 records of 31 invertebrate fauna (cf attached *ob.dbf). No data-sensitive taxa were identified.

Map 1: Known observations of rare and/or protected flora and fauna within buffered study area.



3.0 SPECIAL AREAS

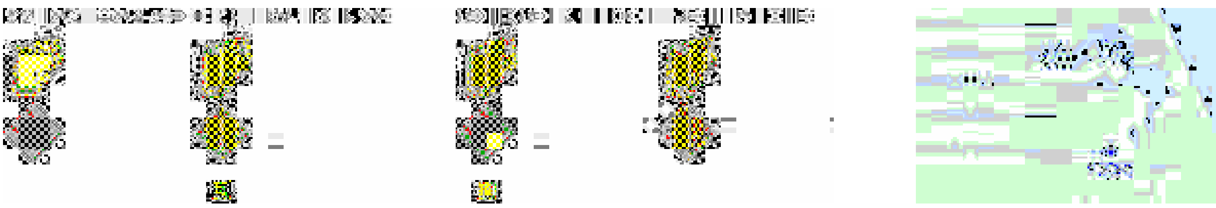
3.1 MANAGED AREAS

The GIS scan identified 4 Managed Areas with some degree of protected status, in the vicinity of the study area (see attached *ma.dbf).

3.2 SIGNIFICANT AREAS

The GIS scan also identified 1 biologically significant site in the vicinity of the study area; such sites are known for exceptional biotic richness but may or may not have legal status (see attached *sa.dbf).

Map 2: Boundaries and/or locations of known Managed and Significant Areas within 5km of study area.



4.0 TAXON LISTS

Rare and/or endangered taxa within the buffered area listed in order of concern, beginning with legally listed taxa, with the number of observations per taxon and the distance in kilometers from study area centroid to the closest observation. [p] = vascular plant, [n] = nonvascular plant, [a] = vertebrate animal, [i] = invertebrate animal, [c] = community.

4.1 FLORA

	scientific name	common name	prov. rarity	prov. status	COSEWIC	obs	dist.km
p	Geum peckii	Eastern Mountain Avens	S1	Endangered	E	2	98 ±0.1
p	Drosera filiformis	Thread-leaved Sundew	S1	Endangered	E	7	11 ±10
p	Coreopsis rosea	Pink Coreopsis	S1	Endangered	E	13	44 ±10
n	Erioderma pedicellatum (Atlantic pop.)	Boreal Felt Lichen - Atlantic pop.	S1S2	Endangered	E	8	53 ±0.1
n	Erioderma mollissimum	Vole Ears	S1S2		E	13	31 ±0.1
p	Sabatia kennedyana	Plymouth Gentian	S1	Endangered	T	21	46 ±5
p	Hydrocotyle umbellata	Water-pennywort	S1	Endangered	T	2	49 ±0
p	Lophiola aurea	Golden Crest	S2	Threatened	T	4	75 ±0.5
p	Baccharis halimifolia	Eastern Baccharis	S1		T	8	15 ±10
p	Eleocharis tuberculosa	Tubercled Spike-rush	S2	Threatened	SC	8	12 ±0
p	Clethra alnifolia	Sweet Pepperbush	S1	Vulnerable	SC	3	43 ±10
p	Lilaeopsis chinensis	Eastern Lilaeopsis	S2	Vulnerable	SC	4	38 ±1
p	Scirpus longii	Long's Bulrush	S2S3	Vulnerable	SC	13	16 ±10
n	Degelia plumbea	Blue Felt Lichen	S2		SC	36	4 ±0.1
n	Pseudevernia cladonia	Ghost Antler Lichen	S2S3		NAR	8	8 ±1
p	Smilax rotundifolia (Atlantic pop.)	Round-leaved Greenbrier	S3		NAR	31	12 ±0
p	Thuja occidentalis	Eastern White Cedar	S1S2	Vulnerable		10	60 ±10
p	Adiantum pedatum	Northern Maidenhair Fern	S1			1	51 ±0.5
p	Spiranthes casei var. casei	Case's Ladies'-Tresses	S1			1	96 ±5
p	Juncus brachycephalus	Short-headed Rush	S1			1	30 ±1
p	Sisyrinchium fuscatum	Coastal Plain Blue-eyed-grass	S1			1	66 ±0.1
p	Rhynchospora macrostachya	Tall Beakrush	S1			1	97 ±0
p	Cyperus diandrus	Low Flatsedge	S1			4	47 ±0
p	Carex wiegandii	Wiegand's Sedge	S1			1	14 ±1
p	Carex viridula var. saxilittoralis	Greenish Sedge	S1			1	96 ±5
p	Galium aparine	Catchweed Bedstraw	S1			2	38 ±0.1
p	Amelanchier nantucketensis	Nantucket Serviceberry	S1			1	41 ±0.1
p	Fraxinus pennsylvanica	Red Ash	S1			1	90 ±0
p	Proserpinaca intermedia	Intermediate Mermaidweed	S1			1	47 ±1
p	Desmodium canadense	Canada Tick-trefoil	S1			1	81 ±10
p	Cuscuta cephalanthi	Buttonbush Dodder	S1			1	59 ±0
p	Hypericum majus	Large St John's-wort	S1			1	86 ±1
p	Suaeda maritima ssp. richii	White Sea-blite	S1			1	15 ±0.1
p	Stellaria crassifolia	Fleshy Stitchwort	S1			1	96 ±10
p	Toxicodendron vernix	Poison Sumac	S1			1	99 ±0
n	Parmeliella parvula	a lichen	S1?			5	62 ±0.1
n	Parmelinopsis horrescens	a Lichen	S1?			1	30 ±0.1
n	Pannaria lurida	a lichen	S1?			7	49 ±0.1
p	Panicum dichotomiflorum var. puritanorum	Fall Panic Grass	S1?			3	35 ±1
p	Dichanthelium acuminatum var. lindheimeri	Woolly Panic Grass	S1?			2	64 ±0.5
p	Triglochin gaspensis	Gaspé Arrowgrass	S1?			7	19 ±0
p	Schoenoplectus robustus	Sturdy Bulrush	S1?			1	53 ±10
p	Carex longii	Long's Sedge	S1?			12	10 ±1
p	Proserpinaca palustris var. palustris	Marsh Mermaidweed	S1?			2	46 ±10
p	Chenopodium rubrum	Red Pigweed	S1?			2	59 ±0
p	Solidago hispida	Hairy Goldenrod	S1?			1	34 ±5
n	Sticta limbata	a lichen	S1S2			1	51 ±0
n	Nephroma resupinatum	a lichen	S1S2			1	84 ±0.1
n	Fuscopannaria leucosticta	a lichen	S1S2			12	30 ±0.1
p	Potamogeton pulcher	Spotted Pondweed	S1S2			5	47 ±0
p	Calamagrostis stricta ssp. stricta	Slim-stemmed Reed Grass	S1S2			1	65 ±0.5
p	Najas gracillima	Thread-Like Naiad	S1S2			3	96 ±0
p	Juncus greenei	Greene's Rush	S1S2			1	10 ±0
p	Agalinis maritima	Saltmarsh Agalinis	S1S2			14	27 ±10
p	Galium obtusum	Blunt-leaved Bedstraw	S1S2			4	45 ±0
p	Ranunculus sceleratus	Cursed Buttercup	S1S2			1	59 ±0
p	Utricularia resupinata	Inverted Bladderwort	S1S2			3	17 ±0.1
p	Cornus suecica	Swedish Bunchberry	S1S2			1	79 ±0.1
n	Leptogium subtile	a Lichen	S1S3			2	54 ±0
p	Huperzia selago	Northern Firmoss	S1S3			1	96 ±5
p	Selaginella selaginoides	Low Spikemoss	S2			1	97 ±5
p	Piptatherum canadense	Canada Rice Grass	S2			7	33 ±0.5
p	Spiranthes lucida	Shining Ladies'-Tresses	S2			4	8 ±10
p	Spiranthes casei var. novaescotiae	Case's Ladies'-Tresses	S2			15	19 ±0.5
p	Spiranthes casei	Case's Ladies'-Tresses	S2			2	18 ±0
p	Platanthera macrophylla	Large Round-Leaved Orchid	S2			1	69 ±1
p	Platanthera flava var. flava	Tubercled Orchid	S2			22	10 ±5
p	Platanthera flava	Tubercled Orchid	S2			1	14 ±10
p	Listera australis	Southern Twayblade	S2			5	60 ±0
p	Goodyera pubescens	Downy Rattlesnake-Plantain	S2			5	90 ±1
p	Allium schoenoprasum var. sibiricum	Wild Chives	S2			1	99 ±0.5
p	Carex atlantica ssp. capillacea	Atlantic Sedge	S2			15	12 ±0
p	Viola nephrophylla	Northern Bog Violet	S2			1	48 ±1
p	Salix sericea	Silky Willow	S2			3	57 ±0
p	Salix pedicellaris	Bog Willow	S2			1	99 ±1
p	Ranunculus flammula var. flammula	Lesser Spearwort	S2			2	44 ±0.1

p	Samolus valerandi ssp. parviflorus	Seaside Brookweed	S2	10	19 ±0
p	Oenothera fruticosa ssp. glauca	Narrow-leaved Evening Primrose	S2	5	60 ±5
p	Myriophyllum farwellii	Farwell's Water Milfoil	S2	6	63 ±10
p	Vaccinium uliginosum	Alpine Bilberry	S2	2	96 ±5
p	Crassula aquatica	Water Pygmyweed	S2	2	11 ±0.1
p	Hudsonia ericoides	Pinebarren Golden Heather	S2	8	16 ±0
p	Cardamine parviflora var. arenicola	Small-flowered Bittercress	S2	1	98 ±5
p	Betula michauxii	Newfoundland Dwarf Birch	S2	2	96 ±5
p	Symphyotrichum undulatum	Wavy-leaved Aster	S2	2	72 ±10
p	Senecio pseudoarnica	Seabeach Ragwort	S2	1	48 ±0.1
p	Lactuca hirsuta var. sanguinea	Hairy Lettuce	S2	3	40 ±10
p	Iva frutescens ssp. oraria	Big-leaved Marsh-elder	S2	12	18 ±0
p	Hieracium robinsonii	Robinson's Hawkweed	S2	3	30 ±1
p	Eupatorium dubium	Coastal Plain Joe-pye-weed	S2	20	30 ±0.1
p	Erigeron philadelphicus	Philadelphia Fleabane	S2	1	69 ±1
p	Conioselinum chinense	Chinese Hemlock-parsley	S2	2	83 ±0.5
p	Dichanthelium linearifolium	Narrow-leaved Panic Grass	S2?	1	61 ±0
p	Eleocharis ovata	Ovate Spikerush	S2?	1	36 ±0
p	Amelanchier fernaldii	Fernald's Serviceberry	S2?	1	48 ±1
p	Rumex maritimus var. persicarioides	Peach-leaved Dock	S2?	1	97 ±0
p	Ceratophyllum echinatum	Prickly Hornwort	S2?	1	54 ±0
p	Symphyotrichum boreale	Boreal Aster	S2?	7	52 ±0
n	Physconia detersa	a Lichen	S2S3	1	64 ±0
n	Leptogium milligranum	a lichen	S2S3	5	11 ±0.1
n	Leptogium corticola	a lichen	S2S3	18	30 ±0.1
n	Collema nigrescens	a lichen	S2S3	9	43 ±0.1
n	Collema leptaleum	a lichen	S2S3	1	85 ±0.1
p	Ophioglossum pusillum	Northern Adder's-tongue	S2S3	5	7 ±10
p	Woodwardia areolata	Netted Chain Fern	S2S3	53	17 ±0.1
p	Panicum tuckermanii	Tuckerman's Panic Grass	S2S3	5	14 ±0
p	Spiranthes ochroleuca	Yellow Ladies'-tresses	S2S3	15	19 ±0.5
p	Eleocharis olivacea	Yellow Spikerush	S2S3	2	36 ±0.5
p	Carex swanii	Swan's Sedge	S2S3	6	38 ±0.5
p	Carex adusta	Lesser Brown Sedge	S2S3	1	94 ±10
p	Polygonum raii	Sharp-fruited Knotweed	S2S3	6	18 ±5
p	Polygonum buxiforme	Small's Knotweed	S2S3	1	97 ±10
p	Fraxinus nigra	Black Ash	S2S3	1	96 ±10
p	Hedeoma pulegioides	American False Pennyroyal	S2S3	4	57 ±5
p	Hypericum dissimulatum	Disguised St John's-wort	S2S3	2	22 ±0.5
p	Suaeda calceoliformis	Horned Sea-blite	S2S3	9	18 ±0
p	Sagina nodosa ssp. borealis	Knotted Pearlwort	S2S3	3	10 ±1
p	Sagina nodosa	Knotted Pearlwort	S2S3	2	60 ±0
p	Asclepias incarnata ssp. pulchra	Swamp Milkweed	S2S3	2	63 ±0
p	Schizaea pusilla	Little Curlygrass Fern	S3	21	10 ±1
p	Botrychium dissectum	Cut-leaved Moonwort	S3	4	49 ±0.5
p	Isoetes acadiensis	Acadian Quillwort	S3	6	19 ±0
p	Panicum rigidulum var. pubescens	Redtop Panic Grass	S3	37	21 ±0
p	Dichanthelium clandestinum	Deer-tongue Panic Grass	S3	5	19 ±0
p	Platanthera orbiculata	Small Round-leaved Orchid	S3	3	31 ±10
p	Platanthera hookeri	Hooker's Orchid	S3	4	69 ±0
p	Goodyera repens	Lesser Rattlesnake-plantain	S3	7	30 ±0
p	Juncus subcaudatus	Woodland Rush	S3	5	34 ±0
p	Juncus marginatus	Grass-leaved Rush	S3	21	9 ±10
p	Schoenoplectus americanus	Olney's Bulrush	S3	26	6 ±0
p	Eleocharis rostellata	Beaked Spikerush	S3	27	14 ±0.1
p	Carex lupulina	Hop Sedge	S3	1	58 ±0
p	Limosella australis	Southern Mudwort	S3	9	8 ±1
p	Agalinis neoscotica	Nova Scotia Agalinis	S3	31	10 ±0
p	Cephalanthus occidentalis	Common Buttonbush	S3	25	47 ±0
p	Rosa palustris	Swamp Rose	S3	22	46 ±0
p	Agrimonia gryposepala	Hooked Agrimony	S3	1	97 ±0
p	Primula laurentiana	Laurentian Primrose	S3	6	36 ±0.5
p	Polygonum scandens	Climbing False Buckwheat	S3	1	60 ±0
p	Polygonum pensylvanicum	Pennsylvania Smartweed	S3	1	81 ±10
p	Rhexia virginica	Virginia Meadow Beauty	S3	48	12 ±0
p	Decodon verticillatus	Swamp Loosestrife	S3	49	13 ±1
p	Utricularia subulata	Zigzag Bladderwort	S3	36	14 ±0
p	Utricularia radiata	Little Floating Bladderwort	S3	8	51 ±0
p	Teucrium canadense	Canada Germander	S3	13	18 ±0
p	Proserpinaca pectinata	Comb-leaved Mermaidweed	S3	12	20 ±0
p	Bartonia virginica	Yellow Bartonia	S3	29	13 ±0.1
p	Chamaesyce polygonifolia	Seaside Spurge	S3	2	81 ±0
p	Vaccinium corymbosum	Highbush Blueberry	S3	23	29 ±0
p	Alnus serrulata	Smooth Alder	S3	13	12 ±10
p	Solidago latissimifolia	Elliott's Goldenrod	S3	40	9 ±1
p	Megalodonta beckii	Water Beggarticks	S3	1	94 ±0.5
p	Hieracium paniculatum	Panicled Hawkweed	S3	4	36 ±0
p	Asclepias incarnata	Swamp Milkweed	S3	10	48 ±0
n	Collema furfuraceum	a lichen	S3?	1	70 ±0.1
n	Nephroma bellum	a lichen	S3?	8	30 ±0.1
n	Sticta fuliginosa	a lichen	S3?	20	21 ±0
n	Anzia colpodes	a Lichen	S3?	11	21 ±0
p	Lycopodiella appressa	Southern Bog Clubmoss	S3S4	44	12 ±0
p	Dichanthelium spretum	Eaton's Witchgrass	S3S4	35	34 ±0.1
p	Liparis loeselii	Loesel's Twayblade	S3S4	6	36 ±1
p	Juncus acuminatus	Sharp-fruited Rush	S3S4	3	33 ±0

p	Sisyrinchium atlanticum	Eastern Blue-Eyed-Grass	S3S4			13	10 ±0
p	Sisyrinchium angustifolium	Narrow-leaved Blue-eyed-grass	S3S4			7	48 ±0
p	Eriophorum chamissonis	Russet Cotton-Grass	S3S4			1	95 ±0
p	Cyperus dentatus	Toothed Flatsedge	S3S4			9	12 ±0
p	Carex argyrantha	Silvery-flowered Sedge	S3S4			5	51 ±0.5
p	Symplocarpus foetidus	Eastern Skunk Cabbage	S3S4			30	30 ±1
p	Viola sagittata var. ovata	Arrow-Leaved Violet	S3S4			1	47 ±0
p	Lindernia dubia	Yellow-seeded False Pimperel	S3S4			2	33 ±0
p	Polygonum robustius	Stout Smartweed	S3S4			12	36 ±0
p	Utricularia gibba	Humped Bladderwort	S3S4			8	53 ±0
p	Pseudognaphalium obtusifolium	Eastern Cudweed	S3S4			8	10 ±0
p	Dichanthelium meridionale	Matting Witchgrass	SH			1	46 ±10
p	Carex norvegica ssp. inferalpina	Scandinavian Sedge	SH			1	43 ±5
p	Solidago simplex var. randii	Sticky Goldenrod	SH			1	98 ±1

4.2 FAUNA

	scientific name	common name	prov. rarity	prov. status	COSEWIC	obs	dist.km
a	Emydoidea blandingii	Blanding's Turtle - Nova Scotia pop.	S1	Endangered	E	3	79 ±10
a	Coregonus huntsmani	Atlantic Whitefish	S1	Endangered	E	3	43 ±10
a	Sterna dougallii	Roseate Tern	S1B	Endangered	E	18	11 ±5
a	Charadrius melodus melodus	Piping Plover melodus ssp	S1B	Endangered	E	51	2 ±10
a	Calidris canutus rufa	Red Knot rufa ssp	S2S3M	Endangered	E	16	9 ±0.5
a	Colinus virginianus	Northern Bobwhite			E	2	15 ±5
a	Chaetura pelagica	Chimney Swift	S2S3B	Endangered	T	20	15 ±5
a	Thamnophis sauritus pop. 3	Eastern Ribbonsnake - Atlantic pop.	S2S3	Threatened	T	25	66 ±0
a	Chordeiles minor	Common Nighthawk	S3B	Threatened	T	29	25 ±5
a	Glyptemys insculpta	Wood Turtle	S3	Vulnerable	T	1	45 ±10
a	Morone saxatilis	Striped Bass	S1		T	8	16 ±10
a	Wilsonia canadensis	Canada Warbler	S3B		T	24	31 ±5
a	Hirundo rustica	Barn Swallow	S3B		T	80	2 ±5
a	Contopus cooperi	Olive-sided Flycatcher	S3B		T	39	16 ±5
a	Dolichonyx oryzivorus	Bobolink	S3S4B		T	19	12 ±5
a	Histrionicus histrionicus pop. 1	Harlequin Duck - Eastern pop.	S2N	Endangered	SC	4	71 ±10
a	Asio flammeus	Short-eared Owl	S1S2		SC	1	18 ±10
i	Danaus plexippus	Monarch	S2B		SC	7	26 ±1
a	Euphagus carolinus	Rusty Blackbird	S2S3B		SC	26	2 ±10
a	Phocoena phocoena (NW Atlantic)	Harbour Porpoise - Northwest Atlantic pop.	S4		SC	1	99 ±1
a	Chelydra serpentina	Snapping Turtle	S5		SC	9	8 ±10
a	Puma concolor pop. 1	Cougar - Eastern pop.	SH		DD	9	32 ±1
a	Lynx canadensis	Canada Lynx	S1	Endangered	NAR	1	14 ±1
a	Glaucomys volans	Southern Flying Squirrel	S2S3		n-a	2	88 ±10
a	Hemidactylium scutatum	Four-toed Salamander	S3		NAR	4	13 ±0.1
a	Sialia sialis	Eastern Bluebird	S3B		NAR	4	29 ±5
a	Sterna hirundo	Common Tern	S3B		NAR	53	8 ±5
a	Gavia immer	Common Loon	S3B,S4N		NAR	112	7 ±10
a	Accipiter gentilis	Northern Goshawk	S3S4		NAR	2	24 ±5
a	Alces americanus	Moose	S1	Endangered		67	12 ±10
a	Martes americana	American Marten	S1	Endangered		13	65 ±10
i	Leptodea ochracea	Tidewater Mucket	S1			1	84 ±10
i	Enallagma signatum	Orange Bluet	S1			2	48 ±0.1
i	Williamsonia fletcheri	Ebony Boghaunter	S1			1	94 ±0.1
i	Ophiogomphus aspersus	Brook Snaketail	S1			1	83 ±1
i	Polygonia satyrus	Satyr Comma	S1			1	99 ±1
a	Perimyotis subflavus	Eastern Pipistrelle	S1?			1	97 ±0
a	Vireo gilvus	Warbling Vireo	S1?B			2	66 ±0.5
a	Tringa solitaria	Solitary Sandpiper	S1?B,S4S5M			11	11 ±0.5
a	Larus delawarensis	Ring-billed Gull	S1?B,S5N			1	59 ±10
a	Hylocichla mustelina	Wood Thrush	S1B			7	17 ±0.5
a	Haematopus palliatus	American Oystercatcher	S1B			9	8 ±5
a	Nycticorax nycticorax	Black-crowned Night-heron	S1B			6	12 ±5
i	Tramea carolina	Carolina Saddlebags	S1B			1	95 ±0.1
a	Alca torda	Razorbill	S1B,S4N			2	40 ±5
a	Fratercula arctica	Atlantic Puffin	S1B,S4S5N			7	26 ±0.5
a	Calidris minutilla	Least Sandpiper	S1B,S5M			26	9 ±0.5
i	Somatochlora kennedyi	Kennedy's Emerald	S1S2			2	94 ±0.1
i	Nymphalis vaualbum j-album	Compton Tortoiseshell	S1S2			1	62 ±1
a	Charadrius semipalmatus	Semipalmated Plover	S1S2B,S5M			32	9 ±0.5
a	Martes pennanti	Fisher	S2			1	94 ±10
a	Salmo salar	Atlantic Salmon	S2			11	16 ±10
a	Asio otus	Long-eared Owl	S2			3	12 ±5
i	Somatochlora forcipata	Forcipate Emerald	S2			1	94 ±0.1
i	Epitheca princeps	Prince Baskettail	S2			5	89 ±1
i	Callophrys henrici	Henry's Elfin	S2			1	56 ±5
i	Amblyscirtes vialis	Common Roadside-Skipper	S2			1	90 ±1
i	Amblyscirtes hegon	Salt and Pepper Skipper	S2			1	35 ±1
a	Vireo philadelphicus	Philadelphia Vireo	S2?B			1	69 ±5
a	Piranga olivacea	Scarlet Tanager	S2B			6	47 ±5
a	Myiarchus crinitus	Great Crested Flycatcher	S2B			5	38 ±5
a	Empidonax traillii	Willow Flycatcher	S2B			3	34 ±5
a	Anas strepera	Gadwall	S2B			4	12 ±5
a	Anas clypeata	Northern Shoveler	S2B			3	32 ±5
a	Anas acuta	Northern Pintail	S2B			2	37 ±5
i	Pantala hymenaea	Spot-Winged Glider	S2B			1	39 ±0.1
a	Bucephala clangula	Common Goldeneye	S2B,S5N			39	7 ±10
i	Enallagma vesperum	Vesper Bluet	S2S3			3	58 ±0.1
i	Erynnis juvenalis	Juvenal's Duskywing	S2S3			2	34 ±1

a	Icterus galbula	Baltimore Oriole	S2S3B	9	37 ±5
a	Molothrus ater	Brown-headed Cowbird	S2S3B	20	2 ±5
a	Tringa semipalmata	Willet	S2S3B	77	2 ±5
a	Cathartes aura	Turkey Vulture	S2S3B	2	24 ±5
a	Phalaropus fulicaria	Red Phalarope	S2S3M	3	15 ±0.5
a	Phalaropus lobatus	Red-necked Phalarope	S2S3M	4	15 ±0.5
a	Poecile hudsonica	Boreal Chickadee	S3	46	2 ±5
a	Phalacrocorax carbo	Great Cormorant	S3	13	14 ±10
i	Amphiagrion saucium	Eastern Red Damsel	S3	1	9 ±1
i	Nannothemis bella	Elfin Skimmer	S3	4	39 ±0.1
i	Erythrodiplax berenice	Seaside Dragonlet	S3	17	19 ±0
i	Somatochlora tenebrosa	Clamp-Tipped Emerald	S3	6	39 ±0.1
i	Gomphaeschna furcillata	Harlequin Darner	S3	2	92 ±1
i	Boyeria grafiana	Ocellated Darner	S3	3	23 ±0.1
i	Aeshna clepsydra	Mottled Darner	S3	10	58 ±0.1
i	Ophiogomphus carolus	Riffle Snaketail	S3	2	62 ±0.1
i	Enodia anthedon	Northern Pearly-Eye	S3	2	37 ±5
i	Polygonia faunus	Green Comma	S3	1	99 ±1
a	Dendroica tigrina	Cape May Warbler	S3?B	7	12 ±5
a	Coccyzus erythropthalmus	Black-billed Cuckoo	S3?B	1	88 ±0.5
a	Pinicola enucleator	Pine Grosbeak	S3?B,S5N	14	21 ±5
a	Mimus polyglottos	Northern Mockingbird	S3B	5	8 ±5
a	Dumetella carolinensis	Gray Catbird	S3B	46	2 ±5
a	Petrochelidon pyrrhonota	Cliff Swallow	S3B	29	15 ±5
a	Riparia riparia	Bank Swallow	S3B	33	8 ±5
a	Sterna paradisaea	Arctic Tern	S3B	36	12 ±0.1
a	Anas discors	Blue-winged Teal	S3B	12	24 ±5
a	Podilymbus podiceps	Pied-billed Grebe	S3B	5	16 ±5
i	Polygonia interrogationis	Question Mark	S3B	1	85 ±1
a	Tringa melanoleuca	Greater Yellowlegs	S3B,S5M	24	10 ±0.5
a	Mergus serrator	Red-breasted Merganser	S3B,S5N	13	16 ±10
a	Calidris pusilla	Semipalmated Sandpiper	S3M	28	9 ±0.5
a	Limosa haemastica	Hudsonian Godwit	S3M	7	11 ±0.5
a	Pluvialis dominica	American Golden-Plover	S3M	13	9 ±0.5
a	Branta bernicla	Brant	S3M	8	8 ±10
a	Calidris maritima	Purple Sandpiper	S3N	21	7 ±10
a	Cardinalis cardinalis	Northern Cardinal	S3S4	13	8 ±5
a	Perisoreus canadensis	Gray Jay	S3S4	49	2 ±5
a	Picoides arcticus	Black-backed Woodpecker	S3S4	8	55 ±5
a	Cepphus grylle	Black Guillemot	S3S4	27	15 ±5
i	Polygonia progne	Gray Comma	S3S4	1	99 ±1
i	Speyeria aphrodite	Aphrodite Fritillary	S3S4	1	53 ±1
i	Callophrys polios	Hoary Elfin	S3S4	2	99 ±1
a	Passerella iliaca	Fox Sparrow	S3S4B	7	8 ±5
a	Pheucticus ludovicianus	Rose-breasted Grosbeak	S3S4B	7	15 ±5
a	Wilsonia pusilla	Wilson's Warbler	S3S4B	4	24 ±5
a	Dendroica striata	Blackpoll Warbler	S3S4B	8	2 ±5
a	Dendroica castanea	Bay-breasted Warbler	S3S4B	32	12 ±5
a	Vermivora peregrina	Tennessee Warbler	S3S4B	19	12 ±5
a	Tyrannus tyrannus	Eastern Kingbird	S3S4B	16	16 ±5
a	Sayornis phoebe	Eastern Phoebe	S3S4B	15	23 ±0.5
a	Empidonax flaviventris	Yellow-bellied Flycatcher	S3S4B	37	12 ±5
a	Contopus virens	Eastern Wood-Pewee	S3S4B	57	11 ±5
a	Gallinago delicata	Wilson's Snipe	S3S4B	22	11 ±0.5
a	Actitis macularius	Spotted Sandpiper	S3S4B	80	8 ±5
a	Charadrius vociferus	Killdeer	S3S4B	42	8 ±5
a	Botaurus lentiginosus	American Bittern	S3S4B	10	12 ±5
a	Carduelis pinus	Pine Siskin	S3S4B,S5N	21	11 ±5

4.3 RANGE MAPS

The legally protected taxa listed below are linked to the study area by predictive range maps based upon expert estimates of distribution. Taxa listed here but not in the observation data above, are unknown within the study area but perhaps present. Ranges of rank 1 indicate possible occurrence, those of rank 2 and 3 increasingly less probable.

	scientific name	common name	prov. rarity	prov. status	COSEWIC	range
p	Listera australis	Southern Twayblade	S2			1
p	Isoetes prototypus	Prototype Quillwort	S2	Vulnerable	SC	1
i	Danaus plexippus	Monarch	S2B		SC	1
a	Bucephala islandica	Barrow's Goldeneye (Eastern pop.)	S1N		SC	2
n	Erioderma pedicellatum	Boreal Felt Lichen (Atlantic pop.)	S1S2	Endangered	E	2
p	Juncus caesariensis	New Jersey Rush	S2	Vulnerable	SC	2
p	Lachnanthes caroliana	Redroot	S2	Threatened	SC	2
p	Hydrocotyle umbellata	Water-pennywort	S1	Endangered	T	1
p	Scirpus longii	Long's Bulrush	S2S3	Vulnerable	SC	1
p	Clethra alnifolia	Sweet Pepperbush	S1	Vulnerable	SC	2
a	Alces alces (NS mainland)	Moose	S1	Endangered		1
n	Erioderma pedicellatum	Boreal Felt Lichen (Atlantic pop.)	S1S2	Endangered	E	1
p	Sabatia kennedyana	Plymouth Gentian	S1	Endangered	T	2
p	Lophiola aurea	Golden Crest	S2	Threatened	T	1
a	Charadrius melodus melodus	Piping Plover melodus ssp	S1B	Endangered	E	1
p	Eleocharis tuberculosa	Tubercled Spike-rush	S2	Threatened	SC	1
p	Lilaeopsis chinensis	Eastern Lilaeopsis	S2	Vulnerable	SC	1
p	Eriocaulon parkeri	Parker's Pipewort			NAR	2
a	Sterna dougallii	Roseate Tern	S1B	Endangered	E	1

p	Coreopsis rosea	Pink Coreopsis	S1	Endangered	E	2
p	Drosera filiformis	Thread-leaved Sundew	S1	Endangered	E	1

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Appendix 9: COMMUNITY ENGAGEMENT

Presentation to Municipality of the District of Barrington – March 26th, 2012

Barrington

Potential Community Wind Project

March 26, 2012

Andrew Arbuckle B. Eng

About Us: Watts Wind Energy

- Nova Scotia CEDIF wind energy development company formed by engineering and corporate finance professionals including the principals of Seaforth Engineering and Eon WindElectric.
- Sixteen years of renewable energy experience.

Seaforth Engineering

Based in Dartmouth, NS

Main areas of business:

- Marine Engineering
- Renewable Energy – original manufacturer the AOC 15/50 wind turbine, Morgan Falls

Seaforth Engineering

Morgan Falls Run of River Hydro Power Plant 1995

AOC 15/50 at Eskasoni, NS 2005

Eon WindElectric

- Wind energy service provider
- Development and Construction Management for large and small wind energy projects
- Service, Maintenance
- Involved in over 250 MW of Wind Projects in Atlantic Canada

Eon Projects


Fermeuse Wind Farm 27MW

Iowa Community Project 2007


Digby Wind Farm 2010

Watts Wind Energy History

- Formed to develop projects owned by Nova Scotians
- Previous project work – projects owned outside the province.
- Developed the Watts Wind Project

Watts Section Project

- **Wind Turbine:** Single 1.5 MW Vensys V77
- **Location:** Watts Section Nova Scotia
- Power sold to NS Power for **20 years**
- Enough green energy to electrify **400 homes**
- Owned 100 percent by Nova Scotians

The Turbine

Manufacturer	Vensys
Type	Vensys 77
Rated power	1500 kW
Cut-in wind speed	3 m/s
Rated wind speed	12.5 m/s
Rotor diameter	77 m
Swept area	4657 sqm
Tower height(s)	85 m
Drive	direct drive

Vensys is headquartered at Wellesweiler, Germany and has been in the wind energy business since 1990. Vensys wind turbines are direct drive designs and function with a minimum of components.

Building Road to Site – Broke ground mid-October 2010 – local contractors hired

Building Foundation – Completed mid-February 2011.

Assembled Rotor

Installing Rotor

Online – March 31, 2011

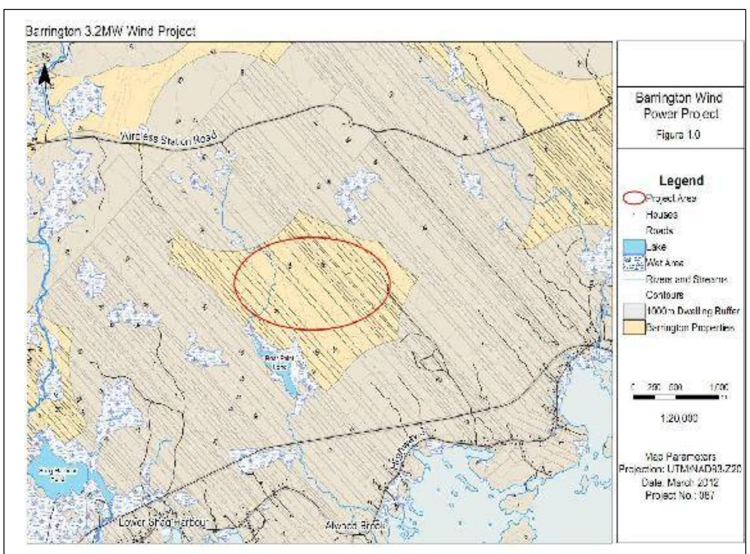
Nova Scotia Renewable Feed In Tariffs

- ComFIT program – special rate for power produced by community owned wind projects.
- Accepting applications Summer 2011
- Definition of Community
- Bear Cove a good possible candidate

NOVA SCOTIA

Barrington Community Project

- Began actively looking for sites in the area November 2011.
- Preliminary Assessment from NSPI in Feb 2012- 2 turbines possible
- Wind resource modeling
- Application for ComFIT rate – scheduled for beginning of April
- EA, Community and First Nations Consultation



Benefits to Community

- Local ownership – good investment
- Community Fund
- Tax Revenue for Municipality for 20 years
- Construction jobs
- Tourism
- Operation and Maintenance work
- Green Energy Produced and Consumed Locally – Not a large wind farm, transmission
- Will displace 4700 tons of coal used for electricity generation per year


Investment Opportunity
CEDIF – Community Economic Development Investment Fund
RRSP Eligible
ComFIT rate – project will pay a dividend


www.wattswindproject.com

Municipality of the District of Barrington

OFFICE OF THE CLERK-TREASURER
P.O. Box 100
Barrington, Nova Scotia
B0W 1E0

April 20, 2012

EMAILED: smason@seafortheng.ca

Mr. Stan Mason
President
Watts Wind Energy Inc.
300 Prince Albert Road
Dartmouth, N.S.
B2Y 4J2

Dear Mr. Mason:

Thank you very much for having Andrew Arbuckle make a presentation to Council regarding your wind energy project. Please thank Mr. Arbuckle for the very informative presentation he made to Council on March 26th. The presentation and discussion with Mr. Arbuckle were most informative. Council appreciates the interest of developers in bringing wind energy developments to the Municipality of Barrington.

As you know, the Municipality has recently revised its Land Use By-Law regulations concerning wind turbine generators, and has put in place the appropriate regulations for these types of development.

Council encourages any and all proponents to develop wind energy in our Municipality within these regulations.

Again, we thank you and Mr. Arbuckle very much for your presentation. Best of luck with your project.

Yours truly,

Brian Holland

Brian Holland, B. Comm., CMA
Clerk-Treasurer

BH:sb

Phone: (902) 637-2015 **E-Mail: munbar@eastlink.ca** **Fax: (902) 637-2075**

Presentation to Community – April 19th, 2012

INFORMATION SESSION

You are invited to attend an information session for a proposed

COMMUNITY WIND TURBINE INSTALLATION

at

BARRINGTON - BARRINGTON PASSAGE AREA

Session will include a presentation and Q and A Forum

DATE: APRIL 19th

TIME: 5:30 pm

LOCATION: BARRINGTON LIONS HALL

Refreshments will be served

Barrington

Potential Community Wind Project

April 19, 2012

Paul Pynn P. Eng.

Watts Wind Inc.

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- Watts Section Nova Scotia
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Assembled Rotor


Installing Rotor

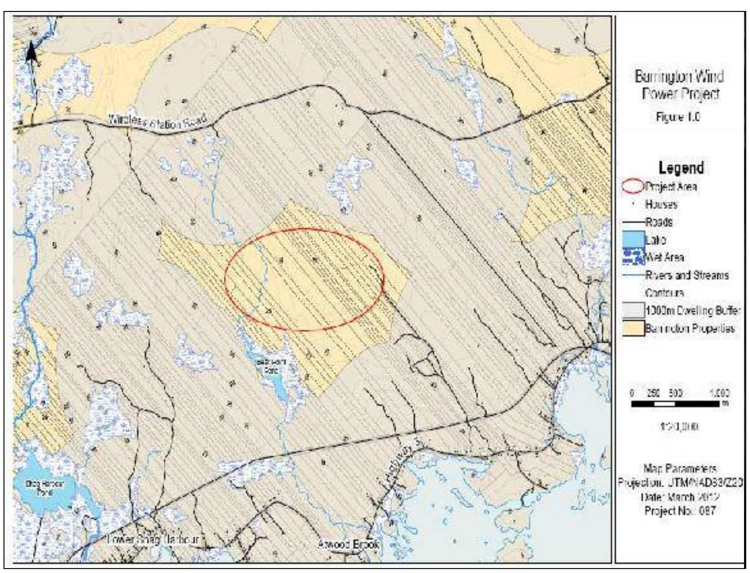

Online – March 31, 2011

Nova Scotia Renewable Feed In Tariffs

- ComFIT program – special rate for power produced by community owned wind projects.
- Accepting applications Summer 2011
- Definition of Community
- Barrington a good possible candidate

Barrington Community Project

- February 2012 met with NSPI to determine best sites for grid connection.
- Began actively looking for sites in the area January 2012.
- Wind Resource assessment
- Environmental Considerations
- Community Consultation
- Measure wind speeds



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Investment Opportunity
CEDIF – Community Economic Development Investment Fund
RRSP Eligible
ComFIT rate – project will pay a dividend


www.wattswindproject.com

Appendix 10: ABORIGINAL ENGAGEMENT

Wattswind
THE ENERGY TO LEAD

Watts Wind Energy
300 Prince Albert Rd.
Suite 200
Dartmouth, Nova Scotia B2Y 4J2

Acadia First Nation
10526 Highway #3
Yarmouth, NS
B5A 4A8

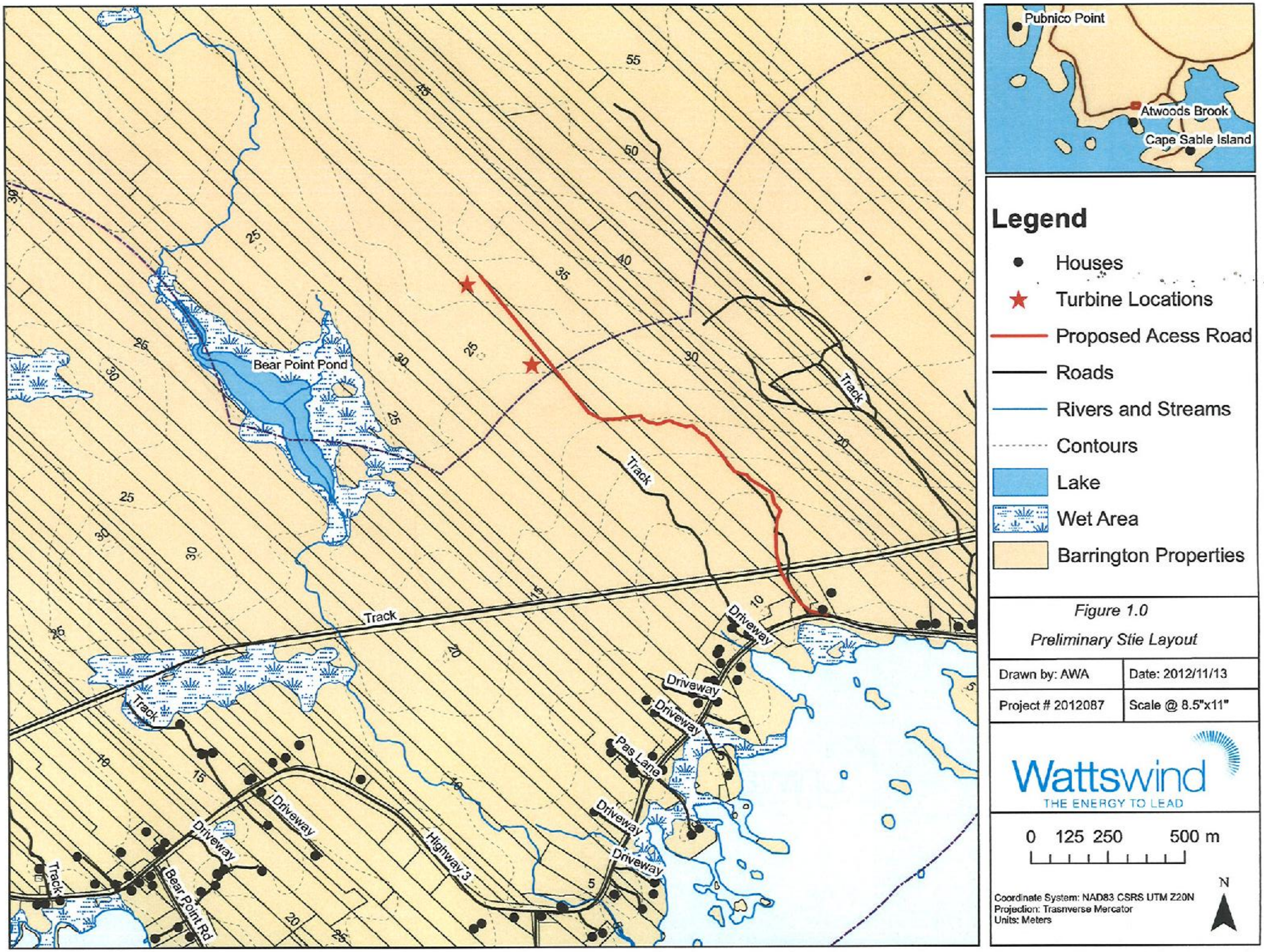
Chief Deborah Robinson,

Please see the attached GIS map showing our proposed wind energy development in the Municipality of Barrington. Watts Wind Energy is a Nova Scotia based company dedicated to developing community owned wind energy projects. We would like to ensure this project does not negatively impact First Nations interests and would be pleased to meet with you to discuss in greater detail.

If you require further information, or would like to arrange a time and location for a meeting, please do not hesitate to contact me at 902-482-8687 ext 222, or smason@seafortheng.ca.

Sincerely,

Stan Mason
President, Watts Wind Energy


Pubnico Point
Atwoods Brook
Cape Sable Island
Legend
Houses
Turbine Locations
Proposed Acess Road
Roads
Rivers and Streams
Contours
Lake
Wet Area
Barrington Properties
Figure 1.0
Preliminary Stie Layout
Drawn by: AWA
Date: 2012/11/13
Project # 2012087
Scale @ 8.5"x11"
Wattswind
THE ENERGY TO LEAD
0 125 250 500 m
N
Coordinate System: NAD83 CSRS UTM Z20N
Projection: Trasnverse Mercator
Units: Meters
Bear Point Pond
Track
Driveway
Pas Lane
Highway 3
Bear Point Rd

Andrew Arbuckle <aarbuckle@eonwind.com>

Barrington Community Wind Project

Andrew Arbuckle <aarbuckle@eonwind.com> Sun, Apr 15, 2012 at 2:03 PM
To: ericchristmas@mikmaqrights.com, Twila Gaudet <twilagaudet@mikmaqrights.com>
Cc: Paul Pynn T <ppynn@eonwind.com>, Stan Mason <smason@seafortheng.ca>

Eric and Twila,

Please see the attached information regarding the proposed Barrington wind project:

- Approximately 48 kms from Annapolis Valley First Nations
- Two 1.6 MW General Electric turbines
- Private Landowner
- See attached map and google earth files for location and site layout details.

Again, as part of our ongoing dialogue, please do not hesitate to contact myself, Stan or Paul with any further questions or comments regarding these three proposed projects.

Kind regards,

Andrew

--
Andrew Arbuckle
B. Eng, Eon WindElectric

Office: +1 902 482 8687
Mobile: +1 902 401 1076
Fax: +1 866 314 5349

200-300 Prince Albert Rd.
Dartmouth, NS B2Y 4J2

www.eonwind.com

2 attachments

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