Appendix

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January 08, 2009

Your file
RMS Maryvale Wind Farms

Our file
08-1431

Ms. Lisa Fulton
RMSenergy Ltd.
796 D Fraser Rd.
RR # 3 Westville, NS B0K 2A0

RE: Wind Farm : 4 (N0° 00' 00.00" W0° 00' 00.00") - Antigonish. NS

Dear Ms. Fulton,

We have evaluated the captioned proposal and NAV CANADA has no objection to the project as submitted. Let me emphasize however that our assessment is limited to the impact of the proposed physical structure on the air navigation system and installations.

In the interest of aviation safety, it is incumbent on NAV CANADA to maintain up-to-date aeronautical publications and issue Notices to Airmen (NOTAM) as required. To assist us in that end, we ask that you notify us on completion of construction. This notification requirement can be satisfactorily met by returning a completed, signed copy of the attached form to us by mail, or fax at (613) 248-4094. In the event that you should decide not to proceed with this project, please advise us accordingly so that we may formally close the file.

NAV CANADA's land use evaluation is valid for a period of 12 months. It neither constitutes nor replaces any approvals or permits required by Transport Canada, Industry Canada, other Federal Government departments, Provincial or Municipal land use authorities or any other agency from which approval is required.

If you have any questions, contact the Land Use Department by telephone at 1-866-577-0247 or e-mail at landuse@navcanada.ca

Yours truly,

Robert Davidge
for
Tom Hollinger
Manager, Data Collection
Aeronautical Information Services

cc Jean-Marc Mazerolle, Atlantic Region Transport Canada (2008-111)

1601, Tom Roberts, P.O. Box 9824 Stn T, Ottawa, ON, K1G 6R2
Telephone: (613)248-4121, Fax: (613)248-4094

1601, Tom Roberts, C.P.9824 Succursale T, Ottawa, Ontario, K1G 6R2
Téléphone: (613)248-4121, Télécopieur: (613)248-4094

Transport Canada Transports Canada

July 23, 2008

Your file Votre référence

Our File Notre référence

M5105-5 (MAM)

Reuben Burge
RMS Energy Ltd
796 Dan Fraser Road
Westville, NS
B0K 1H0

Dear Mr Burge

RE: AERONAUTICAL OBSTRUCTION CLEARANCE FORM

Based on the information which you have provided on the Aeronautical Obstruction Clearance Form attached and listed below, Transport Canada, Aerodromes and Air Navigation, Atlantic Region has no objection to your proposal subject to the conditions noted on the form

Transport Canada #	*Location / Coordinates*
2008-111	Antigonish, NS (45° 44' 00" N / 62° 03' 56" W)

We ask that you also coordinate your proposal with Nav Canada to ensure they have no objections The Land Use Department at Nav Canada, Ottawa can be contacted by

Phone 1-866-577-0247 *or* E-mail landuse@navcanada ca

Please keep in mind that this does not constitute approvals from other Federal Government departments or other local land use authorities Furthermore, it is the responsibility of the operator to ensure that the appropriate NOTAM (Notice to Airmen) is issued when any condition on this application cannot be met or maintained

Lighting and painting standards can be found in CAR 621 19 (Canadian Aviation Regulations)

Please inform this office if this project is cancelled If you have further questions, feel free to contact us

Yours truly,

S.T Cripps

S T Cripps
Regional Manager
Aerodromes & Air Navigation
Transport Canada, Civil Aviation, Atlantic Region

P O Box 42
Moncton, NB Ph (506) 851-3342
E1C 8K6 Fax (506) 851-3022 Attach c c Land Use Department (Nav Canada, Ottawa)

Canada

Transport Canada / Transports Canada

APPENDIX C TO CAR 621.19 - ANNEXE C RAC 621.19

TC File No /Ref No – TC n° du dossier/N° de réf

RECEIVED / REÇU
JUL 16 2008
TC # 2008-111
MAM

AERONAUTICAL OBSTRUCTION CLEARANCE FORM

FORMULAIRE D'AUTORISATION D'OBSTACLE AÉRIEN

TO BE COMPLETED BY APPLICANT – À REMPLIR PAR LE REQUÉRANT

Operator's Name – Nom de l'opérateur
Reuben Burge (RMSenergy Ltd)

Operator's Address – Adresse de l'opérateur
796 Dan Fraser Road, Westville, N.S , B0K 1H0

Operator's Contact – Agent de liaison de l'opérateur
Reuben Burge

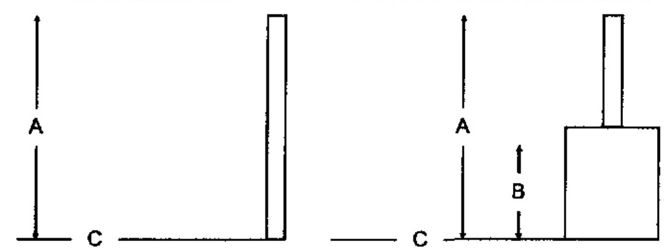
Contact's Telephone No – N° de téléphone de liaison	Contact's FAX No – N° de télécopieur de liaison	Contact's Email Address – Adresse électronique de liaison
902-771-0322	902-695-6271	reubenburge@eastlink ca

Applicant's Name – Nom du requérant	Address – Adresse	
Troy Bouchie	796 Dan Fraser Road, Westville, N S , B0K 2A0	
City – Ville	**Province/Territory - Province/Territoire**	**Postal – Code – postal**
Westville	Nova Scotia	B0K 2A0
Applicant's Telephone No – N° de téléphone du requérant	**Applicant's FAX No – N° de télécopieur du requérant**	**Applicant's Email Address – Adresse électronique du requérant**
902-754-2876	902-695-6271	troybouchie@hotmail com

Nearest city / town to proposed facility – Ville la plus proche de la structure proposée: Antigonish

Geographic coordinates of structure – coordonnées géographiques de la structure:
45° 43' 50" N Latitude / Latitude N; 62° 3' 45" W Longitude / Longitude O
☐ NAD27 ☐ NAD83 ☑ WGS84

TOWERS / ANTENNAS – TOURS / ANTENNES; BUILDING OR OTHER STRUCTURE – BÂTIMENT OU AUTRE STRUCTURE



		Feet – Pieds	Meters – Mètres
A	Height above ground / Hauteur au-dessus du sol		61 (99.5m)
B	Building height / Hauteur du bâtiment		61
C	Ground elevation above sea level / Hauteur du sol au-dessus du niveau de la mer		228(avg)

List any tall adjacent buildings and structures which may shield the proposed structure (Attach sketch)

Faire une liste indiquant les structures et bâtiments avoisinants plus haut que le bâtiment projeté (Inclure un diagramme)

New struc – Nouv struc: ☑ Yes / Oui ☐ No / Non

Add to exist struc incl total hght – Ajout à un bâti exis incl hauteur total: 61m + ½ blade length = 99.5m in vertical position

Proposed Construction – Date – de construction proposée: September, 2009-December, 2009

TYPE OF STRUCTURE (narrative description and function) – GENRE DE STRUCTURE (description narrative et fonction)

Wind Turbine Generator Towers

Signature (of applicant) (du requérant) ▶ Troy Bouchie [signature]   Date (Y/A-M-D/J) 08/07/09

TRANSPORT CANADA USE ONLY – A L USAGE DE TRANSPORTS CANADA

AERONAUTICAL ASSESSMENT – ÉVALUATION AÉRONAUTIQUE

Site acceptable – Emplacement acceptable: ☒ Yes / Oui ☐ No / Non (If no reason) (si non pourquoi)

Lighting as per (TP382) required – Balisage lumineux tel que demandé au (TP382): ☒ Yes / Oui ☐ No or / Non ou — All 4 Turbines must be lighted

Painting as per (TP382) required – Balisage peint tel que demandé au (TP382): ☐ Yes / Oui ☒ No or / Non ou

Temporary lighting required – Nécessité d'un balisage lumineux temporaire: ☐ Yes / Oui ☒ No / Non (if yes type) (si oui de quel genre)

Advise Transport Canada in writing 90 days before construction / Avertir Transports Canada par écrit 90 jours avant la construction ▶ ☐ when construction starts / au commencement de la construction ☐ and on completion / et à la fin des travaux ☒ Valid to / Valide jusqu au 2009-12-31

Civil Aviation Inspector (as required) – Inspecteur Aviation Civile (si nécessaire)
Comments – Commentaires

Signature [signature]   (Y/A M-D/J) 2008-07-23 Date

Regional Manager Aerodrome Safety / Gestionnaire Régional Sécurité des aérodromes ▶ Signature [signature]   Date (Y/A-M-D/J) 2008-07-24

26-0427 (0005 01)

Canada

Vegetation Assessment of Site Proposed for Wind Turbines at Maryvale, Antigonish County, Nova Scotia

Methods

Vegetation at the site proposed for four wind turbines at Maryvale, Antigonish County, was assessed on three occasions, first on 26 May 2008 to observe spring-flowering species, and again on 31 July and 3 August. The site was surveyed by Dr. Barry R. Taylor (B.Sc., M.Sc., Ph.D.; St. Francis Xavier University), assisted by Mr. Troy Bouchie (RMS Energy) and Ms Amanda Lowe (St. FX). The land to be included in the examination was specified by the proponent. The site comprises about 1 km^2 of high ridge-top running approximately northwest-southeast just west of Highway 245, at an elevation near 220 m. A logging road provides access to the site, and one little-used road runs through it. Weather was warm and sunny on 26 May and 31 July, but 3 August was rainy.

We traversed the site on foot, observing the nature and species composition of the vegetation throughout. We noted sensitive habitats or those likely to support rare or unusual species and geo-referenced them with a GPS unit. Most of the site is easily accessible; impenetrably dense vegetation hindered access between proposed turbines 3 and 4, however. We approached turbine 3 from Highfield Road. We searched specifically for species of concern identified as potentially present in the area, according to data provided by Heritage Division, Nova Scotia Department of Heritage, Tourism and Culture. However, ordinary roadside species, which are ubiquitous throughout the province, were not surveyed in detail. Specimens of less obvious species were taken back to St. Francis Xavier University for identification. Species observed on the site are listed in Appendix 1. All taxonomy follows Zinck (1998).

Site Description

The access road to the ridge ends at a large clearing, perhaps an old yarding station, occupied by an assortment of common roadside herbs (Appendix I). Aside from this clearing and the overgrown logging road traversing the ridge, the site comprises only two vegetation types: more or less mature, open, deciduous forest dominated by maples, beech and some yellow birch; and dense, young stands of the same species regenerating on old clear-cuts. Conifers were absent except for young balsam fir (*Abies balsamea*), mostly in old cut-overs, and a few red spruce (*Picea rubens*). The older beech-maple forest predominates in the area around proposed turbines 1 and 2, (except for one recent clear-cut) while turbines 3 and 4 would be built in regenerating forest.

According to Mr. John Teesdale, whose family has owned the site for generations, the entire forest has succeeded on abandoned farmland. Nevertheless, decaying stumps suggest that even the more mature forest has been harvested once since the forest was established. All the forests are even-aged, except for a few, conspicuously larger individuals which presumably were spared from the previous harvest. There are few saplings or seedlings in evidence. Despite its location on a wind-swept hilltop, the site is relatively moist and productive.

The hardwood forest is co-dominated by red maple (*Acer rubrum*), sugar maple (*Acer saccharum*), yellow birch (*Betula alleghaniensis*) and American beech (*Fagus grandifolia*). Self-thinning and growth have produced a closed canopy of widely spaced trees. Striped maple (*Acer pennsylvanicum*) and a few pin cherry (*Prunus pensylvanica*) and mountain-ash (*Sorbus americana*) compose the sparse subcanopy. Pin-cherry is more abundant in cut-overs near Highfield Road. Early successional trees such as trembling aspen (*Populus tremuloides*) and downy alder (*Alnus viridis*) were observed only in a few places, always on disturbed ground.

The shrub layer in most of the forest is sparse, comprising scattered individuals of typical forest shrubs such as bush-honeysuckle (*Diervilla lonicera*), fly-honeysuckle (*Lonicera canadensis*), alternate-leaved dogwood (*Cornus alternifolia*), skunk current (*Ribes glandulosum*) and wild raisin (*Viburnum nudum*). Red raspberry (*Rubus ideaus*) and blackberry (*R. allegheniensis*) produce dense thickets in clearings, roadsides and recent clear-cuts where light is plentiful.

Ferns are plentiful in most mature stands, among which spinulose wood fern (*Dryopteris carthusiana*) and northern lady fern (*Athyrium felix-femina*) are dominant. Northern beech fern (*Phegopteris connectilis*) and New York fern (*Thelypteris noveboracensis*) are infrequent. Hay-scented fern (*Dennstaedtia punctilobula*) covers large areas in more open sites and in regenerating forest. In the older stands, the ferns may form an unbroken lawn over the forest floor, sparingly interrupted by shrubs and tall herbs. None of these species, however, is rare or to any degree unusual in this habitat.

Ground vegetation throughout the study area is also simple and unremarkable. In addition to ferns and bushes, all sites support widespread woodland forbs such as wild sarsparilla (*Aralia nudicaulis*), Indian cucumber-root (*Medeola virginiana*), clintonia lily, wild lily-of-the-valley (*Maianthemum canadense*), wood aster (*Aster acuminatus*) and starflower. Grass, mostly wire grass (*Danthonia spicata)* and wood-reed (*Cinna latifolia*), is sporadic, as are the seven common species of sedge (Appendix I). Red top (*Agrostis gigantea*), makes confluent lawns along logging roads, occasionally mixed with panic-grass (*Panicum lanuginosum*) and timothy (*Phleum pratense*).

Clear-cuts and regenerating cutovers were remarkably similar in species composition to older forest stands. These young forests consist of dense growths of the canopy species, especially maples and beech, usually a few metres tall. Young balsam fir are more common here. Ferns, especially *D. punctilobula*, may carpet the ground, except under dense canopy. The sapling stands are interrupted by small clearings entirely occupied by luxuriant growth of blackberries, raspberries, and forbs such as tall white aster (*Aster umbellatus*). Toward Highfield Road, (turbine 3) white and grey birch (*Betula papyrifera, B. populifolia*) also occur in regenerating forest, and pin cherry is abundant.

There are no streams on the site and no wetlands of significant size. Small depressions in the hummock-and-hollow topography explain the presence of hydrophilic species such as fowl manna-grass (*Glyceria striata*), soft rush (*Juncus effusus*), and the stream-side sedges *Carex crinita* and *C. lurida*. The largest wetland observed was a pocket bog <50 m^2 in area midway between proposed turbines 1 and 2. This was the only place where *Sphagnum* moss, dewberry (*Rubus hispidus*), bulrush (*Scirpus atrovirens*), boneset (*Eupatorium perfoliatum*) and skullcap

(*Scutelaria lateriflora*) were found. Again, however, these species are all exceedingly common in this habitat throughout the province.

Significant Species

With the minor exception of the wet habitats just described, we did not find any unique or unusual habitats where uncommon species are likely to grow. The topography and disturbance history of the study area suggest such sites are very unlikely. A single specimen of dwarf ginseng, *Panax trifolius*, was observed in the May survey; more were probably present, as this species is known to occur in similar habitat on nearby Brown's Mountain. *Panax trifolius* is an infrequent species but is not considered a species of concern (Department of Natural Resources website, 2008).

A list of vulnerable ("yellow") and threatened ("red") plant species, as defined by Department of Natural Resources, known to occur in the area was complied by staff at the Nova Scotia Museum Collections Unit (Letter to Troy Bouchie, 12 May 2008). We looked for these 19 species wherever appropriate habitat occurred. We observed none of the noted species at risk on the site; for the greatest number, specific habitats such as rich flood plains, lake shores and alkaline soil were not present in the study area. *Polygonum cilinode*, a common herbaceous vine, was observed climbing over other vegetation all along the trails, but the infrequent *P. scandens* was never found. It is conceivable that some of the many blackberries occupying clearings are the less common Pennsylvanian blackberry (*Rubus pensilvanicus*), rather than the common blackberry (*R. allegheniensis*), but all of the specimens we examined were the latter species. Similarly, there is no intersection between the seven species of *Carex* discovered on the study site and the three species at risk for this area.

We observed no orchids except for two specimens of pink lady's slipper (*Cypripedium acaule*), a common species. Painted trillium (*Trillium undulatum*) and nodding trillium (*Trillium cernuum*) are scattered in older forest stands, but the other, rare species (*T. grandiflorum*, *T. erectum*), for which rich hardwood forests provide habitat were never observed. In summary, the study area does not appear to succour any plant species of special concern.

Literature Cited

Zinck, M. 1998. Roland's Flora of Nova Scotia. Third Edition. Nimbus Publishing and Nova Scotia Museum, Halifax, N.S. Two volumes, 1297 p.

Figure 1. Photograph of typical closed-canopy hardwood forest at the study site, showing even-aged maple and beech trees with an understorey of ferns, interspersed with grass and forbs. Photograph by Amanda Lowe.

Appendix 1. Vascular plants observed at the proposed site for four wind turbines near Maryvale, Nova Scotia, 26 May, 31 July and 3 August 2008. An asterisk indicates that a voucher specimen has been deposited in the Herbarium of St. Francis Xavier University.

TREES

Scientific Name	**Common Name**	**Notes**
Abies balsamea	balsam fir	scattered, more common in clear-cuts
Acer pennsylvanicum	striped maple	occasional in understorey
Acer rubrum	red maple	co-dominant in canopy
Acer saccharum	sugar maple	co-dominant in canopy
Alnus viridis	downy alder	by Highfield Road, and in a wetland
Betula alleghaniensis	yellow birch	occasional
Betula papyrifera	white birch	by Highfield Road
Betula populifolia	grey birch	by Highfield Road
Fagus grandifolia	American beech	co-dominant in canopy
Fraxinus americana	white ash	occasional
Picea rubens	red spruce	few
Populus tremuloides	trembling aspen	a few small trees beside access road
Prunus pensylvanica	pin-cherry	few, except in cut-overs
Sorbus americana	Mountain-ash	few

BUSHES

Scientific Name	Common Name	Notes
Amelanchier sp.	serviceberry	probably *A. arborea*
Diervilla lonicera	bush-honeysuckle	common in understorey
Corylus cornuta	beaked hazelnut	one plant, regrowth near turbine 4
Cornus alternifolia	alternate-leaved dogwood	scattered in mature forest
*Lonicera canadensis**	fly-honeysuckle	common in mature forest
Ribes glandulosum	skunk currant	
Sambucus racemosa	red-berried elder	
Vaccinium angustifolium	lowbush blueberry	few
Viburnum nudum	wild raisin	common in understorey

HERBACEOUS SPECIES

Scientific Name	Common Name	Notes
Actaea alba	white baneberry	one plant, in mature deciduous forest
*Agrostis gigantea**	red top	logging roads, clearings
Anaphalis margaritacea	pearly everlasting	
Aralia nudicaulis	wild sarsaparilla	
Aster acuminatus	wood aster	
Aster umbellatus	tall white aster	
Aster lateriflorus	aster	edge of forest
Carex crinita/gynandra	sedge	
Carex debilis	sedge	
*Carex deweyana**	sedge	Occasional
*Carex disperma**	sedge	on a hummock in mature forest
Carex lurida	sedge	wet spots
*Carex scoparia**	sedge	
Carex spicata	sedge	
Chrysanthemum leucanthemum	ox-eye daisy	Clearings
*Cinna latifolia**	wood-reed	in mature forest
*Claytonia caroliniana**	spring beauty	few, in mature forest, in May
Clintonia borealis	clintonia-lily	
Cornus canadensis	bunchberry	

Scientific Name	**Common Name**	**Notes**
Cypripedium acaule	pink lady's-slipper	two plants by trail
*Deschampsia flexuosa**	common hair grass	Scattered
*Dianthus armeria**	Deptford pink	along Highfield Road
Erigeron sp.	daisy fleabane	*E. annuus* or *E. stigosus*
Epilobium angustifolium	fireweed	
Eupatorium perfoliatum	boneset	pocket wetland
Euthamia graminifolia	narrow-leaved goldenrod	Clearings
Fragaria vesca	woodland strawberry	Clearings
Galeopsis tetrahit	hemp-nettle	along logging roads, disturbed ground
Glyceria striata	fowl manna-grass	pocket wetland
Gnaphalium uliginosum	low cudweed	compacted logging road
Hieracium caespitosum	hawkweed	clearing
Hieracium kalmii	hawkweed	scattered in forest understorey
Hieracium sp.	hawkweed	probably *H. lachenalii*; May
Huperzia lucidula	shining fir-moss	
Hypericum ellipticum	St. John's-wort	
Juncus effusus	soft rush	wet depressions throughout
*Juncus tenuis**	rush	puddles and wet depressions
Lactuca canadensis	wild lettuce	cut-overs, along logging roads

Scientific Name	Common Name	Notes
Lycopodium obscurum	ground-pine	one plant, in beech-maple forest
Luzula multiflora	common wood-rush	one plant, near turbine 3
Maianthemum canadense	wild lily-of-the-valley	
Medeola virginiana	Indian cucumber-root	
Mitchella repens	partridge-berry	on a hummock in mature forest
Oenethera biennis	evening-primrose	
Oxalis acetosella	wood-sorrel	one stand
Panax trifolius	dwarf ginseng	one plant, in wet clearing, May
*Panicum lanuginosum**	panic-grass	along logging roads, compacted soil
Phleum pratense	timothy	along logging roads
Plantago major	common plantain	compressed soil, logging road
Polygonun cilinode	polygonum	abundant in clearings, climbing over other vegetation
Potentilla simplex	cinquefoil	
Prenanthes trifoliata	lion's-paw	forest understorey
Rubus allegheniensis	common blackberry	massively abundant in clearings
Rubus idaeus	red raspberry	abundant in clearings
Rubus hispidus	dewberry	pocket wetland
Scirpus atrovirens	bulrush	wet spots
*Scutelaria lateriflora**	skullcap	pocket wetland

Scientific Name	**Common Name**	**Notes**
Solidago puberula	rough goldenrod	
Streptopus roseus	rosy twisted stalk	in mature forest
Triadenum virginicum	marsh St. John’s-wort	wet ground on logging roads
Trientalis borealis	starflower	
*Trifolium aureum**	clover	in clearings, along logging roads
Trifolium pratense	red clover	
Trillium cernuum	nodding trillium	
*Trillium undulatum**	painted trillium	
Veronica officinalis	field speedwell	
Viola cucullata	blue violet	wet depressions
Viola macloskeyi	small white violet	wet ground, open area
Viola sororia	violet	scattered in open forest

FERNS

Scientific Name	Common Name	Notes
Atherium felix-femina	northern lady fern	abundant in mature forest
Dennstaedtia punctilobula	hay-scented fern	confluent in clearings
Dryopteris carthusiana	spinulose wood fern	very abundant in mature forest
Phegopteris connectilis	northern beech fern	occasional in dense forest
Thelypteris noveboracensis	New York fern	

Report

Noise Simulation for Maryvale Wind Farm

Prepared for: Maryvale Wind LP
2300 Yonge St. Suite# 801
P.O. Box 2300, Toronto ON
M4P 1E4

Attention: Lisa Fulton
796 Dan Fraser Road, RR #3
Westville, NS
B0K 2A0

Prepared by: Jon Fournier, B.Sc., Ext. 543
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Fax: (905) 855-0406

Project #: 70234
21 Pages

Date: January 22, 2009

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1. INTRODUCTION

Maryvale Wind Farm (the client) contracted ORTECH to perform noise modeling simulations for a wind development near Maryvale, Nova Scotia. The development consisted of four Vensys 77 1.5MW turbines. The simulation included calculation of noise contours at sound power levels of 35, 40, 45, 50 and 55 dBA around the wind farm as well as the sound power level at each of the receptors within 2km of the closest turbine. All information including; turbine and receptor locations and turbine noise data was provided by the client.

Only the closest receptor, No. 12; within 250m of M2, had a sound power level much greater than 35dBA, at a level of 46.4dBA (lowest – 6m/s) and 48.1dBA (highest – 7m/s). Most municipalities and regions surveyed in the report *Model wind turbine by-laws and best practices for Nova Scotia Municipalities* commissioned by the Union of Nova Scotia Municipalities, have regulations that wind turbine noise at a receptor location should not exceed 35-45 dBA.

Figure 1 - Overview of Maryvale Wind Farm Location

2. SIMULATION MODEL

The Noise model used was ISO 9613-2 General, which is required by the Ontario Ministry of Environment, since Nova Scotia does not yet have defined guidelines for performing these analyses specifically for wind farms. The province is however, developing these regulations and they may differ from those used in Ontario.

Octave Band Data:

The octave band data provided and used in the simulations is shown in Table 1. Octave band data is a breakdown of the total sound power produced into specific frequency bands; the centers of the bands are at the values in the table.

Table 1 - Octave band data

Sound Power (dBA)		Frequency (Hz)								
		62.5	125	250	500	1000	2000	4000	8000	Total
Wind Speed	6 m/s	85.6	91.4	96	95.2	95.1	92	87.6	76.8	101.6
	7 m/s	89.5	94.2	97.8	96.2	96.2	94.1	89.8	78.3	103.3
	8 m/s	88.6	93.6	96.8	95.8	96.2	94.2	89.9	78.9	102.9
	9 m/a	88.9	92.5	96.1	96.2	96.8	94.5	89.8	79.1	102.9

Ground Attenuation:

The ground attenuation coefficient defines how much sound power is absorbed and reflected when sounds waves come in contact with the ground. A ground attenuation coefficient of 0.5 was chosen as a reasonable estimate for the flat soft soil, farmed crops and grasses in the area.

Imission Height

The height of imission used for all receptors was 4.5m and taken at the center of the receptor.

Atmospheric Absorption Coefficients:

The atmospheric absorption coefficients define how sound power decays over distance for specific frequency bands. The coefficients used in the simulation are defined by ISO 9613-2 and are shown in Table 2.

Table 2 - Atmospheric Absorption Coefficients

Atmospheric Absorption Coefficient (dB/km)							
62.5Hz	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	8000Hz
0.1	0.4	1	1.9	3.7	9.7	32.8	117

3. RESULTS

The results of the simulations for each wind speed; 6, 7, 8 and 9 m/s are displayed in Tables 3-6 respectively. The tables show each receptor and the total sound power as a result of turbine operation at the associated wind speed. Following each tables are figures 1-4, these are maps showing the turbine locations, receptor locations and sound power contour lines. Receptor number 12 resulted in sound power levels much higher than any other receptor; greater than 45dBA. This is a result of the proximity of receptor 12 to turbine M2, less than 250m which is significantly closer than any other receptor. The close proximity can be seen in Figure 1.

Table 3 – 6m/s Simulation Results

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	[dB(A)]
1	A	Four Valleys Fire Hall	573,059	5,067,014	56.5	4.5	25.0
2	B	St. Mary's Parish	573,872	5,066,080	71.0	4.5	28.1
3	C	John Teasdale Residence	574,351	5,065,017	74.2	4.5	29.5
4	D	Maryvale Elementary	574,356	5,064,966	75.6	4.5	29.6
5	E	BLDG60	572,046	5,062,371	111.0	4.5	26.8
6	F	BLDG60	572,250	5,066,287	167.1	4.5	28.8
7	G	BLDG60	572,369	5,065,957	210.0	4.5	31.2
8	H	BLDG60	572,448	5,063,026	306.3	4.5	31.6
9	I	BLDG60	572,481	5,063,050	256.3	4.5	31.8
10	J	BLDG60	572,780	5,065,791	140.9	4.5	32.9
11	K	BLDG60	573,092	5,063,350	180.4	4.5	33.8
12	L	BLDG60	573,094	5,064,417	222.3	4.5	46.4
13	M	BLDG60	573,130	5,063,326	162.4	4.5	33.4
14	N	BLDG60	573,197	5,066,458	79.7	4.5	27.7
15	O	BLDG60	573,206	5,066,505	75.5	4.5	27.5
16	P	BLDG60	573,224	5,066,520	74.0	4.5	27.4
17	Q	BLDG60	573,251	5,066,637	69.7	4.5	26.7
18	R	BLDG60	573,286	5,066,657	66.8	4.5	26.5
19	S	BLDG60	573,296	5,066,372	76.1	4.5	28.1
20	T	BLDG60	573,298	5,066,633	68.1	4.5	26.7
21	U	BLDG60	573,319	5,066,368	74.5	4.5	28.1
22	V	BLDG60	573,410	5,063,287	111.8	4.5	32.0
23	W	BLDG60	573,474	5,066,253	71.7	4.5	28.4
24	X	BLDG60	573,547	5,066,411	61.1	4.5	27.3
25	Y	BLDG60	573,552	5,063,580	117.0	4.5	33.2
26	Z	BLDG60	573,579	5,066,413	60.0	4.5	27.3
27	AA	BLDG60	573,581	5,066,355	63.1	4.5	27.6
28	AB	BLDG60	573,594	5,066,336	64.2	4.5	27.6

Table 4 – 6m/s Simulation Results - Continued

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	[dB(A)]
29	AC	BLDG60	573,645	5,066,121	74.2	4.5	28.6
30	AD	BLDG60	573,682	5,066,049	80.0	4.5	28.9
31	AE	BLDG60	573,694	5,066,032	80.0	4.5	28.9
32	AF	BLDG60	573,719	5,066,235	67.5	4.5	27.8
33	AG	BLDG60	573,768	5,066,359	60.0	4.5	27.0
34	AH	BLDG60	573,776	5,066,331	61.9	4.5	27.2
35	AI	BLDG60	573,780	5,065,910	87.2	4.5	29.3
36	AJ	BLDG60	573,800	5,066,340	61.1	4.5	27.1
37	AK	BLDG60	573,806	5,065,632	86.2	4.5	30.6
38	AL	BLDG60	573,808	5,065,651	84.9	4.5	30.5
39	AM	BLDG60	573,814	5,065,610	86.8	4.5	30.6
40	AN	BLDG60	573,826	5,066,104	70.0	4.5	28.1
41	AO	BLDG60	573,850	5,065,508	90.0	4.5	30.9
42	AP	BLDG60	573,852	5,063,611	111.9	4.5	31.5
43	AQ	BLDG60	573,875	5,065,703	80.0	4.5	29.9
44	AR	BLDG60	573,877	5,066,114	69.6	4.5	27.9
45	AS	BLDG60	573,887	5,066,090	70.0	4.5	28.0
46	AT	BLDG60	573,905	5,066,026	73.7	4.5	28.2
47	AU	BLDG60	573,906	5,065,713	80.0	4.5	29.7
48	AV	BLDG60	573,906	5,065,802	80.0	4.5	29.3
49	AW	BLDG60	573,920	5,065,782	80.0	4.5	29.3
50	AX	BLDG60	573,932	5,065,323	80.3	4.5	31.3
51	AY	BLDG60	573,966	5,065,528	80.0	4.5	30.2
52	AZ	BLDG60	574,028	5,063,735	115.9	4.5	30.9
53	BA	BLDG60	574,062	5,065,250	79.5	4.5	30.7
54	BB	BLDG60	574,073	5,065,220	81.7	4.5	30.8
55	BC	BLDG60	574,080	5,065,629	80.0	4.5	29.2
56	BD	BLDG60	574,116	5,065,633	80.0	4.5	29.0
57	BE	BLDG60	574,174	5,065,166	76.7	4.5	30.3
58	BF	BLDG60	574,215	5,065,149	76.8	4.5	30.1
59	BG	BLDG64	574,237	5,065,270	70.0	4.5	29.6
60	BH	BLDG60	574,238	5,063,636	123.9	4.5	29.4
61	BI	BLDG60	574,239	5,065,259	70.4	4.5	29.6
62	BJ	BLDG60	574,243	5,065,106	77.6	4.5	30.0
63	BK	BLDG60	574,262	5,065,229	71.3	4.5	29.6
64	BL	BLDG60	574,297	5,065,183	73.8	4.5	29.5
65	BM	BLDG60	574,318	5,065,214	71.5	4.5	29.3
66	BN	BLDG60	574,348	5,065,039	73.8	4.5	29.5
68	BO	BLDG60	574,361	5,063,602	200.1	4.5	28.6

Table 5 – 6m/s Simulation Results - Continued

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	[dB(A)]
69	BP	BLDG60	574,389	5,065,179	71.3	4.5	28.9
70	BQ	BLDG60	574,392	5,064,541	80.0	4.5	29.8
71	BR	BLDG60	574,399	5,064,499	83.1	4.5	29.7
72	BS	BLDG60	574,402	5,065,225	69.3	4.5	28.8
73	BT	BLDG60	574,403	5,064,674	74.5	4.5	29.6
74	BU	BLDG60	574,406	5,063,623	120.1	4.5	28.4
75	BV	BLDG60	574,414	5,064,531	80.0	4.5	29.6
76	BW	BLDG60	574,415	5,064,008	100.5	4.5	29.2
77	BX	BLDG60	574,423	5,063,613	106.8	4.5	28.3
78	BY	BLDG60	574,441	5,065,151	70.5	4.5	28.7
79	BZ	BLDG60	574,456	5,065,077	71.9	4.5	28.8
80	CA	BLDG60	574,457	5,065,129	70.8	4.5	28.7
81	CB	BLDG60	574,459	5,063,818	147.1	4.5	28.6
82	CC	BLDG60	574,463	5,065,238	65.5	4.5	28.4
83	CD	BLDG60	574,466	5,064,456	82.7	4.5	29.3
84	CE	BLDG60	574,470	5,065,224	66.3	4.5	28.4
85	CF	BLDG60	574,475	5,065,018	74.2	4.5	28.8
86	CG	BLDG60	574,476	5,065,134	70.5	4.5	28.5
87	CH	BLDG60	574,495	5,065,093	71.3	4.5	28.5
88	CI	BLDG60	574,504	5,063,631	96.9	4.5	27.9
89	CJ	BLDG60	574,519	5,063,647	96.8	4.5	27.8
90	CK	BLDG60	574,538	5,064,914	80.0	4.5	28.6
91	CL	BLDG60	574,552	5,064,824	80.0	4.5	28.6
92	CM	BLDG60	574,595	5,064,839	80.0	4.5	28.3
93	CN	BLDG60	574,613	5,063,884	230.0	4.5	27.9
94	CO	BLDG60	574,625	5,063,723	143.9	4.5	27.5
95	CP	BLDG60	574,641	5,063,836	164.6	4.5	27.6
96	CQ	BLDG60	574,647	5,063,804	152.5	4.5	27.5
97	CR	BLDG60	574,660	5,064,336	80.0	4.5	28.1
98	CS	BLDG60	574,681	5,064,335	80.0	4.5	27.9
99	CT	BLDG60	574,694	5,064,351	80.0	4.5	27.9
100	CU	BLDG60	574,733	5,064,010	155.2	4.5	27.4
101	CV	BLDG60	574,816	5,064,334	90.0	4.5	27.2
102	CW	BLDG60	574,840	5,064,329	134.1	4.5	27.1
103	CX	BLDG60	574,854	5,064,267	291.8	4.5	27.0
104	CY	BLDG60	574,869	5,064,283	259.0	4.5	26.9

Figure 2 – 6m/s Simulation Contour Map

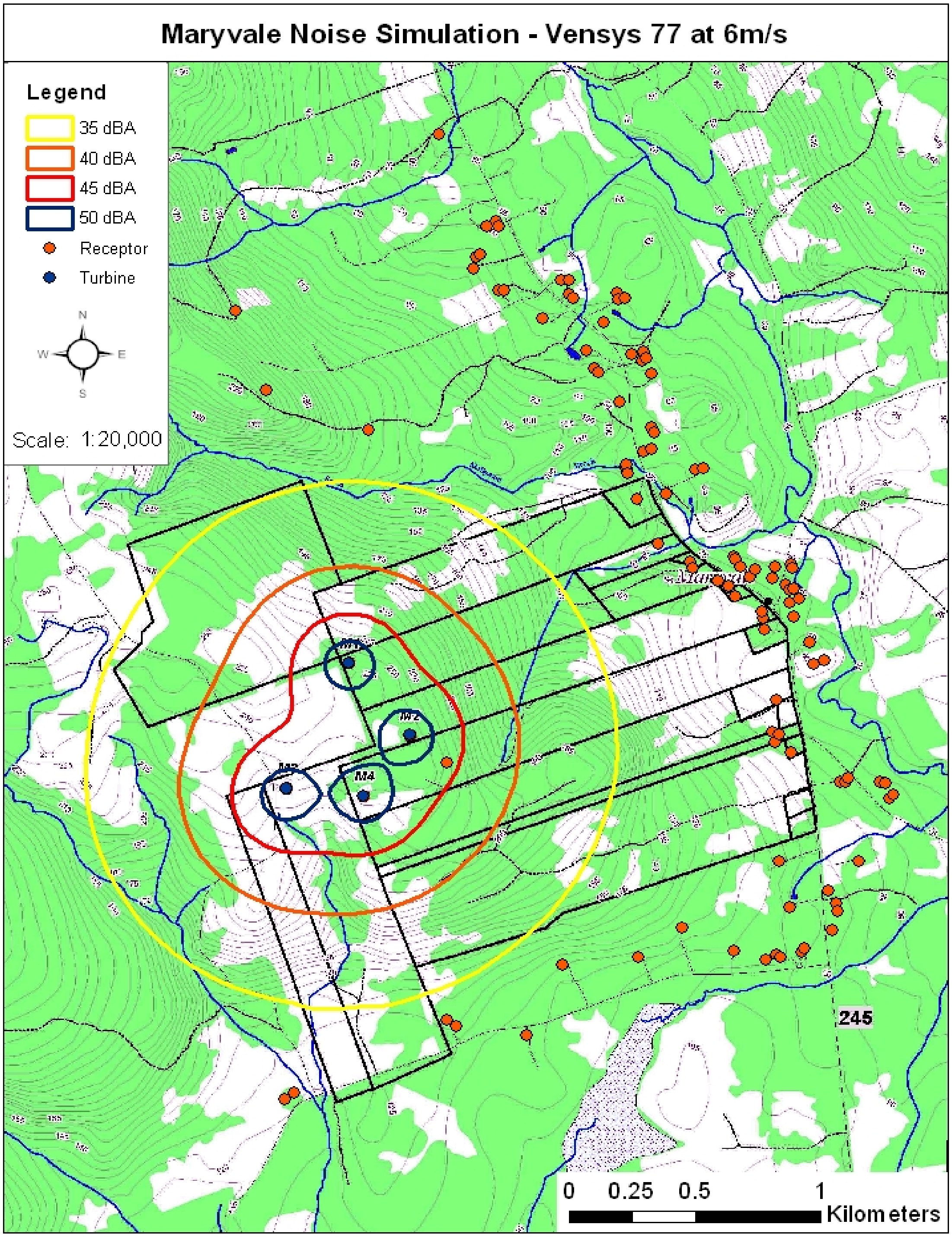


Table 6 – 7m/s Simulation Results

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	[dB(A)]
1	A	Four Valleys Fire Hall	573,059	5,067,014	56.5	4.5	27.1
2	B	St. Mary's Parish	573,872	5,066,080	71.0	4.5	30.0
3	C	John Teasdale Residence	574,351	5,065,017	74.2	4.5	31.4
4	D	Maryvale Elementary	574,356	5,064,966	75.6	4.5	31.5
5	E	BLDG60	572,046	5,062,371	111.0	4.5	28.8
6	F	BLDG60	572,250	5,066,287	167.1	4.5	30.7
7	G	BLDG60	572,369	5,065,957	210.0	4.5	33.1
8	H	BLDG60	572,448	5,063,026	306.3	4.5	33.4
9	I	BLDG60	572,481	5,063,050	256.3	4.5	33.6
10	J	BLDG60	572,780	5,065,791	140.9	4.5	34.8
11	K	BLDG60	573,092	5,063,350	180.4	4.5	35.6
12	L	BLDG60	573,094	5,064,417	222.3	4.5	48.1
13	M	BLDG60	573,130	5,063,326	162.4	4.5	35.2
14	N	BLDG60	573,197	5,066,458	79.7	4.5	29.7
15	O	BLDG60	573,206	5,066,505	75.5	4.5	29.4
16	P	BLDG60	573,224	5,066,520	74.0	4.5	29.3
17	Q	BLDG60	573,251	5,066,637	69.7	4.5	28.7
18	R	BLDG60	573,286	5,066,657	66.8	4.5	28.5
19	S	BLDG60	573,296	5,066,372	76.1	4.5	30.0
20	T	BLDG60	573,298	5,066,633	68.1	4.5	28.6
21	U	BLDG60	573,319	5,066,368	74.5	4.5	30.0
22	V	BLDG60	573,410	5,063,287	111.8	4.5	33.8
23	W	BLDG60	573,474	5,066,253	71.7	4.5	30.3
24	X	BLDG60	573,547	5,066,411	61.1	4.5	29.3
25	Y	BLDG60	573,552	5,063,580	117.0	4.5	35.0
26	Z	BLDG60	573,579	5,066,413	60.0	4.5	29.2
27	AA	BLDG60	573,581	5,066,355	63.1	4.5	29.5
28	AB	BLDG60	573,594	5,066,336	64.2	4.5	29.6
29	AC	BLDG60	573,645	5,066,121	74.2	4.5	30.5
30	AD	BLDG60	573,682	5,066,049	80.0	4.5	30.8
31	AE	BLDG60	573,694	5,066,032	80.4	4.5	30.8
32	AF	BLDG60	573,719	5,066,235	67.5	4.5	29.7
33	AG	BLDG60	573,768	5,066,359	60.0	4.5	29.0
34	AH	BLDG60	573,776	5,066,331	61.9	4.5	29.1
35	AI	BLDG60	573,780	5,065,910	87.2	4.5	31.2
36	AJ	BLDG60	573,800	5,066,340	61.1	4.5	29.0

Table 7 – 7m/s Simulation Results - Continued

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	[dB(A)]
37	AK	BLDG60	573,806	5,065,632	86.2	4.5	32.4
38	AL	BLDG60	573,808	5,065,651	84.9	4.5	32.3
39	AM	BLDG60	573,814	5,065,610	86.8	4.5	32.5
40	AN	BLDG60	573,826	5,066,104	70.0	4.5	30.0
41	AO	BLDG60	573,850	5,065,508	90.0	4.5	32.8
42	AP	BLDG60	573,852	5,063,611	111.4	4.5	33.4
43	AQ	BLDG60	573,875	5,065,703	80.0	4.5	31.7
44	AR	BLDG60	573,877	5,066,114	69.6	4.5	29.8
45	AS	BLDG60	573,887	5,066,090	70.0	4.5	29.9
46	AT	BLDG60	573,905	5,066,026	73.7	4.5	30.1
47	AU	BLDG60	573,906	5,065,713	80.0	4.5	31.6
48	AV	BLDG60	573,906	5,065,802	80.0	4.5	31.1
49	AW	BLDG60	573,920	5,065,782	80.0	4.5	31.2
50	AX	BLDG60	573,932	5,065,323	80.3	4.5	33.1
51	AY	BLDG60	573,966	5,065,528	80.0	4.5	32.1
52	AZ	BLDG60	574,028	5,063,735	115.9	4.5	32.8
53	BA	BLDG60	574,062	5,065,250	79.5	4.5	32.6
54	BB	BLDG60	574,073	5,065,220	81.7	4.5	32.6
55	BC	BLDG60	574,080	5,065,629	80.0	4.5	31.1
56	BD	BLDG60	574,116	5,065,633	80.0	4.5	30.9
57	BE	BLDG60	574,174	5,065,166	76.7	4.5	32.2
58	BF	BLDG60	574,215	5,065,149	76.8	4.5	31.9
59	BG	BLDG64	574,237	5,065,270	70.0	4.5	31.5
60	BH	BLDG60	574,238	5,063,636	123.9	4.5	31.3
61	BI	BLDG60	574,239	5,065,259	70.4	4.5	31.5
62	BJ	BLDG60	574,243	5,065,106	77.6	4.5	31.9
63	BK	BLDG60	574,262	5,065,229	71.3	4.5	31.5
64	BL	BLDG60	574,297	5,065,183	73.6	4.5	31.4
65	BM	BLDG60	574,318	5,065,214	71.5	4.5	31.2
66	BN	BLDG60	574,348	5,065,039	73.8	4.5	31.4
68	BO	BLDG60	574,361	5,063,602	210.1	4.5	30.5
69	BP	BLDG60	574,389	5,065,179	71.2	4.5	30.8
70	BQ	BLDG60	574,392	5,064,541	80.0	4.5	31.7
71	BR	BLDG60	574,399	5,064,499	83.1	4.5	31.6
72	BS	BLDG60	574,402	5,065,225	69.4	4.5	30.7
73	BT	BLDG60	574,403	5,064,674	73.1	4.5	31.5
74	BU	BLDG60	574,406	5,063,623	154.2	4.5	30.3

Table 8 – 7m/s Simulation Results - Continued

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	[dB(A)]
75	BV	BLDG60	574,414	5,064,531	80.0	4.5	31.5
76	BW	BLDG60	574,415	5,064,008	100.5	4.5	31.1
77	BX	BLDG60	574,423	5,063,613	132.1	4.5	30.2
78	BY	BLDG60	574,441	5,065,151	70.5	4.5	30.6
79	BZ	BLDG60	574,456	5,065,077	71.9	4.5	30.7
80	CA	BLDG60	574,457	5,065,129	70.8	4.5	30.6
81	CB	BLDG60	574,459	5,063,818	147.1	4.5	30.5
82	CC	BLDG60	574,463	5,065,238	65.9	4.5	30.3
83	CD	BLDG60	574,466	5,064,456	82.7	4.5	31.2
84	CE	BLDG60	574,470	5,065,224	66.6	4.5	30.3
85	CF	BLDG60	574,475	5,065,018	74.2	4.5	30.7
86	CG	BLDG60	574,476	5,065,134	70.5	4.5	30.5
87	CH	BLDG60	574,495	5,065,093	71.3	4.5	30.4
88	CI	BLDG60	574,504	5,063,631	97.5	4.5	29.8
89	CJ	BLDG60	574,519	5,063,647	96.8	4.5	29.8
90	CK	BLDG60	574,538	5,064,914	80.0	4.5	30.5
91	CL	BLDG60	574,552	5,064,824	80.0	4.5	30.5
92	CM	BLDG60	574,595	5,064,839	80.0	4.5	30.2
93	CN	BLDG60	574,613	5,063,884	230.0	4.5	29.8
94	CO	BLDG60	574,625	5,063,723	143.9	4.5	29.4
95	CP	BLDG60	574,641	5,063,836	164.6	4.5	29.6
96	CQ	BLDG60	574,647	5,063,804	152.5	4.5	29.5
97	CR	BLDG60	574,660	5,064,336	80.0	4.5	30.0
98	CS	BLDG60	574,681	5,064,335	80.0	4.5	29.9
99	CT	BLDG60	574,694	5,064,351	80.0	4.5	29.8
100	CU	BLDG60	574,733	5,064,010	155.2	4.5	29.4
101	CV	BLDG60	574,816	5,064,334	90.0	4.5	29.1
102	CW	BLDG60	574,840	5,064,329	134.1	4.5	29.0
103	CX	BLDG60	574,854	5,064,267	291.8	4.5	29.0
104	CY	BLDG60	574,869	5,064,283	259.0	4.5	28.9

Figure 3 – 7m/s Simulation Contour Map

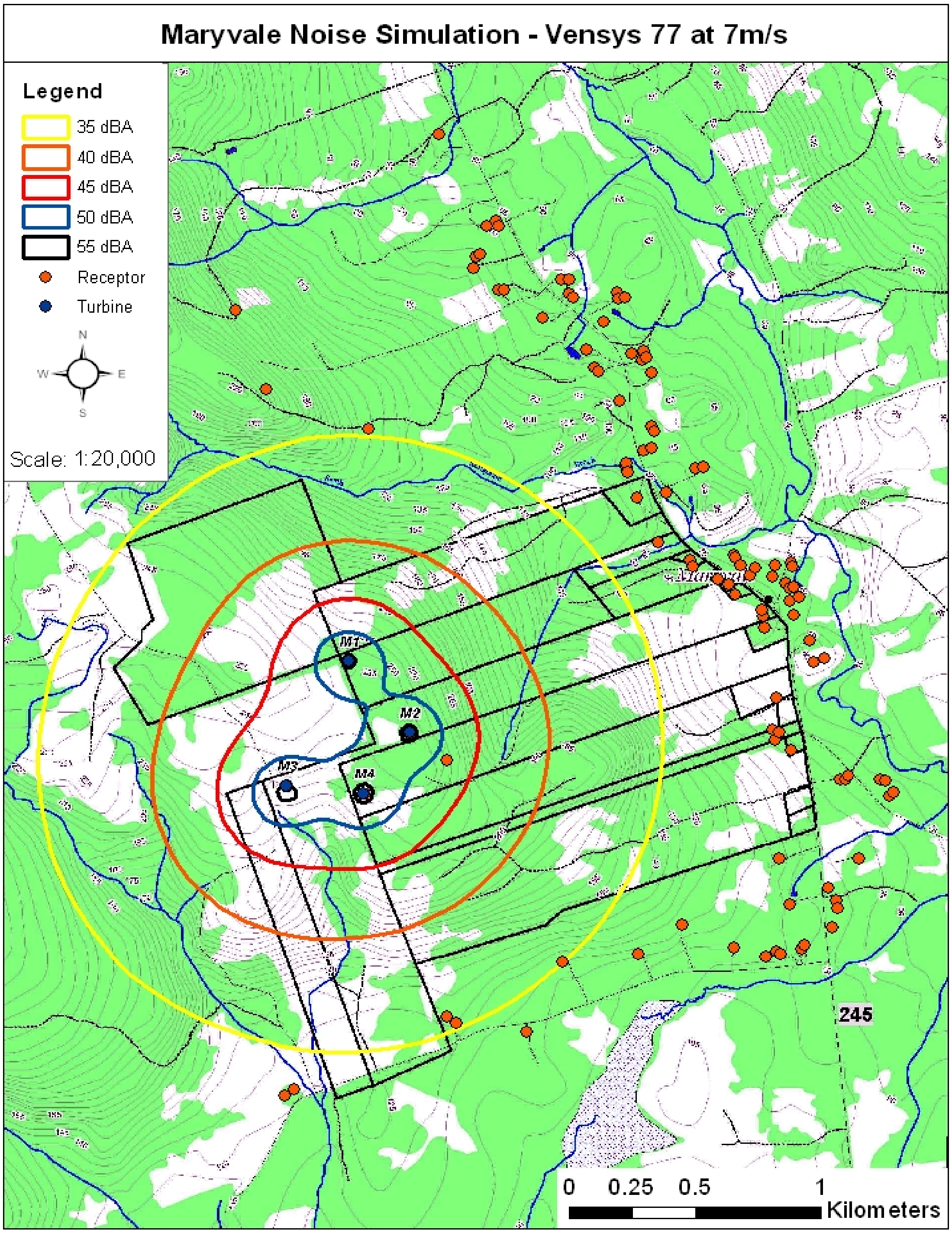


Table 9 – 8m/s Simulation Results

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	[dB(A)]
1	A	Four Valleys Fire Hall	573,059	5,067,014	56.5	4.5	26.3
2	B	St. Mary's Parish	573,872	5,066,080	71.0	4.5	29.3
3	C	John Teasdale Residence	574,351	5,065,017	74.2	4.5	30.7
4	D	Maryvale Elementary	574,356	5,064,966	75.6	4.5	30.8
5	E	BLDG60	572,046	5,062,371	111.0	4.5	28.1
6	F	BLDG60	572,250	5,066,287	167.1	4.5	30.0
7	G	BLDG60	572,369	5,065,957	210.0	4.5	32.4
8	H	BLDG60	572,448	5,063,026	306.3	4.5	32.8
9	I	BLDG60	572,481	5,063,050	256.3	4.5	33.0
10	J	BLDG60	572,780	5,065,791	140.9	4.5	34.1
11	K	BLDG60	573,092	5,063,350	180.4	4.5	34.9
12	L	BLDG60	573,094	5,064,417	222.3	4.5	47.6
13	M	BLDG60	573,130	5,063,326	162.4	4.5	34.6
14	N	BLDG60	573,197	5,066,458	79.7	4.5	29.0
15	O	BLDG60	573,206	5,066,505	75.5	4.5	28.7
16	P	BLDG60	573,224	5,066,520	74.0	4.5	28.6
17	Q	BLDG60	573,251	5,066,637	69.7	4.5	28.0
18	R	BLDG60	573,286	5,066,657	66.8	4.5	27.8
19	S	BLDG60	573,296	5,066,372	76.1	4.5	29.3
20	T	BLDG60	573,298	5,066,633	68.1	4.5	27.9
21	U	BLDG60	573,319	5,066,368	74.5	4.5	29.3
22	V	BLDG60	573,410	5,063,287	111.8	4.5	33.2
23	W	BLDG60	573,474	5,066,253	71.7	4.5	29.6
24	X	BLDG60	573,547	5,066,411	61.1	4.5	28.6
25	Y	BLDG60	573,552	5,063,580	117.0	4.5	34.4
26	Z	BLDG60	573,579	5,066,413	60.0	4.5	28.5
27	AA	BLDG60	573,581	5,066,355	63.1	4.5	28.8
28	AB	BLDG60	573,594	5,066,336	64.2	4.5	28.9
29	AC	BLDG60	573,645	5,066,121	74.2	4.5	29.9
30	AD	BLDG60	573,682	5,066,049	80.0	4.5	30.1
31	AE	BLDG60	573,694	5,066,032	80.0	4.5	30.2
32	AF	BLDG60	573,719	5,066,235	67.5	4.5	29.0
33	AG	BLDG60	573,768	5,066,359	60.0	4.5	28.3
34	AH	BLDG60	573,776	5,066,331	61.9	4.5	28.4
35	AI	BLDG60	573,780	5,065,910	87.2	4.5	30.5
36	AJ	BLDG60	573,800	5,066,340	61.1	4.5	28.3

Table 10 – 8m/s Simulation Results - Continued

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	[dB(A)]
37	AK	BLDG60	573,806	5,065,632	86.2	4.5	31.8
38	AL	BLDG60	573,808	5,065,651	84.9	4.5	31.7
39	AM	BLDG60	573,814	5,065,610	86.8	4.5	31.8
40	AN	BLDG60	573,826	5,066,104	70.0	4.5	29.4
41	AO	BLDG60	573,850	5,065,508	90.0	4.5	32.2
42	AP	BLDG60	573,852	5,063,611	111.9	4.5	32.7
43	AQ	BLDG60	573,875	5,065,703	80.0	4.5	31.1
44	AR	BLDG60	573,877	5,066,114	69.6	4.5	29.1
45	AS	BLDG60	573,887	5,066,090	70.0	4.5	29.2
46	AT	BLDG60	573,905	5,066,026	73.7	4.5	29.4
47	AU	BLDG60	573,906	5,065,713	80.0	4.5	30.9
48	AV	BLDG60	573,906	5,065,802	80.0	4.5	30.5
49	AW	BLDG60	573,920	5,065,782	80.0	4.5	30.5
50	AX	BLDG60	573,932	5,065,323	80.3	4.5	32.5
51	AY	BLDG60	573,966	5,065,528	80.0	4.5	31.4
52	AZ	BLDG60	574,028	5,063,735	115.9	4.5	32.2
53	BA	BLDG60	574,062	5,065,250	79.5	4.5	31.9
54	BB	BLDG60	574,073	5,065,220	81.7	4.5	32.0
55	BC	BLDG60	574,080	5,065,629	80.0	4.5	30.4
56	BD	BLDG60	574,116	5,065,633	80.0	4.5	30.2
57	BE	BLDG60	574,174	5,065,166	76.7	4.5	31.5
58	BF	BLDG60	574,215	5,065,149	76.8	4.5	31.3
59	BG	BLDG64	574,237	5,065,270	70.0	4.5	30.8
60	BH	BLDG60	574,238	5,063,636	123.9	4.5	30.6
61	BI	BLDG60	574,239	5,065,259	70.4	4.5	30.8
62	BJ	BLDG60	574,243	5,065,106	77.6	4.5	31.2
63	BK	BLDG60	574,262	5,065,229	71.3	4.5	30.8
64	BL	BLDG60	574,297	5,065,183	73.8	4.5	30.7
65	BM	BLDG60	574,318	5,065,214	71.5	4.5	30.5
66	BN	BLDG60	574,348	5,065,039	73.8	4.5	30.7
68	BO	BLDG60	574,361	5,063,602	200.1	4.5	29.9
69	BP	BLDG60	574,389	5,065,179	71.3	4.5	30.2
70	BQ	BLDG60	574,392	5,064,541	80.0	4.5	31.0
71	BR	BLDG60	574,399	5,064,499	83.1	4.5	31.0
72	BS	BLDG60	574,402	5,065,225	69.3	4.5	30.0
73	BT	BLDG60	574,403	5,064,674	74.5	4.5	30.9
74	BU	BLDG60	574,406	5,063,623	120.1	4.5	29.6
75	BV	BLDG60	574,414	5,064,531	80.0	4.5	30.9

Table 11 – 8m/s Simulation Results - Continued

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	[dB(A)]
76	BW	BLDG60	574,415	5,064,008	100.5	4.5	30.4
77	BX	BLDG60	574,423	5,063,613	106.8	4.5	29.5
78	BY	BLDG60	574,441	5,065,151	70.5	4.5	29.9
79	BZ	BLDG60	574,456	5,065,077	71.9	4.5	30.0
80	CA	BLDG60	574,457	5,065,129	70.8	4.5	29.9
81	CB	BLDG60	574,459	5,063,818	147.1	4.5	29.9
82	CC	BLDG60	574,463	5,065,238	65.5	4.5	29.6
83	CD	BLDG60	574,466	5,064,456	82.7	4.5	30.5
84	CE	BLDG60	574,470	5,065,224	66.3	4.5	29.6
85	CF	BLDG60	574,475	5,065,018	74.2	4.5	30.0
86	CG	BLDG60	574,476	5,065,134	70.5	4.5	29.8
87	CH	BLDG60	574,495	5,065,093	71.3	4.5	29.7
88	CI	BLDG60	574,504	5,063,631	96.9	4.5	29.1
89	CJ	BLDG60	574,519	5,063,647	96.8	4.5	29.1
90	CK	BLDG60	574,538	5,064,914	80.0	4.5	29.8
91	CL	BLDG60	574,552	5,064,824	80.0	4.5	29.8
92	CM	BLDG60	574,595	5,064,839	80.0	4.5	29.6
93	CN	BLDG60	574,613	5,063,884	230.0	4.5	29.1
94	CO	BLDG60	574,625	5,063,723	143.9	4.5	28.7
95	CP	BLDG60	574,641	5,063,836	164.6	4.5	28.9
96	CQ	BLDG60	574,647	5,063,804	152.5	4.5	28.8
97	CR	BLDG60	574,660	5,064,336	80.0	4.5	29.3
98	CS	BLDG60	574,681	5,064,335	80.0	4.5	29.2
99	CT	BLDG60	574,694	5,064,351	80.0	4.5	29.1
100	CU	BLDG60	574,733	5,064,010	155.2	4.5	28.7
101	CV	BLDG60	574,816	5,064,334	90.0	4.5	28.4
102	CW	BLDG60	574,840	5,064,329	134.1	4.5	28.4
103	CX	BLDG60	574,854	5,064,267	291.8	4.5	28.3
104	CY	BLDG60	574,869	5,064,283	259.0	4.5	28.2

Figure 4 – 8m/s Simulation Contour Map

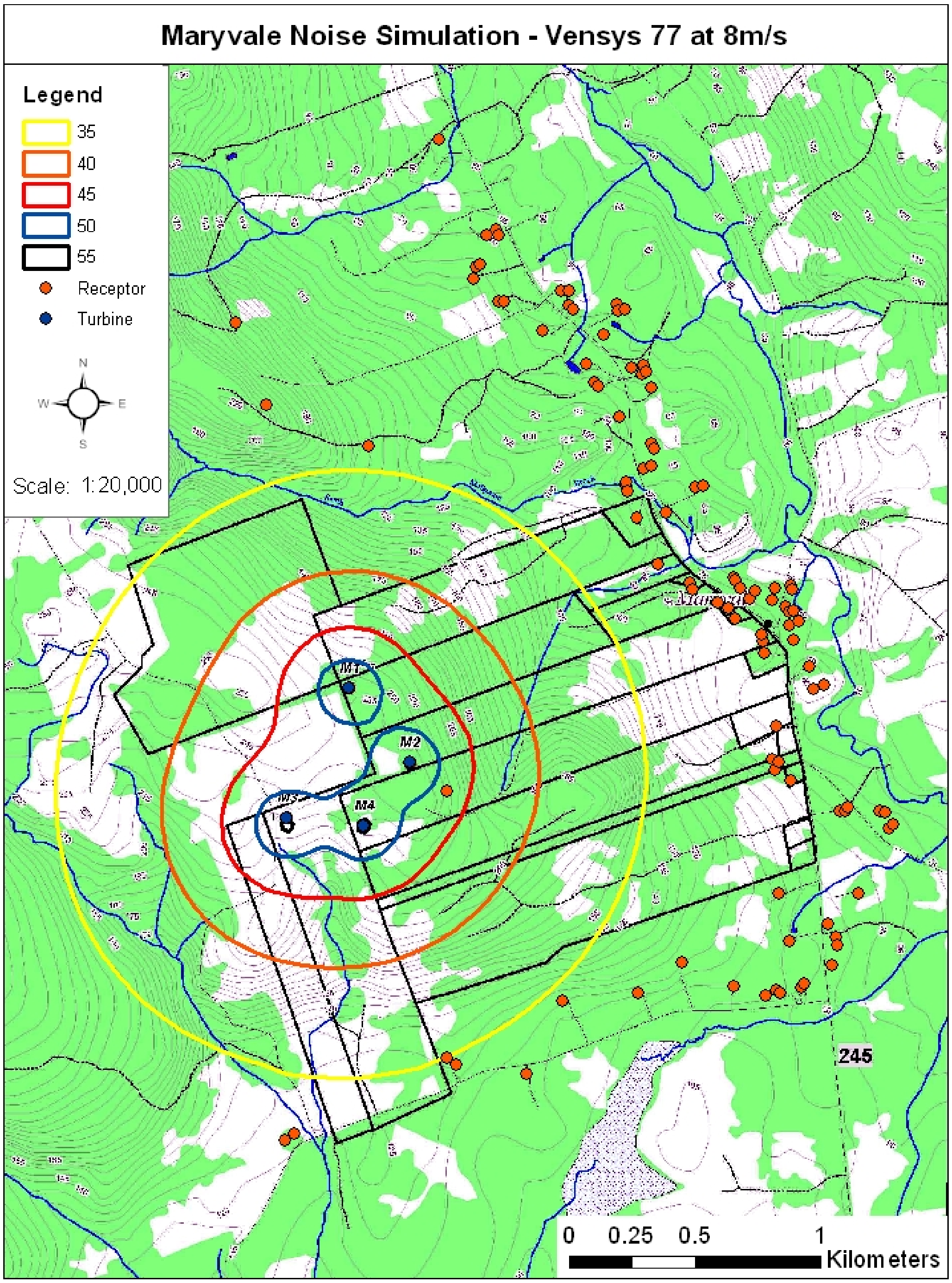


Table 12 – 9m/s Simulation Results

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	[dB(A)]
1	A	Four Valleys Fire Hall	573,059	5,067,014	56.5	4.5	26.1
2	B	St. Mary's Parish	573,872	5,066,080	71.0	4.5	29.1
3	C	John Teasdale Residence	574,351	5,065,017	74.2	4.5	30.6
4	D	Maryvale Elementary	574,356	5,064,966	75.6	4.5	30.6
5	E	BLDG60	572,046	5,062,371	111.0	4.5	27.8
6	F	BLDG60	572,250	5,066,287	167.1	4.5	29.8
7	G	BLDG60	572,369	5,065,957	210.0	4.5	32.3
8	H	BLDG60	572,448	5,063,026	306.3	4.5	32.6
9	I	BLDG60	572,481	5,063,050	256.3	4.5	32.9
10	J	BLDG60	572,780	5,065,791	140.9	4.5	34.0
11	K	BLDG60	573,092	5,063,350	180.4	4.5	34.8
12	L	BLDG60	573,094	5,064,417	222.3	4.5	47.6
13	M	BLDG60	573,130	5,063,326	162.4	4.5	34.5
14	N	BLDG60	573,197	5,066,458	79.7	4.5	28.8
15	O	BLDG60	573,206	5,066,505	75.5	4.5	28.5
16	P	BLDG60	573,224	5,066,520	74.0	4.5	28.4
17	Q	BLDG60	573,251	5,066,637	69.7	4.5	27.8
18	R	BLDG60	573,286	5,066,657	66.8	4.5	27.6
19	S	BLDG60	573,296	5,066,372	76.1	4.5	29.1
20	T	BLDG60	573,298	5,066,633	68.1	4.5	27.7
21	U	BLDG60	573,319	5,066,368	74.5	4.5	29.1
22	V	BLDG60	573,410	5,063,287	111.8	4.5	33.1
23	W	BLDG60	573,474	5,066,253	71.7	4.5	29.4
24	X	BLDG60	573,547	5,066,411	61.1	4.5	28.4
25	Y	BLDG60	573,552	5,063,580	117.0	4.5	34.3
26	Z	BLDG60	573,579	5,066,413	60.0	4.5	28.3
27	AA	BLDG60	573,581	5,066,355	63.1	4.5	28.6
28	AB	BLDG60	573,594	5,066,336	64.2	4.5	28.7
29	AC	BLDG60	573,645	5,066,121	74.2	4.5	29.7
30	AD	BLDG60	573,682	5,066,049	80.0	4.5	29.9
31	AE	BLDG60	573,694	5,066,032	80.0	4.5	30.0
32	AF	BLDG60	573,719	5,066,235	67.5	4.5	28.9
33	AG	BLDG60	573,768	5,066,359	60.0	4.5	28.1
34	AH	BLDG60	573,776	5,066,331	61.9	4.5	28.2
35	AI	BLDG60	573,780	5,065,910	87.2	4.5	30.3
36	AJ	BLDG60	573,800	5,066,340	61.1	4.5	28.1
37	AK	BLDG60	573,806	5,065,632	86.2	4.5	31.6

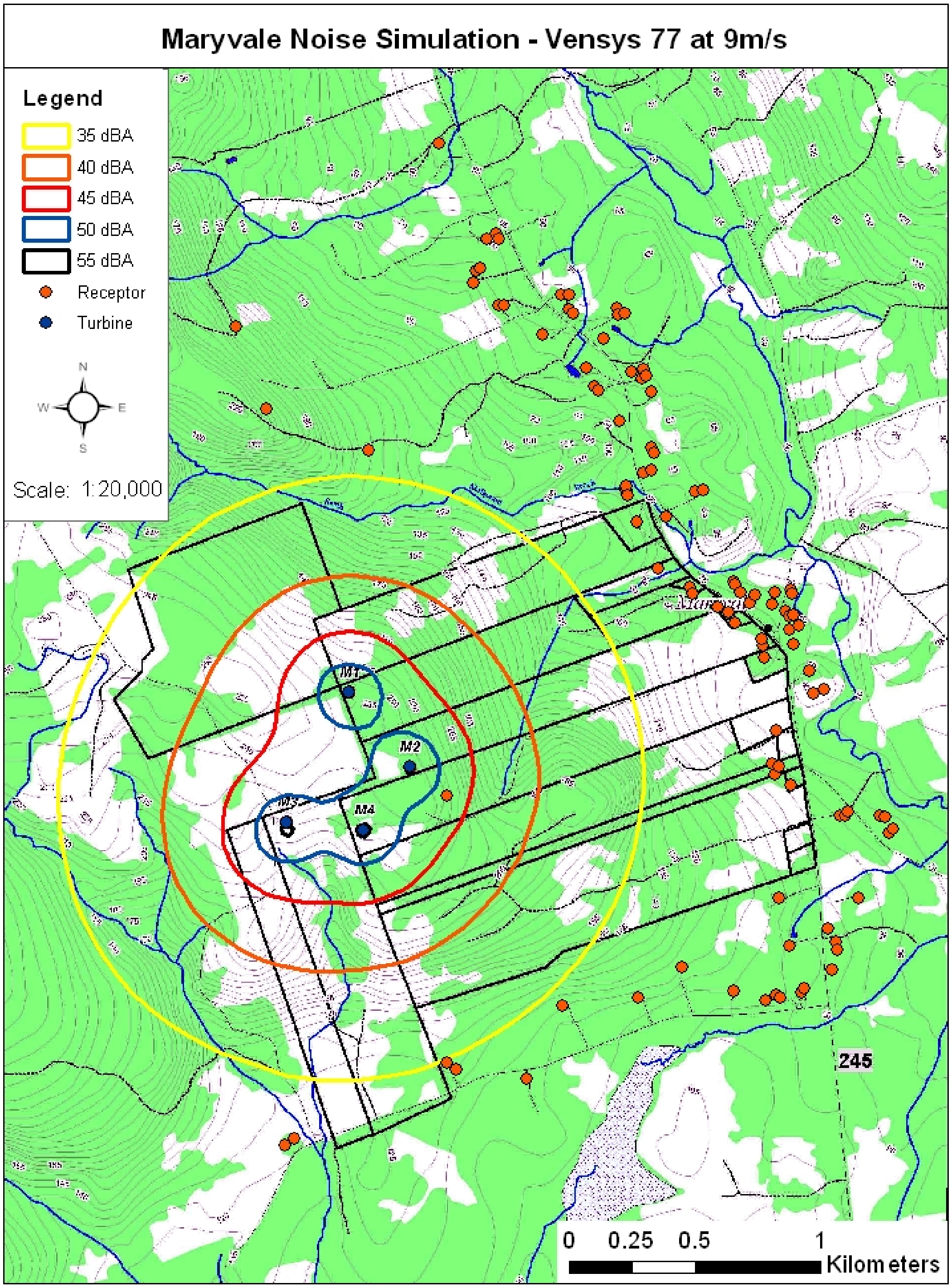
Table 13 – 9m/s Simulation Results - Continued

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	[dB(A)]
38	AL	BLDG60	573,808	5,065,651	84.9	4.5	31.5
39	AM	BLDG60	573,814	5,065,610	86.8	4.5	31.7
40	AN	BLDG60	573,826	5,066,104	70.0	4.5	29.2
41	AO	BLDG60	573,850	5,065,508	90.0	4.5	32.0
42	AP	BLDG60	573,852	5,063,611	111.9	4.5	32.6
43	AQ	BLDG60	573,875	5,065,703	80.0	4.5	30.9
44	AR	BLDG60	573,877	5,066,114	69.6	4.5	28.9
45	AS	BLDG60	573,887	5,066,090	70.0	4.5	29.0
46	AT	BLDG60	573,905	5,066,026	73.7	4.5	29.3
47	AU	BLDG60	573,906	5,065,713	80.0	4.5	30.7
48	AV	BLDG60	573,906	5,065,802	80.0	4.5	30.3
49	AW	BLDG60	573,920	5,065,782	80.0	4.5	30.3
50	AX	BLDG60	573,932	5,065,323	80.3	4.5	32.3
51	AY	BLDG60	573,966	5,065,528	80.0	4.5	31.3
52	AZ	BLDG60	574,028	5,063,735	115.9	4.5	32.0
53	BA	BLDG60	574,062	5,065,250	79.5	4.5	31.8
54	BB	BLDG60	574,073	5,065,220	81.7	4.5	31.8
55	BC	BLDG60	574,080	5,065,629	80.0	4.5	30.3
56	BD	BLDG60	574,116	5,065,633	80.0	4.5	30.1
57	BE	BLDG60	574,174	5,065,166	76.7	4.5	31.3
58	BF	BLDG60	574,215	5,065,149	76.8	4.5	31.1
59	BG	BLDG64	574,237	5,065,270	70.0	4.5	30.6
60	BH	BLDG60	574,238	5,063,636	123.9	4.5	30.5
61	BI	BLDG60	574,239	5,065,259	70.4	4.5	30.7
62	BJ	BLDG60	574,243	5,065,106	77.6	4.5	31.1
63	BK	BLDG60	574,262	5,065,229	71.3	4.5	30.6
64	BL	BLDG60	574,297	5,065,183	73.8	4.5	30.5
65	BM	BLDG60	574,318	5,065,214	71.5	4.5	30.3
66	BN	BLDG60	574,348	5,065,039	73.8	4.5	30.6
68	BO	BLDG60	574,361	5,063,602	200.1	4.5	29.7
69	BP	BLDG60	574,389	5,065,179	71.3	4.5	30.0
70	BQ	BLDG60	574,392	5,064,541	80.0	4.5	30.8
71	BR	BLDG60	574,399	5,064,499	83.1	4.5	30.8
72	BS	BLDG60	574,402	5,065,225	69.3	4.5	29.8
73	BT	BLDG60	574,403	5,064,674	74.5	4.5	30.7
74	BU	BLDG60	574,406	5,063,623	120.1	4.5	29.5
75	BV	BLDG60	574,414	5,064,531	80.0	4.5	30.7

Table 14 – 9m/s Simulation Results - Continued

No.	ID	Name	East	North	Z	Imission height	From WTGs
					[m]	[m]	
76	BW	BLDG60	574,415	5,064,008	100.5	4.5	30.3
77	BX	BLDG60	574,423	5,063,613	106.8	4.5	29.3
78	BY	BLDG60	574,441	5,065,151	70.5	4.5	29.8
79	BZ	BLDG60	574,456	5,065,077	71.9	4.5	29.8
80	CA	BLDG60	574,457	5,065,129	70.8	4.5	29.7
81	CB	BLDG60	574,459	5,063,818	147.1	4.5	29.7
82	CC	BLDG60	574,463	5,065,238	65.5	4.5	29.4
83	CD	BLDG60	574,466	5,064,456	82.7	4.5	30.3
84	CE	BLDG60	574,470	5,065,224	66.3	4.5	29.4
85	CF	BLDG60	574,475	5,065,018	74.2	4.5	29.8
86	CG	BLDG60	574,476	5,065,134	70.5	4.5	29.6
87	CH	BLDG60	574,495	5,065,093	71.3	4.5	29.6
88	CI	BLDG60	574,504	5,063,631	96.9	4.5	28.9
89	CJ	BLDG60	574,519	5,063,647	96.8	4.5	28.9
90	CK	BLDG60	574,538	5,064,914	80.0	4.5	29.6
91	CL	BLDG60	574,552	5,064,824	80.0	4.5	29.6
92	CM	BLDG60	574,595	5,064,839	80.0	4.5	29.4
93	CN	BLDG60	574,613	5,063,884	230.0	4.5	28.9
94	CO	BLDG60	574,625	5,063,723	143.9	4.5	28.5
95	CP	BLDG60	574,641	5,063,836	164.6	4.5	28.7
96	CQ	BLDG60	574,647	5,063,804	152.5	4.5	28.6
97	CR	BLDG60	574,660	5,064,336	80.0	4.5	29.1
98	CS	BLDG60	574,681	5,064,335	80.0	4.5	29.0
99	CT	BLDG60	574,694	5,064,351	80.0	4.5	28.9
100	CU	BLDG60	574,733	5,064,010	155.2	4.5	28.5
101	CV	BLDG60	574,816	5,064,334	90.0	4.5	28.2
102	CW	BLDG60	574,840	5,064,329	134.1	4.5	28.1
103	CX	BLDG60	574,854	5,064,267	291.8	4.5	28.1
104	CY	BLDG60	574,869	5,064,283	259.0	4.5	28.0

Figure 5 – 9m/s Simulation Contour Map



4. REFERENCES

Jacques Whitford (2008). *Model wind turbine by-laws and best practices for Nova Scotia Municipalities.* Commissioned by the Union of Nova Scotia Municipalities. http://www.unsm.ca/read_write/File/UNSM%20Wind%20By-Laws%20Best%20Practices%20January%2029%20complete.pdf

Maryvale Bird Survey – April 2008 to March 2009

Introduction

This document details the pre-construction bird monitoring effort for the Maryvale wind turbine site under the direction of RMS Energy Ltd. This project, if undertaken, will culminate in the construction of 4 to 5 turbines in the elevated terrain of Maryvale, Antigonish County, near Highway 245.

Methodology

There are five distinct types or periods of monitoring involved in this study:

1) Spring Migration (Apr. 6, 15, 22, 30, May 4, 7, 14, 17, 25)
2) Breeding (Jun. 1, 15, 22, Jul. 1)
3) Fall Migration (Aug. 24, Sep. 11, 18, 28, Oct. 12, 16, 26)
4) Raptor Counts (Oct. 4, 12)
5) Winter Monitoring (Dec. 31, Jan. 31)
6) Post-construction monitoring

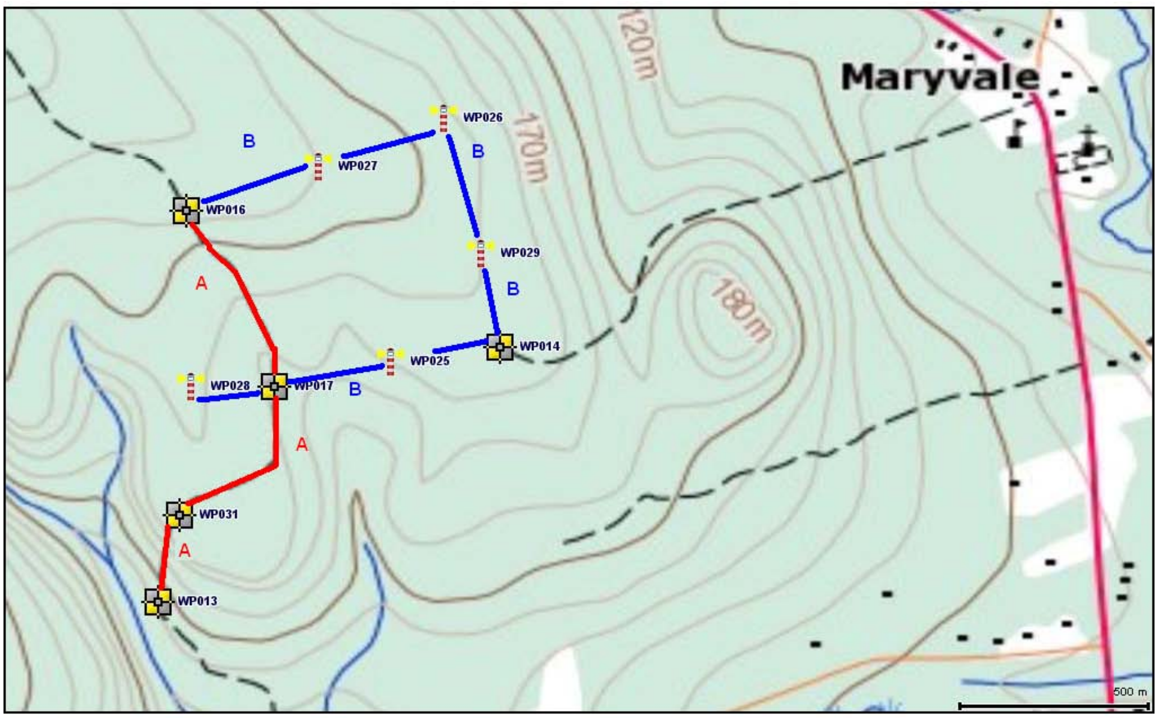


Figure 1 – Map of the study site. Waypoints WP025 – WP029 are the approximate locations of proposed wind turbines. WP013, WP014, WP016, WP017, and WP031 are the remaining 5 waypoints at which point counts were conducted in June. Route A is shown in red and Route B is shown in blue.

Waypoint Name	Turbine Location?	Easting	Northing
WP013	N	572101E	5063666N
WP014	N	572999E	5064349N
WP016	N	572164E	5064701N
WP017	N	572404E	5064237N
WP025	Y	572711E	5064306N
WP026	Y	572844E	5064952N
WP027	Y	572513E	5064819N
WP028	Y	572183E	5064234N
WP029	Y	572945E	5064597N
WP031	N	572155E	5063896N

Table 1 – List of point count locations. Five occur at proposed turbine locations and 5 occur in places designed to complement the habitat types represented at the turbine locations and provide adequate representation of all habitats encountered in the study area.

Spring Migration

Counts in spring migration were carried out as stopover counts. Two routes were selected (A and B) that sampled most major habitat types. Figure 1 illustrates the two routes.

Breeding

Each point count followed the protocols established by the Canadian Wildlife Service (CWS). Two point counts were conducted consecutively, each five minutes in duration. Only species not observed in the first five minutes were tallied in the second five minutes. The final result for each point count is the ten-minute sum. Point counts were done in June (and July 1st) with additional area searches used after this period to compile higher breeding evidence (Jul. 6, 27, and Aug. 16). The breeding evidence table given in the Results section includes this data.

Fall Migration

Fall migration counts were conducted using stopover counts. Two routes were outlined (A and B), with one route walked per survey, and routes alternated between surveys.

Raptor Counts

Two raptor counts were conducted in October. Only one site was determined to have a suitable vista for tallying raptors. This site was used for both counts. Observations were recorded between 9 am and 4 pm. All species of raptor were recorded, along with their apparent behaviour (hunting versus migration).

Winter Monitoring

A single route was established for completing winter monitoring counts (a combination of A and B). This was route was used for the monthly counts conducted in December through March. This route sampled all major habitat types.

Post-construction Monitoring

Post-construction monitoring must be undertaken to determine impacts of construction on bird populations and dynamics. This consists of the following components:

1) Breeding season surveys
2) Non-breeding season surveys
3) Carcass searches

1) Breeding Season counts are to be carried out according to a similar methodology as in pre-construction. The intensity and duration of this study will be determined through consultation with CWS. Non-breeding season counts. In general, the smaller the study site and proposed construction, the fewer years of post-construction studies that will have to be conducted. In some cases the first year of post-construction monitoring would not be for a year after construction.

2) Non-breeding post-construction studies need only be conducted if the area is important for birds at certain times of year (i.e., spring or fall migration). This will be determined after consultation with CWS.

3) Carcass counts are used to determine the initial impact to migrating birds (and bats). One season of carcass counts is recommended for sites that are not deemed high-risk to the environment, with additional years (springs) required if carcass counts show high migration mortality rates in the first spring.

Carcass counts should be conducted every 3 days for 6 to 8 weeks during spring migration. The principal estimates required from carcass counts are:

1. The proportion of carcasses that fell outside the search radius
2. The proportion of carcasses that fell inside and were removed by scavengers
3. The proportion found inside by the observer

The radius of search for an 80 m turbine with 40 m blades is typically 80 m from the turbine, while most bats killed in impacts will be found within the first 50 m from the turbine. Since this is a small site, every turbine should be searched (all ~4 for this site). Complete requirements and methodology for post-construction monitoring can be found in [1].

Collision studies will likely not be required for this site (to be confirmed by consultation with CWS).

Results

Spring Migration

Spring Migration counts were conducted by area searches along 2 routes labeled A and B. Each route samples most major habitats, and when possible, both were conducted in the same day. Due to the time constraints (one half-hour before sunrise until 4 hours after sunrise) this was not always possible. 47 species were encountered throughout the spring migration period.

Species	**6-Apr**	**15-Apr**	**22-Apr**	**30-Apr**	**4-May**	**7-May**	**14-May**	**17-May**	**25-May**
Route	**A,B**	**A,B**	**A,B**	**A,B**	**A,B**	**A**	**A,B**	**A**	**A,B**
Double-crested Cormorant						45			
Ruffed Grouse	2	1	1		3	1	1	1	
Red-tailed Hawk									1
Sharp-shinned Hawk									1
Wilson's Snipe					1				
Mourning Dove	1						1		
Hairy Woodpecker					1				1
Downy Woodpecker				1					
Northern Flicker			2	2	5	2	3	2	2
Yellow-bellied Sapsucker			11	1	3	1	3	2	
Pileated Woodpecker	1								
Least Flycatcher								1	2
Blue Jay	8	5	1		1	3		1	2
American Crow	21		2		2		1		
Common Raven	2	1			1				2
Blue-headed Vireo							3	3	1
Golden-crowned Kinglet		2		1	2		2		
Ruby-crowned Kinglet				13	18	4	4	5	1
Winter Wren				1		1	1	1	1
Boreal Chickadee	4	4	1	3		1	1		
Black-capped Chickadee	7	2	2	1		1	2	3	1
White-breasted Nuthatch							2		
Hermit Thrush				6	7	6	4	3	1
American Robin	11	10	8	11	8	4	5	1	2
Northern Parula								1	3
Yellow-rumped Warbler			1	1	3	1	4	11	2
Palm Warbler					2		2		
Black-and-white Warbler							2	2	1
Black-throated Green Warbler							1	6	6
Ovenbird								4	11
Magnolia Warbler								2	5
Chestnut-sided Warbler									2
Common Yellowthroat									3
Black-throated Blue Warbler									3
Nashville Warbler									1
Lincoln's Sparrow									2
Swamp Sparrow								1	
Chipping Sparrow								2	
White-throated Sparrow			2	9	25	6	13	13	7
Song Sparrow	2	2	3	3	3				1
Dark-eyed Junco	3	5	1	6	9	2	4		2
Pine Grosbeak	8								
Purple Finch	2		1			2	1		2
American Goldfinch		1	1					1	1
Evening Grosbeak			2	3	1	2	4	4	1
Common Grackle					1				
Unknown finch species						13			

Breeding Season

A total of 63 species were recorded throughout the study period. Only Olive-sided Flycatcher (*Contopus cooperi*) has a relevant status with COSEWIC; it is listed as Threatened in Nova Scotia. The reason for its decline is listed as unknown. The following observed birds are listed as yellow, or "sensitive to human activities or natural events" by Nova Scotia Department of Natural Resources:

1) Boreal Chickadee
2) Northern Goshawk
3) Olive-sided Flycatcher

Northern Goshawk (*Accipiter gentilis*) was only noted on one occasion, in October. The individual did not appear to be migrating. Boreal chickadees (*Poecile hudsonicus*) have been noted on most surveys, particularly in winter. They are typically found in habitats dominated by spruce, of which there are pockets at this site. Olive-sided Flycatcher was observed singing during several surveys in the spring and summer, and fledged young were seen on one occasion. This species benefits from forest disturbance such as fire or cutting, followed by regrowth.

The following table illustrates the number of breeding season point counts taken in the first and second grouping.

HABITAT TYPE	NUMBER OF POINT COUNTS COMPLETED		
	1ST SURVEY	2ND SURVEY	TOTAL
Mature Deciduous Forest		2	2
Mature Mixed Forest	2	3	5
Young Deciduous Forest	3	3	6
Young Coniferous Forest	1	1	2
Open Upland Country	0	1	1
TOTAL	6	10	16

List of Maritimes Breeding Bird Atlas (MBBA) codes:

OBSERVED
X – Species observed, but no breeding evidence observed, or observed outside of breeding period, or observed in unsuitable habitat for breeding

POSSIBLE
H – Species observed in its breeding season in suitable nesting habitat
S – Singing male(s) present, or breeding calls heard, in suitable nesting habitat in breeding season

PROBABLE
P – Pair observed in suitable nesting habitat in nesting season
T – Permanent territory presumed through registration of territorial song, or the occurance of a adult bird, at the same place, in breeding habitat, on at least two days a week or more apart, during its breeding season
D – Courtship or display, including interaction between a male and a female or two males, including courtship feeding or copulation
A – Agitated behavior or anxiety calls of an adult

CONFIRMED
NB – Nest-building or carrying nest materials, for all species except wrens and woodpeckers
DD – Distraction display or injury feigning
NU – Used nest or egg shells found (occupied or laid within the period of the survey)
FY – Recently fledged young or downy young, including incapable of sustained flight
AE – Adults leaving or entering nest site in circumstances indicating occupied nest
FS – Adult carrying faecal sac
CF – Adult carrying food
NE – Nest containing eggs
NY – Nest with young seen or heard

The following table serves as a list of all breeding evidence obtained, as well as a master list of all species observed throughout the study.

Species	**Breeding Evidence**	**MBBA Breeding Code**
Canada Goose	Observed	X
Double-crested Cormorant	Observed	X
Bald Eagle	Observed	X
Red-tailed Hawk	Probable	P
Sharp-shinned Hawk	Possible	H
Northern Goshawk	Observed	X
Northern Harrier	Observed	X
Merlin	Observed	X
Ruffed Grouse	Probable	D
Mourning Dove	Possible	S
Wilson's Snipe	Probable	D
Herring Gull	Observed	X
Ruby-throated Hummingbird	Possible	H
Downy Woodpecker	Possible	H
Hairy Woodpecker	Possible	H
Yellow-bellied Sapsucker	Probable	D
Northern Flicker	Confirmed	FY
Pileated Woodpecker	Possible	H
Least Flycatcher	Possible	S

Eastern Wood-Pewee	Possible	S
Olive-sided Flycatcher	Confirmed	FY
Alder Flycatcher	Possible	S
Yellow-bellied Flycatcher	Possible	S
American Crow	Possible	H
Blue Jay	Possible	H
Common Raven	Probable	P
Winter Wren	Possible	T
Red-eyed Vireo	Confirmed	FY
Blue-headed Vireo	Confirmed	FY
Boreal Chickadee	Confirmed	FY
Black-capped Chickadee	Confirmed	FY
White-breasted Nuthatch	Probable	P
Red-breasted Nuthatch	Possible	S
Golden-crowned Kinglet	Confirmed	FY
Ruby-crowned Kinglet	Confirmed	FY
Cedar Waxwing	Probable	P
Northern Parula	Confirmed	FY
Ovenbird	Probable	P
Chestnut-sided Warbler	Possible	S
Yellow-rumped Warbler	Probable	P
Common Yellowthroat	Possible	S
Black-throated Blue Warbler	Possible	S
Nashville Warbler	Possible	S
Palm Warbler	Probable	P
Black-and-white Warbler	Confirmed	CF
Magnolia Warbler	Confirmed	CF
Black-throated Green Warbler	Confirmed	FY
Mourning Warbler	Possible	S
Blackburnian Warbler	Possible	S
American Redstart	Possible	S
Swainson's Thrush	Possible	S
American Robin	Probable	A
Hermit Thrush	Probable	P
Chipping Sparrow	Probable	P
Fox Sparrow	Observed	X
Dark-eyed Junco	Confirmed	FY
Lincoln's Sparrow	Possible	S
Swamp Sparrow	Possible	S
Song Sparrow	Possible	S
White-throated Sparrow	Confirmed	FY
Evening Grosbeak	Probable	P
Purple Finch	Probable	P
Pine Grosbeak	Possible	H
American Goldfinch	Possible	S
Common Grackle	Possible	H

Of the 65 species observed, fourteen (14) species were confirmed to breed, fifteen (15) were recorded as probable breeders, 28 species possibly bred, and eight (8) were observed, but showed no evidence of breeding.

Fall Migration

27 species were observed during fall migration.

Fall migration totals	**24-Aug**	**11-Sep**	**18-Sep**	**28-Sep**	**12-Oct**	**16-Oct**	**26-Oct**	**Totals**
Route Number	**A**	**A**	**B**	**A**	**B**	**A**	**B**	
Canada Goose					15			15
Double-crested Cormorant		2			59			61
Northern Harrier	1							1
Merlin/American Kestrel					1			1
Sharp-shinned Hawk					1			1
Northern Goshawk					1			1
Herring Gull		1						1
Northern Flicker		2						2
Northern Flicker/Pileated WP					2			2
Hairy Woodpecker			2				1	3
Downy Woodpecker					2		1	3
Common Raven			2	2		1	3	8
American Crow				2	1	2		5
Blue Jay	1	5	2		2	1	1	12
Golden-crowned Kinglet	1	3		1	3	1	1	10
Ruby-crowned Kinglet	1	1						2
Red-breasted Nuthatch	2							2
Black-capped Chickadee		2			2		1	5
Boreal Chickadee		1			1	2	2	6
American Robin			1	4	2			7
Yellow-rumped Warbler	1							1
Ovenbird	1							1
Unidentified Warbler sp.	2	2	5					9
White-throated Sparrow					1		1	2
Dark-eyed Junco		3		4	2		8	17
Fox Sparrow					2			2
Evening Grosbeak	1				3			4
Pine Grosbeak					1			1
American Goldfinch	1							1
Unidentified Finch sp.	1						9	10

Raptor Count

Raptor counts were conducted from the same location (WP014) on the 4th and 12th of October. During the first count, no raptors were observed even though the conditions were not deemed adverse to migration. Given in the table below are all sightings from the 12th of October, including the apparent behaviour of individuals. In the final column, the suspected individual bird is assigned a number, ie., the first Sharp-shinned Hawk seen was assigned the designation "1", whereas one seen later was determined to be a different individual, and assigned "5".

Raptor Count		**20081004**			
	No raptors observed				
Raptor Count		**20081012**			
Time	**Species**	**Comment**	**Behaviour**	**Heading**	**individual number**
12:25	Sharp-shinned Hawk	juvenile	hunting		1
12:33	Sharp-shinned Hawk	juvenile	hunting		1
12:35	2 hawks (buteos?)		flyover		2,3
12:40	1 small raptor, high		possible migrant		4
12:46	Sharp-shinned Hawk	new indiv.	flyover		5
1:30	Sharp-shinned Hawk	juvenile	hunting		1
1:35	Sharp-shinned Hawk	juvenile	hunting		1
1:42	Bald Eagle	juvenile	hunting		6
1:55	hawk (buteo)?	distant	migration	east	7

Winter Monitoring

Winter monitoring was conducted on a single route that sampled all major habitat types.

COMMON NAME	SCIENTIFIC NAME	Dec. 31	Jan. 31	Feb. 28	Mar. 21
Ruffed Grouse	Bonasa umbellus	1			1
Hairy Woodpecker	Picoides villosus	2			
Blue Jay	Cyanocitta cristata	2			
American Crow	Corvus brachyrhynchos		1		
Common Raven	Corvus Corax	1	1	1	
Black-capped Chickadee	Poecile atricapillus	3	11	1	1
Boreal Chickadee	Poecile hudsonica	5	7		
Golden-crowned Kinglet	Regulus satrapa	4	1	4	
Unidentified Finch		4			
Bald Eagle	Haliaeetus leucocephalus		1		1

Post-construction Monitoring

Carcass counts will be undertaken to establish migratory mortality rates of birds (and bats) in the first spring after construction.

Preliminary Findings

1. No bird colonies are present in the study area

2. The study area does not appear to be an important breeding area for any bird species at risk (although Olive-sided flycatcher was confirmed to have bred and is threatened under COSEWIC in Canada)
3. There do not appear to be landforms in the study area that concentrate migrating birds
4. The study area is not an important corridor for migrating raptor species
5. Numbers and species of migrating birds counted during the fall season are representative of what one would expect to encounter in similar habitat types in this region of Nova Scotia
6. There are no lit structures nearby that would attract birds

References

[1] Recommended protocols for monitoring impacts of wind turbines on birds, Canadian Wildlife Service, April 2007.
Retrieved from: http://www.cws-scf.ec.gc.ca/publications/eval/prot/index_e.cfm

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[3] Non-green status of birds for Nova Scotia (extinct, extirpated, endangered, threatened, special concern), Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Retrieved from:
http://www.cosewic.gc.ca/eng/sct1/SearchResult_e.cfm?commonName=&scienceName=&boxTaxonomic=2&location=9&Submit=Submit

[4] Status of bird species for Nova Scotia, Department of Natural Resources, http://www.gov.ns.ca/natr/wildlife/genstatus/ranks.asp.

Moose Transects- Maryvale Location

These transects were completed on May 9, 2008. A total of eight transects were covered. It was a cool day with cloudy sky. Transects were randomly picked of the study area map. Transects varied in length depending on the study area boundaries for mat transect.

No moose sign was found on any of transects. There was quite a diverse ground type and forest type covered. Most transects had young striped maple growing which showed no signs of browsing, striped maple is one of foods in a moose diet.

Length of Transects

A) 640 meters
B) 575 meters
C) 680 meters
D) 660 meters
E) 680 meters
F) 600 meters
G) 760 meters
H) 640 meters

<u>**Moose Transects For Maryvaie Location**</u>

A) The first 200-250 meters of this transect was primarily mature hardwood heading past a frequently used camp men down a very steep grade. Where the ridge began to flatten out were several wet runs making the ground in this area quite swampy. In this swampy area the trees were younger, small hardwood (2-3 m)with a few softwood thickets throughout. Beyond the wet area the woods became a mix of mature to over mature hardwood and softwood. The transect ended at a brook.

B) This transect began in a mature hardwood stand (ave. diameter 7") with lots of hardwood regen (1-1.5m) in the understory. The ground was hard and could be described as having rolling terrain. About halfway was a fresh cutover (wood still piled in cut over) about 50-60 meters across then into a mature mix stand on the other side with rolling terrain, as well.

C) Transect C was mostly mature hardwood at the beginning and eventually became hardwood regen (approx. 2-3 meters tall) from a cut over several years ago. This area was mostly striped maple, yellow and white birch, and red maple. Near the last 200-300 meters was a softwood thinning from many years ago; there were stumps visible, but lots of regen was present and the spruce were about 10-15 feet in height. This transect ended at a rock dyke.

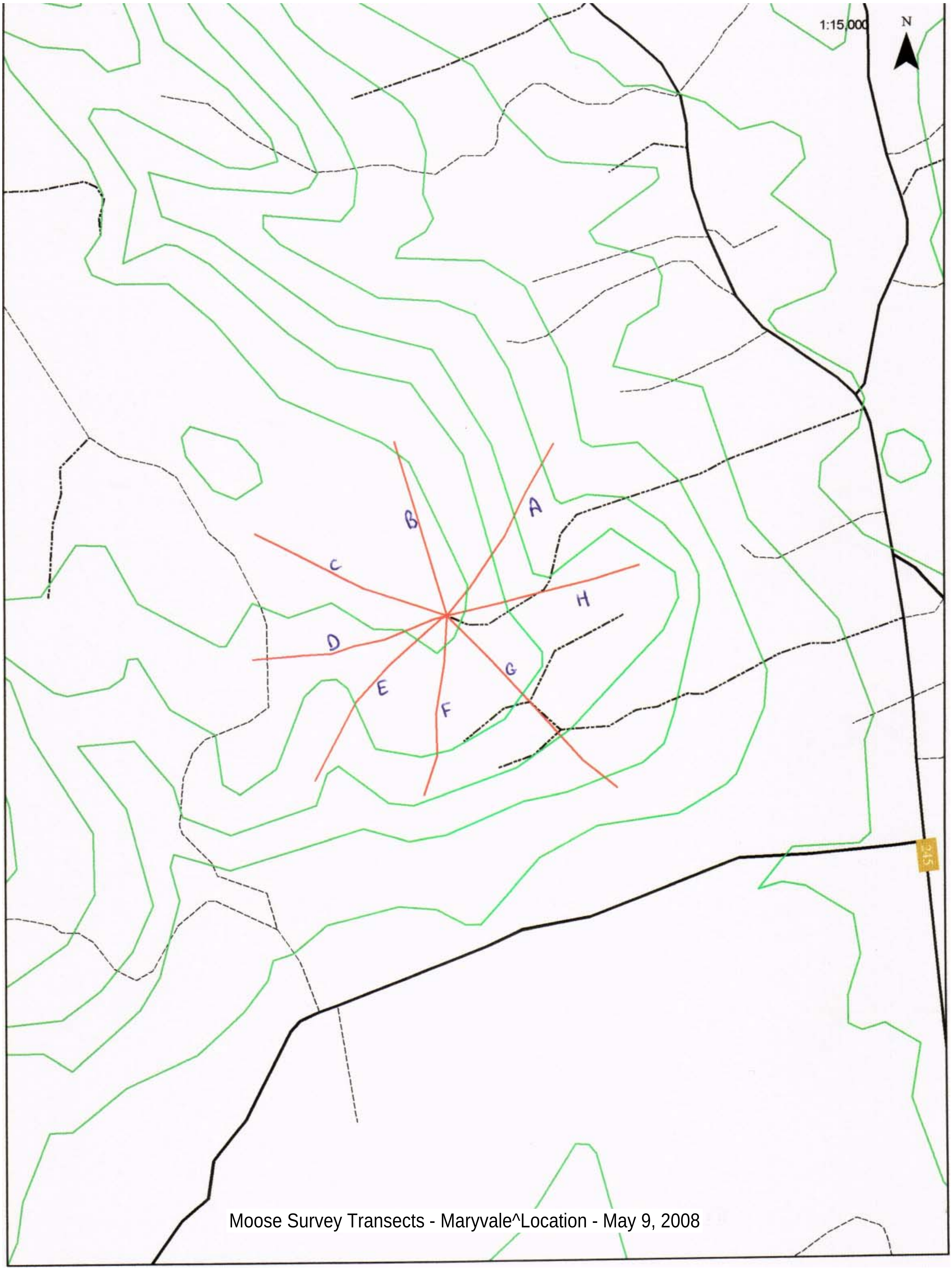
D) Transect D left the landing as a hardwood thicket with softwood thickets scattered throughout. The trees were 8-12 feet tall and growing very close together (old cutover). The stand was primarily striped maple and yellow and white birch. About halfway (250 m or so) were two brooks. The ground was hard and dry, for the most part. However, there were several small swampy areas along the way. The transect ended at an old forwarder trail.

E) The first two hundred meters was old cutover, young maple and birch saplings throughout (2-4m). The ground was good hard ground. The next four hundred meters was through a ravine. There was a brook running through the ravine, there was mature mixed wood through this area. The ground was mostly swampy. The rest of the transect was through an old cutover with young softwood coming up (0-2m).

F) The first three hundred meters was old cutover with young hardwood saplings (2-4m). The next hundred meters was through mature standing hardwood. At four hundred meters was a young spruce plantation (2-3m). At roughly five hundred meters the hill started to drop off at a pretty good rate.

G) The first two hundred meters was old cutover with young hardwood coming up (2-4m). The next one hundred and fifty meters was mature standing hardwood. The next three hundred and fifty meters was younger hardwood (4-7m). At seven hundred meters was a young mixedwood stand in a low area (9-12m).

H) The first three hundred meters was through standing mature hardwood. At one hundred and fifty meters the hill drops off. At three hundred meters is a young hardwood stand (3-4m tall). At four hundred meters there is a mixed-wood stand, and at five hundred meters the stand is young hardwood for the rest of the transect.



Moose Survey Transects - Maryvale^Location - May 9, 2008

COMNAME	GRANK	NPROT	SUBNAT	SRANK	SPROT
Piping Plover	G3	E	NS	S1B	Endangered
Moose	G5		NS	S1	Endangered
Whip-Poor-Will	G5		NS	S1?B	
Warbling Vireo	G5		NS	S1?B	
Philadelphia Vireo	G5		NS	S1?B	
Black-crowned Night-heron	G5		NS	S1B	
Long-eared Owl	G5		NS	S1S2	
Barrow's Goldeneye - Eastern pop	G5	SC	NS	S1N	
Wood Turtle	G4	SC	NS	S3	Vulnerable
Maine Snaketail	G4		NS	S1	
Subarctic Darner	G5		PE	S1	
Amber-Winged Spreadwing	G4		PE	S1	
Acadian Hairstreak	G5		NS	S1	
Petite Emerald	G5		PE	S1	
Azure Bluet	G5		PE	S1	
Brook Floater	G3		NS	S1S2	
Hoary Comma	G5		NS	S1	

COMNAME	GRANK	NPROT	SUBNAT	SRANK	SPROT
Maritime Saltbush	G2G4		NS	S1?	
Sand-Heather	G5		NS	S1	
Canada Clearweed	G5		NS	S1	
Estuary Beggar-Ticks	G4		NS	S1	
Common Alexanders	G5		NS	S1S2	
White Snakeroot	G5		NS	S1	
Button-Bush Dodder	G5		NS	S1	
Coast-Blite Goosefoot	G5		NS	S1?	
Rich's Sea-blite	G5T3		NS	S1	
A Hawthorn	G2G4Q		NS	S1?	
Bebb's Sedge	G5		NS	S1S2	
Foxtail Sedge	G5		NS	S1	
Greene's Rush	G5		NS	S1S2	
Panic Grass	G5T5		NS	S1?	
Estuarine Sedge	GNR		NS	S1S3	
Tinged Sedge	G4G5		NS	S1	
Coast-Blite Goosefoot	G5		NS	S1?	
Woolly Sedge	G5		NS	S1	
Virginia Anemone	G5		NS	S1S2	
Bottlebrush Grass	G5T5?		NS	S1	
Showy Tick-Trefoil	G5		NS	S1	
Wiegand's Wild Rye	G4G5		NS	S1	
Black-Seed Plantain	G5		NS	S1SE	
Black Snake-Root	G5		NS	S1	
Slender Blue Flag	G4G5		NS	S1	
Running Serviceberry	G5		PE	S1?	
Slender Sedge	G5		NS	S1S2	

An assessment of the potential impacts of a wind turbine farm at Maryvale, NS on local bat populations.

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Context

The proponent is proposing to install four electricity generating wind turbines on at Maryvale Nova Scotia. There is potential for the proposed development to have negative impacts on bat populations. The goal of this desktop exercise is to provide information on bat species occurrence in the area and their resource requirements that might be useful for predicting whether there will be any negative impact of the proposed development on bat populations.

Specifically, the objectives of this report are to provide:

(1) a review of the potential impacts of wind turbine developments on bats.

(2) a summary of the ecology of the bat species that are likely to be present in the area that is relevant to the proposed development.

(3) An assessment of the potential for their to be bat hibernacula with 25 km of the proposed development site (As per NS DEL regulations, 2007)

(4) A goal and specific objectives that would be necessary for any field studies recommended to assess the potential for there to be impacts on bats and provide a costing for these items for consideration.

This report is limited to relevant information about bats and bat resources; it makes no attempt to evaluate the project relative to any other potential impacts of the proposal, positive or negative.

Introduction

By now, it is widely known that some wind turbine farms are a major source of mortality for many bat species (Barclay et al., 2007; Johnson, 2005), whereas other farms cause few, if any, direct mortalities. Estimates of the number of bat fatalities is highly variable ranging from less than 3 up to 50 bats/turbine/year (Jain et al., 2007; Johnson et al., 2003a; Johnson et al., 2003b; Kerns et al., 2005; Kerns and Kerlinger, 2004; Nicholson, 2003). Mortalities occur due to direct strikes of the animals with the rotating turbine blades or by experiencing a rapid drop in pressure as they fly in proximity to the rotating blades-barotrauma (Baerwald et al., 2008). The issue of bat mortalities at existing and proposed wind farms is a major concern to the environmental and scientific communities (Mammalogists, 2008).

In North America, large bat fatality events occur primarily in late summer and early fall and the species most effected are the long distance migrant species including hoary bats (*Lasiurus cinereus*), silver-haired bats (*Lasionycteris noctivagans*) and eastern red bats (*Lasiurus borealis*). However, bat fatalities have also been reported, in smaller numbers for short-distance migrant (or 'resident') bat species such as the tri-colored bat (*Perimyotis subflavus;* the common name of this species was formerly the eastern pipistrelle), northern long-eared (*Myotis septentrionalis*) and little brown bats (*Myotis lucifugus*) (Jain et al., 2007; Johnson, 2005; Nicholson, 2003).

The large variability in species composition and rates of fatalities among wind generation facilities has been suggested to be due to the placement of facilities (e.g., along migratory routes or not), and from the use of increasingly larger turbines which extend into the flight space of migrating bats (Barclay et al., 2007). However, behavioral observations suggest that bats that are killed often display foraging – type flight pattern rather than simply passing through the area (Horn et al., 2008). Further, bat mortalities tend to occur more often during nights with low windspeed (Horn et al., 2008). Therefore, as mortalities may be a result of site- 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 farms on bat populations (Mammalogists, 2008).

In Nova Scotia there are occurrence records for seven bat species (each of the 6 mentioned above as well as the big brown bat, *Eptesicus fuscus*) (Broders et al., 2003; van Zyll De Jong, 1985), and each have been documented to have experienced fatalities at wind turbine sites. Nova Scotia is at, or near the periphery of the current known range for each of these species, with the exceptions of the northern long-eared and the little brown bat (van Zyll De Jong, 1985). These two species, as well as the tri-colored bat, appear to be the only bat species with significant populations in Nova Scotia (Broders et al., 2003; Farrow, 2007). Little brown and northern long-eared bats are widespread in Nova Scotia while tri-colored bats appears to be restricted to southwest Nova Scotia (Broders et al., 2003; Farrow, 2007; Rockwell, 2005). The low number of echolocation recordings of migratory species (i.e., red, hoary and silver-haired bats; 15 out of 30 000 echolocation sequences) by Broders (2003) and other unpublished work suggests there are no significant populations or migratory movements of these species in southwest Nova Scotia. As for big brown bats, there is only one unconfirmed observation of 2 individuals of this species hibernating at Hayes Caves, there are no other records (Moseley, 2007). In other work that my students and I have conducted in more northerly parts of Nova Scotia (Farrow, 2007; Rockwell, 2005), as well as Prince Edward Island (Henderson et al., 2008; Henderson et al., 2009) and work done by others in Newfoundland (Grindal, 1999) since that time suggests that the incidence of long distance migrants and tri-colored bats in more northerly and easterly parts of NS is also very low.

Only the northern long-eared and little brown bat are expected to be common summer residents of the eastern mainland of Nova Scotia. The life history of both of these species is typical for temperate 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 cost of reproduction in the summer from pregnancy and by providing sole parental care to juveniles (Barclay, 1991; Broders et al., 2006; 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 et al., 2006; Henderson and Broders, 2008; Jung et al., 2004). Females form maternity roosting colonies in coniferous or deciduous tree, depending on availability (Broders and Forbes, 2004; Foster and Kurta, 1999; Garroway and Broders, 2008; Henderson 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, 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 shown to roost in 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). Regardless, our ability to sample bat activity at high altitudes is extremely limited and therefore our ability to make inference on the vertical distribution of bats is extremely limited.

In addition to the paucity of information on the vertical distribution during the summer, little is also known about the dynamics of movement (e.g., altitude and travel routes) of 'resident' bats (i.e., little brown bats, northern long-eared bats and tri-colored bats) to and from hibernation sites, but it would seem likely that they would use ridges and other linear landscape elements as travel routes. Further, bats arrive at hibernacula 1-2 months before the onset of hibernation when courtship and copulation is believed to occur (Fenton, 1969). During this period bats do not roost inside the hibernacula and exploratory research in Nova Scotia indicated that resident bats are 'on the move' during this period but at this time we do not understand the dynamics of this behavior (Poissant and Broders, unpublished data). Movement data in Ontario indicate these bats move up to at least 120 km between hibernacula within a year and up to at least 500 km between years (Fenton, 1969). In New England bats moved 214 km between hibernacula within one year with one female moving 128 km in only 3 nights during the spring emergence from hibernation (Davis and Hitchcock, 1965) which demonstrates large scale movements by resident hibernating species. Flight behavior (height above ground level, routes, etc.) during this time is likely different from when they are on the 'summering grounds'. The paucity of information on this aspect of bat biology would appear to be the largest impediment to accurately predicting the impact of wind farms on bats. This is, of course, assuming that mortality of bats at wind farms are not the result of being attracted to them out of curiosity or some other reason (Horn et al., 2008).

At this point, Nova Scotia has approximately 50 wind turbines in operation and, as of yet, there have been no reported mortalities of bats (Elderkin, NSDNR, pers. comm. 14 April 2009). Also, on Prince Edward Island there are approximately 70 wind turbines in operation and there are confirmed reports of 2 bat fatalities at each of 2 farms (Curley, PEI Dept Environment, Energy and Forestry, pers comm. 14 April 2009). For context and qualification though most of these turbines have been operating for only a short period of time (months to a few years) and it is not advisable to rely on this data to make predictions for elsewhere in the region and into the future. In the recently released US Federal Aviation Administration's National Wildlife Aircraft Strike Database there are no records of bats being struck by aircrafts. This database is for airports throughout the US and Canada (including Stanfield International Airport) and includes data related to reports of birds, bats and other animals struck by aircrafts (database accessed on 26 April 2009). Although the pertinence of this database is peripheral it does have, at least some, relevance.

The guide to wind development prepared by the Nova Scotia Department of Environment and Labour (NSDEL, 2007) states that wind farm sites within 25 km of a known bat hibernaculum have a ‘very high’ site sensitivity. Currently, there are no known bat hibernacula within 25 km of the proposed development area at Maryvale. Although there are mining records for approximately 64 sites within 25 km, only one is an adit or shaft of any length (id code: BMC-1-001 with an original depth of 45 m; unpublished data from the NS DNR). Of these 64 records, this would seem to be the only place that might be suitable as a hibernaculum. However information on this site is scant and, to my knowledge, it has never been surveyed for bats. Given this, there is no information to suggest that there are any significant hibernacula in the vicinity of the proposed development.

Other than bat mortality directly as a result of turbines, there is also a high likelihood that disruption of the forest structure (removal and fragmentation of trees for road building and deployment of turbines, etc.) for the development will degrade the local environment for colonies/populations that reside in the area during the summer by eliminating roost trees and isolating remaining ones as well as eliminating or degrading foraging areas. This negative aspect will almost certainly occur and will add to the cumulative effect of loss of bat habitat that is occurring throughout the range of these species.

Recommendations

Given the above synthesis, it is recommended that the following site specific follow-up be conducted.

1. Acoustic surveys should be conducted at the site to determine if there are any unusually high concentrations of bats in the area. These surveys should be conducted over many nights sometime mid-late August. Ideally, there would be an ultrasonic recorder deployed on a met tower and one on the ground.
2. Regardless of the results of the above, it will be imperative that post construction surveys be conducted to search for carcasses of bats at the base of the turbines. These surveys should be systematic in terms of how and when they are conducted. All mortalities should be reported. See below.

Proposed protocol for post construction carcass searches

It is possible that, if a development site is along a bat migratory route (if they exist) the number of bat deaths that the development would cause could be large. Unfortunately there are limitations in our ability to predict, pre-construction, the likelihood of this occurring. Currently in Nova Scotia there is no data suggesting that existing wind farms are problematic for bat populations, but this data should be interpreted with caution as most turbines have been operational for only a short period of time. Further, given the paucity of information about bat movement patterns it is possible that, as of yet, turbines have not been deployed along migratory routes. As such it is recommended that pre-construction monitoring occur and it is imperative that, if the development proceeds, monitoring begin immediately after the first turbines become operational to begin systematic surveys to determine whether any bat mortality is occurring. Such surveys should be conducted in a systematic way.

To devise a protocol, studies of bat and bird mortality at wind farms were reviewed (i.e. (Arnett et al., 2005; Erickson et al., 2003a; Erickson et al., 2003b; Erickson et al., 2000; Jain et al., 2007; Johnson et al., 2003a; Kerns et al., 2005; Nicholson, 2003; Osborn et al., 2000; Young et al., 2003). For the purpose of this proposal 2 seasons are designated: spring/summer residency season (May- 10 August) and fall migratory season (10 August – October).

Post construction fatality searches should be conducted for a full active season from May through to October. Searches should be conducted once a week during the spring/summer residency season and to better estimate fatalities during the period of highest bat activity when most fatalities occur every 3-5 days in the fall migratory season (Jain et al., 2007; Reynolds, 2006). Recent surveys have found that ≥ 80% of all bat fatalities occur within 40 m of the turbine (Kerns et al., 2005; Morrison, 2002) therefore it is recommended that 6400 m^2 square plot be constructed that are centered on each turbine and set up linear and parallel transects within this area to search for carcasses (Figure 1). Variability in cleared areas around each turbine may mean that the effective area searched may be slightly reduced with searches ending at the tree-line. The establishment of semi-permanent plots would facilitate efficient searches throughout the entire study period.

Carcasses identified in surveys should be geo-referenced, bagged and frozen. Minimum data to be recorded should include: bat carcass identification number, date, time found, turbine identification, plot zone, species, sex, age (if possible), carcass condition (entire, partial or scavenged). All carcasses should be frozen for identification and for potential use later for searcher efficiency and/or scavenger removal trials. If there are a ‘significant’ number of fatalities found during these carcass search trials searcher efficiency and/or scavenger removal trials should be conducted for obtain a better estimate of the extent of bat mortality events (Arnett, 2005; Johnson et al., 2003a; Kerns et al., 2005; Osborn et al., 2000). A protocol for these may be designed later if required.

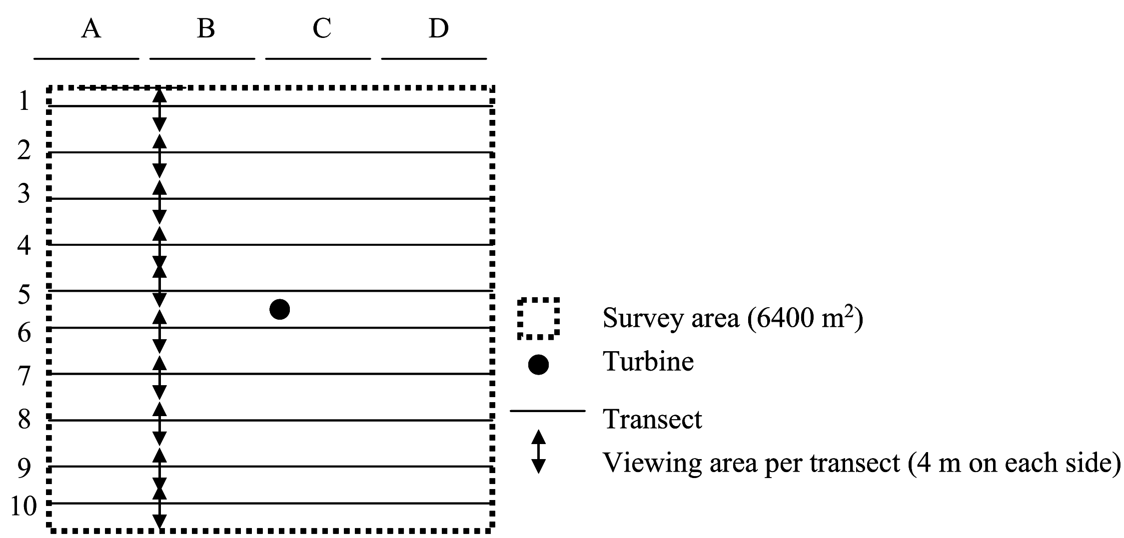

Figure 1: Survey area and transect design. The survey area will be a square with side length of 80 m, transects will be 8 m apart and searchers will scan 4 m on each side of the transect for carcasses. Transects will be labeled 1, 2, 3, etc. and subdivided into 4 equal lengths (20 m each) and labeled A,B, C and D so that the plot zone for each observation can be identified (e.g., 1C, 5A, etc).

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MARYVALE WIND PROJECT, ANTIGONISH COUNTY: ARCHAEOLOGICAL RESOURCE IMPACT ASSESSMENT

Heritage Research Permit A2008NS50

July 2008

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MARYVALE WIND PROJECT, ANTIGONISH COUNTY: ARCHAEOLOGICAL RESOURCE IMPACT ASSESSMENT

Heritage Research Permit A2008NS50
Category C

Davis Archaeological Consultants Limited

Principal Investigator: April D. MacIntyre
Report Compiled by: April D. MacIntyre & Stephen A. Davis

Cover: Stone property boundary encountered on the west side of the development area between proposed turbines 1 and 3, looking northeast.

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EXECUTIVE SUMMARY

Davis Archaeological Consultants Limited conducted an archaeological resource impact assessment of the proposed Maryvale Wind Project in Antigonish County in June 2008. The assessment included a historic background study of the development area as well as predictive modeling for First Nations resources, and an archaeological field survey. The background study indicated that the area was of moderate potential for historic period archaeological resources associated with early nineteenth century Scottish immigrant settlement. However, predictive modeling based on visual analysis of maps and archaeological experience suggested that the development area was of low archaeological potential for precontact First Nations resources. This was corroborated by the field survey. No significant archaeological resources were encountered during the field survey and, therefore no further active mitigation is recommended for the current proposed development area.

1.0 INTRODUCTION

In April 2008, Davis Archaeological Consultants (DAC) Limited was contracted by Fulton Energy Research to conduct an archaeological resource impact assessment of the proposed Maryvale Wind Project in Antigonish County. The purpose of the assessment was to determine the potential for archaeological resources within the development area and to provide recommendations for further mitigation, if necessary. The assessment included a historical background study, predictive modeling for First Nations resources, and an archaeological survey.

The assessment was conducted under Category C Heritage Research Permit A2008NS50 (Appendix A) issued by the Nova Scotia Heritage Division. This report conforms to the standards required by the Heritage Division under the Special Places program.

2.0 DEVELOPMENT AREA

The Maryvale Wind Project development area includes four proposed turbines located approximately 14 kilometres north of Antigonish on the west side of Route 245. An area of approximately 1 acre will be impacted for each of the four turbines. In addition to this, the project will require the construction of necessary access roads and power lines between the turbines. The access roads will be 6 metres in width (Figure 2.0-1). The development area is identified as those areas which will be directly impacted by construction of the four turbines and access roads. The power line will run along a right-of-way adjacent to the access roads.

Maryvale is located in Nova Scotia Theme Region #583: Antigonish Uplands, sub-Unit: Lakevale. The Antigonish Uplands region is divided into several tertiary watersheds which drain mainly into St. George's Bay. The surface water in this region is comprised primarily of tributaries that flow into first order streams by way of a modified trellis pattern. The soils in the Lakevale sub-Unit are imperfectly-drained, either because of fine-textured underlying clays or flat-lying bedrock. Sugar Maple, Yellow Birch, and American Beech are most common in that part of the region covered by the development area. Freshwater fish are abundant in lakes and streams, although no significant habitats exist within the development area. There is virtually no information on small mammals in this sub-Unit.[1]

[1] Davis & Browne, 1996: 142.

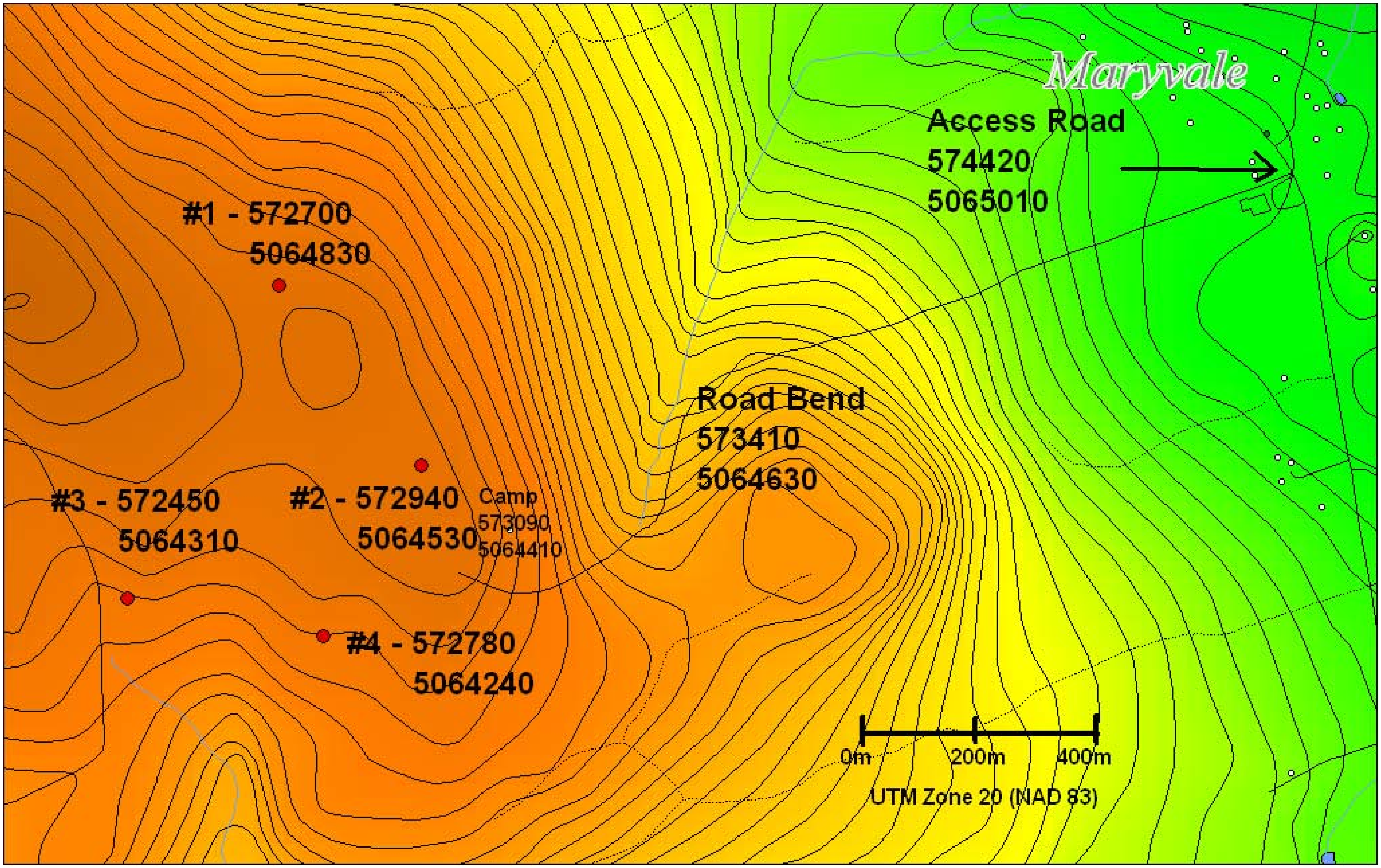

Figure 2.0-1: Proposed locations of turbines (map courtesy Fulton Energy Research).

3.0 METHODOLOGY

Historical maps and manuscripts, land records, and published literature were consulted at the Public Archives of Nova Scotia in Halifax. The Maritime Archaeological Resource Inventory at the Nova Scotia Museum, a provincial database of known archaeological sites, was also consulted as part of the desktop study. A predictive model was used to determine the potential for First Nations resources within the study area. This model was based on visual analysis of National Topographic Series maps at a scale of 1:10,000. The model took into consideration historic documentation, topography, floral and faunal ecology, stream order, climate, and available transportation routes. A field reconnaissance was conducted for the development zone by April MacIntyre and Heather MacLeod-Leslie on 5 June 2008. Approximately a 100-metre radius was surveyed around each proposed turbine site. For each of the proposed turbine sites and access roads, archaeologists were cognizant of positive as well as negative evidence of cultural activity including potential cultivation, stone piles, stone property boundaries, modern cultural and natural disturbance, shallow soil, and rugged topography in the vicinity of the impact areas. Field notes and photographs were taken to record the progress and results of the survey.

3.1 Maritime Archaeological Resource Inventory

The Maritime Archaeological Resource Inventory, a database of previously-recorded archaeological sites held at the Nova Scotia Heritage Division, was consulted by April MacIntyre on 12 June 2008. At that time, the Inventory did not include any previously-recorded archaeological sites near the study area. At least three known sites, all associated with First Nations land use dating to the precontact era (11,000 years BP to 500 years BP)[2], are located well outside the development area. These include sites at Harris' Island in the north end of Antigonish Harbour, at Dunn's Beach and at Crystal Cliffs. Remnants of the Hierlihy Regiment's settlement at Town Point have also been reported.

3.2 Predictive Modeling

Visual analysis of National Topographic Series maps at a scale of 1:50 000 (1953 and revised in 2003), and the 1893 Geological Survey of Canada map, along with the consideration of available natural resources, transportation routes, and historic documentation, shows that the development area is of low archaeological potential for First Nations resources. A complex network of rivers, streams, and lakes exist to the west, south, and east of the study area. However, the study area itself is relatively dry, with the exception of a few swampy areas and no suitable source of freshwater or

[2] "BP" refers to "Before Present". "Present" is generally accepted to be the year 1950.

transportation route is available. The only watercourses are in gullies at the base of the mountainous region and these are predominantly intermittent streams. In the summer months, First Nations peoples were most likely to have taken advantage of the abundant aquatic resources in Antigonish Harbour, which is corroborated by the existence of known First Nations sites there. In the winter months, although people would migrate inland, they were unlikely to set up camp in mountainous regions such as Maryvale simply due to inclement weather and the absence of terrestrial resources in the highland areas during those months.

3.3 Historical Background

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

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

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

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

The Mi'kmaq were the first documented inhabitants of Antigonish County. The district was known to the Mi'kmaq as *Nalegitkoonech* meaning "place were branches are torn off" as it is said that bears tore down branches to retrieve beech nuts here. The present town site of Antigonish was known by the eighteenth century French as Indian Gardens and Father Maillard, a Roman Catholic priest, referred to *Naltigonech* as being part of his mission to Christianize the Mi'kmaq in1745.[3] In about 1720, Father Gaulin, also a Catholic missionary reported to his superiors that the "Micmacs of Acadia are desirous of being collected in one village; then they could send for grain and catch fish sufficiently to make a living, and that is what induced them to select the river d'Arthigoniesche near which to set up a village…. The little corn the Indians have been growing there for some

[3] Walsh, 1989:16-20.

time, and peas, and beans and cabbages grow there very well".[4] In 1783, a licence was granted to the chief of the Antigonish band to occupy the land on the western side of the harbour as well as the village at the head of the harbour which they had improved upon. In December 1783, the Governor at Halifax issued a licence to Anthony Bernard, chief of the Antigonish Indians, "for them to occupy undisturbed the several villages and tracts they have improved or settled upon on the River (that is, the harbour) of the same name, to wit: on the peninsula on the western side of the river where the Mass house is placed; also the island near the western side of the River, together with the village near the head of the tide on both sides of the river with liberty of hunting and fishing as customary". However, his deputy surveyor, while laying out the grant of 21,600 acres for Colonel Timothy Hierlihy and his disbanded regiment, ignored the Governor's order and the whole of the reservation was taken up.[5] The Mi'kmaq were slowly pushed out of their settlement on the west side of the harbour and by the mid-nineteenth century, they had taken up new lands on the east side of the harbour near Pomquet where the Pa'qntkek First Nation is presently located.

Hierlihy, a captain in the British army, was stationed at New York during the war between America and Britain. Shortly after the outbreak of war, the regiment was sent to Halifax and later to Prince Edward Island where it remained until the end of the war. One day during their station at PEI, four or five soldiers deserted and Hierlihy was sent to capture them. He landed at Pictou and took an Indian guide to Merigomish where he then sailed along the shore to the Guysborough where he found the deserters. During this expedition, Hierlihy entered Antigonish Harbour and was so impressed with the place that he decided once the war was over, he would take up land there. In 1783, the regiment was called to Halifax and disbanded. Hierlihy, along with 88 others, were given a grant on both sides of the harbour, including the former Indian Gardens. The grant became known as the Soldier's Grant and was the first settlement in Antigonish County by Europeans, but it did not extend so far inland as Maryvale. Each soldier was given 100 acres plus one-quarter acre of town lot. The settlers named the place Dorchester in honour of Sir Guy Carleton, Lord Dorchester and Governor of Canada. In 1784, 76 men, 12 women, 8 children above ten years of age, 6 children under ten years of age, and 18 servants were listed on the town's muster roll.[6]

Shortly after the settlement of Dorchester by Loyalist refugees, a large influx of Scottish immigrants began arriving in Pictou County and quickly made their way to Antigonish County, or what was then the county of Sydney. The earliest Scotch immigrants settled at Arisaig on the north coast. Their descendants, and subsequent waves of immigrants, made their way to inland regions of the county, the frontlands having been taken up by the multitudes of Scottish immigrants who landed between 1773 and 1800.

The community of Maryvale was originally known to its European settlers as Malignant Brook. It was not until 1871, by Provincial Statute, that the name was changed to

[4] MacGillivray, 1935:95-96.
[5] MacGillivray, 1935:96-97.
[6] Rankin, 1929:4-6; Walsh, 1989:25-26.

Maryvale.[7] The first land grants made in Malignant Brook date to the first 3 decades of the nineteenth century. These were granted to Scottish immigrants, or their first generation descendants.

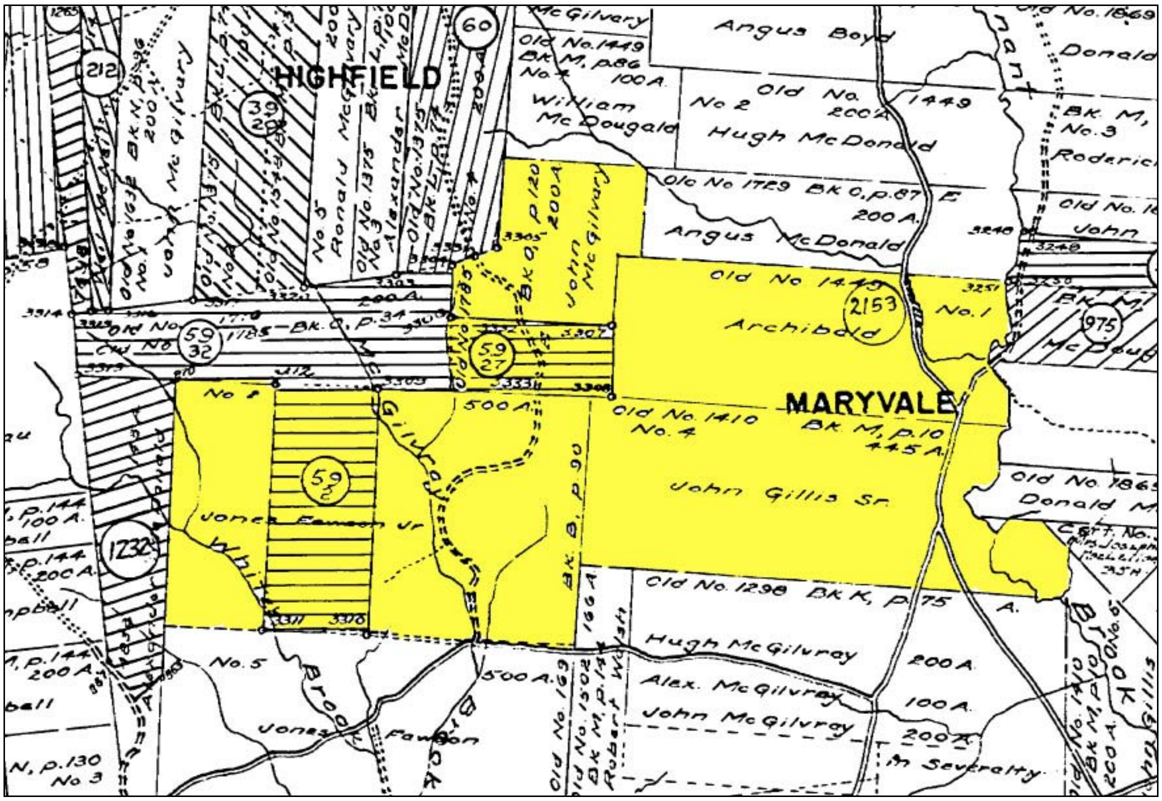

Figure 3.3-1: Original Crown land grants in the area of Maryvale. The original grants which fall within the study area are highlighted in yellow.

Jones Fawson Jr. was granted 500 acres of land in 1811 and is likely one of the earliest grantees in this area. John Gillis Sr., Archibald McDougald, and John McGilvray received their grants between 1827 and 1830 (Figure 3.3-1).[8]

Ambrose F. Church's map of Antigonish County, published in 1879, shows two residents on the west side of the study area (Figure 3.3-2). J. McGillivray and S. McDougall were likely descendents of the original grantees John McGilvray and Archibald McDougald. John McGillivray was still residing on the west side of the study area in 1893 when the Geological Survey of Canada published its map of this area (Figure 3.3-3). Much of the land in and around the study area is still owned by MacGillavrys (Figure 3.3-4).

[7] Statutes of Nova Scotia, 1871.
[8] Crown land grants, Book B p. 90; Book M p. 10; Book M p. 86; Book O p. 120.

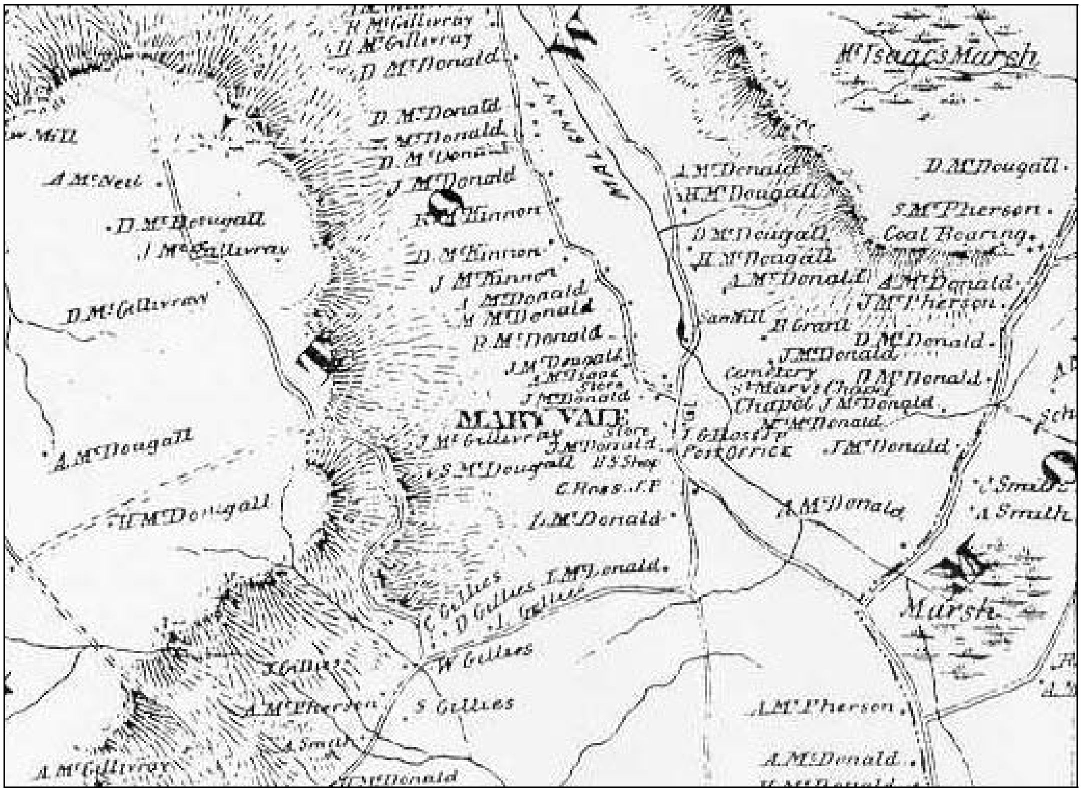

Figure 3.3-2: A portion of Ambrose F. Church's map of Antigonish County in 1879 showing settlers on the west side of the development area.[9]

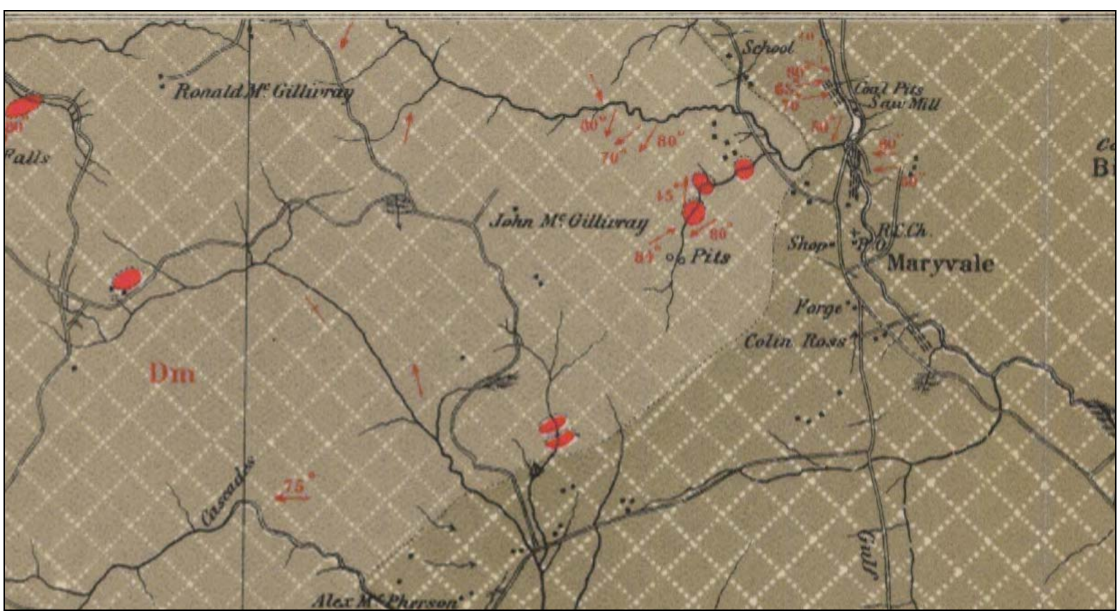

Figure 3.3-3: A portion of the Geological Survey of Canada map for the Antigonish area, published in 1893.[10]

[9] Church, 1879.
[10] Faribault and Fletcher, 1893.

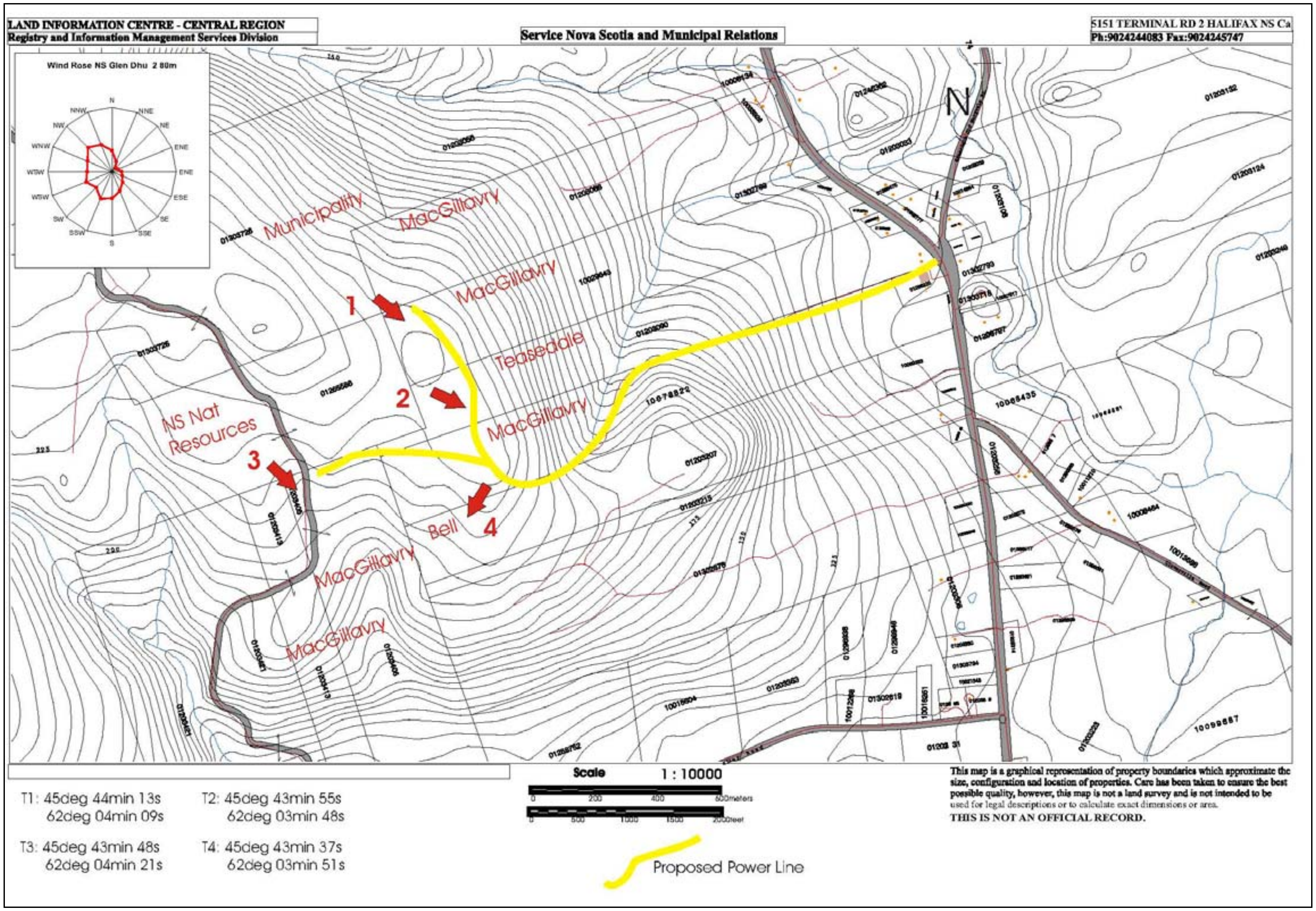

Figure 3.3-4: Nova Scotia Land Information Centre map showing the current landowners and property boundaries in and around the study area. The proposed power line/road alignment is shown in yellow. The proposed locations of the turbines have shifted slightly from those shown here.

Three significant roads through Maryvale to communities on the Northumberland Strait and were constructed fairly early on. The Great Map of 1834 shows what are now the Cloverville Road and Greendale Old Maryvale Road which run from Antigonish in the south through Maryvale and on to Georgeville in the north, and Route 245 from Antigonish to Malignant Cove.[11] A fourth road to the west of Maryvale ran past John McGillivray and S. McDougall's houses from Pleasant Valley to Malignant Cove (Figure 3.3-2 and 3.3-3).

3.4 Archaeological Survey

An archaeological survey of the development area was conducted by April MacIntyre and Heather MacLeod-Leslie on 5 June 2008. Approximately a 100-metre radius was surveyed around each of the four proposed turbine sites. For each of the proposed turbine sites and access roads, archaeologists were cognizant of positive as well as negative evidence of cultural activity including potential cultivation, stone piles, stone property boundaries, modern cultural and natural disturbance, shallow soil, and rugged topography in the vicinity of the impact areas. Field notes and photographs were taken to record the progress and results of the survey.

4.0 RESULTS AND DISCUSSION

The review of existing historic documentation and the Nova Scotia Heritage Divisions Maritime Archaeological Resource Inventory, as well as the predictive modeling exercise, have shown that the development area is of low archaeological potential for First Nations resources but of moderate potential for historic period resources, particularly on the west side of the development area. However, the archaeological survey showed that no archaeological resources were present within the development area. Furthermore, the absence of substantial watercourses combined with the lack of suitable topography and climate lend credence to the prediction that the study area is of low potential for First Nations resources.

The areas around proposed turbines 2 and 3 appear to have been logged within the last thirty years to the present. The access road to turbine 2 has been travelled recently by a tracked vehicle that was likely being used for logging activities. The land immediately east of the proposed turbine location is low and wet and till material and eroded bedrock is visible on the surface. The land immediately within the turbine 3 development area is covered in young spruce and alder growth and the land is slightly undulating as a result of cutting in the last thirty years. The turbine location can be accessed via a trail immediately west of the proposed location, as is evident in the modern refuse on the site. The area around proposed turbine 1 is covered predominantly in mature hardwood

[11] MacKay, 1834.

growth, although some young spruce tree growth suggests this area may have been undercut. Finally, proposed turbine 4 is located between two small swampy areas which are fed by intermittent springs or rivulets. Young alders have grown up immediately within the turbine development area.

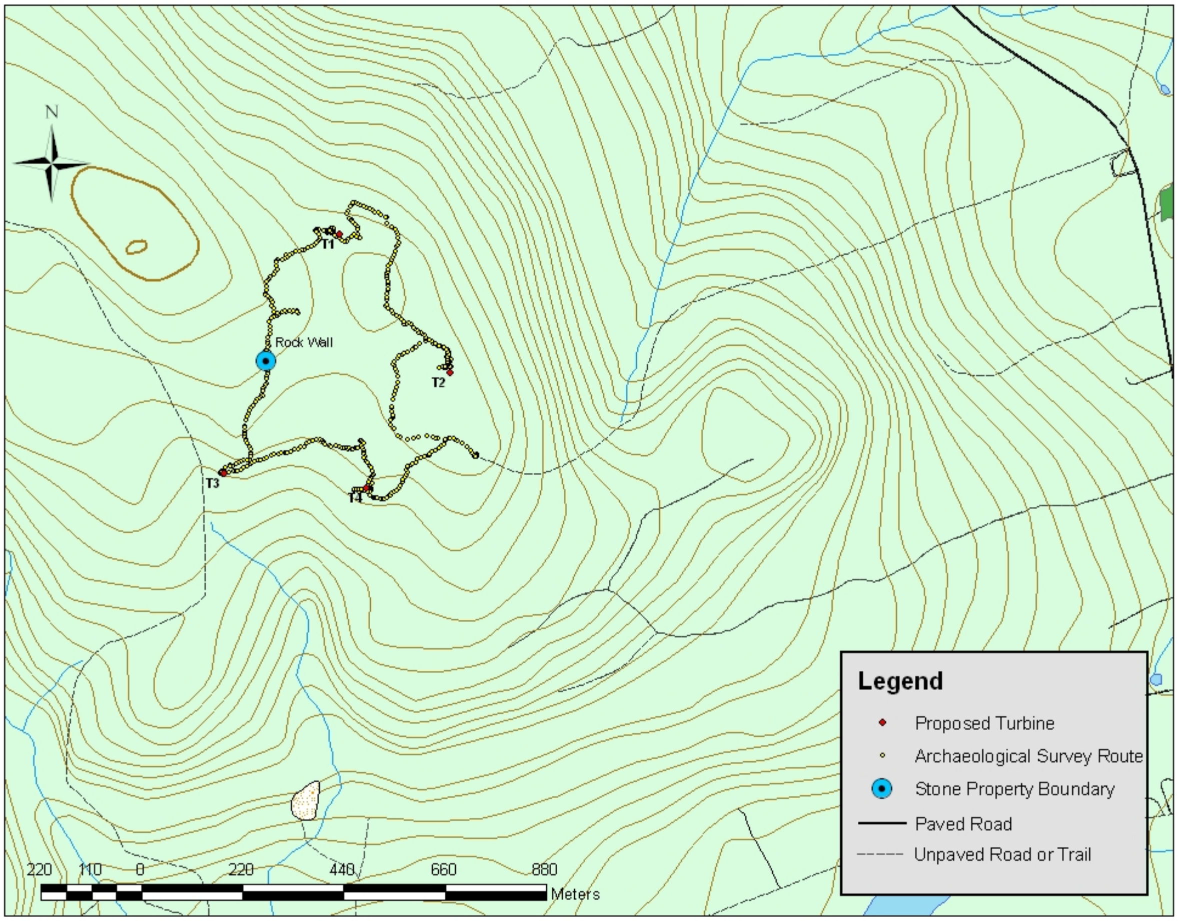

Figure 4.0-1: Results of the archaeological survey showing the route surveyed along the proposed access roads to each turbine site, as well as a point on the stone property boundary. The property boundary is aligned 60° east of north.

No significant archaeological resources were encountered during the field survey. A linear stone property boundary was encountered approximately half way between proposed turbines 1 and 3 but is not expected to be impacted by construction of access roads (*frontispiece*). Furthermore, the feature is of low archaeological significance as the potential to yield additional historic/archaeological information is negligible. The feature is believed to mark the property boundary between the Department of Natural Resources property (PID 01265586, escheated from Walsh, O'Brien, McInnis, McDonald and

McDonald in 1942)[12] and McGillivray (PID 01203405, originally granted to Jones Fawson Jr.) (Figures 3.4-5 and 4.0-1, Plate 5).

5.0 CONCLUSIONS AND RECOMMENDATIONS

Although the historic background study indicated that the area was of moderate potential for historic archaeological resources, no significant resources were encountered during the field survey and much of the area was shown to have been previously disturbed by wood cutting activity. The development area has been determined, through predictive modeling, to be of low archaeological potential for First Nations resources, which was corroborated by the archaeological survey. Therefore, no further archaeological assessment is recommended for the current proposed development. However, should development plans change so that disturbance is expected in those areas not surveyed during the current assessment, it is recommended that a subsequent archaeological assessment be conducted. Furthermore, in the unlikely event that archaeological resources are encountered during ground disturbance, it is recommended that all activity cease and the Manager of Special Places, Mr. Robert Ogilvie (902-424-6475) be contacted regarding a suitable method of mitigation.

6.0 REFERENCES

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PLATES

Plate 1: Proposed turbine 1 site, looking south southeast.

Plate 2: Proposed turbine 2 location, looking northeast. The land to the right of the photo (east) is low and wet.

Plate 3: Proposed turbine 3 location, looking north.

Plate 4: Proposed turbine 4 location, looking north.

APPENDIX A:
HERITAGE RESEARCH PERMIT

NOVA SCOTIA
Tourism, Culture and Heritage
Heritage Division
Special Places Protection Act, R.S.N.S. 1989

Application for
Heritage Research Permit
(Archaeology)

(Original becomes Permit when approved by the Executive Director of the Heritage Division)

Permit No. A2008NS50

The undersigned April MacIntyre

of c/o 6519 Oak Street, Halifax, NS B3L 1H6

representing (institution) Davis Archaeological Consultants Limited

hereby applies for a permit under Section 8 of the Special Places Protection Act to carry out archaeological investigations during the period:

from 09 June 2008 to 30 September 2008

at Maryvale Wind Project

general location Antigonish County

specific location(s) (cite Borden numbers and UTM designations where appropriate

centre point: Lat 45* 43' 50" Long 62* 03'47" (NAD83)

and as described separately in accordance with the attached Project Description. Please refer to the appropriate Archaeological Heritage Research Permit Guidelines for the appropriate Project Description format.

I certify that I am familiar with the provisions of the Special Places Protection Act of Nova Scotia, and that I will abide by the terms and conditions listed in the Heritage Research Permit Guidelines for the category (check one).

- ○ Category A - Archaeological Reconnaissance
- ○ Category B - Archaeological Research
- ⊙ Category C - Archaeological Resource Impact Assessment

Signature of applicant A.M. MacIntyre **Date** 23 May 2008

Approved:
Executive Director Bill Greenlaw **Date** June 3, 2008